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Contents

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Case Report

Clinicopathological Correlation in Reis-Bücklers's Dystrophy

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Abstract

Reis-Bückler's Corneal Dystrophy (RBCD) is a rare corneal dystrophy which mainly affects the Bowman's layer leading to its disintegration and eventually corneal opacification. Various investigative modalities are needed to establish the diagnosis of RBCD. We report a patient in whom various clinical and pathological tests were performed to establish the diagnosis of RBCD. We will also describe the clinical course of the same patient. Treatment modality for the same patient is described.

Key words: Reis-Bückler's Corneal Dystrophy (RBCD), Anterior Segment OCT (AS OCT), Phototherapeutic Keratectomy (PTK)

INTRODUCTION

- Reis-Bückler's corneal dystrophy is an autosomal dominant progressive dystrophy initially described by Reis in 19171 and later by Bücklers2 in 1949.
- The transforming growth factor beta induced gene (TGFBI, OMIM 601692), located on chromosome 5q31 has been linked with RBCD3. Thus, genetic analysis helps in confirmation of the diagnosis.
- Anterior segment OCT can help localizing the exact depth of involvement of corneal layers and can help in planning further management.
- Pathological examination of corneal button can help confirm the diagnosis by showing disintegration of Boman's membrane, subepithelial and anterior stromal eosinophilic deposits that stain positively with Masson's trichome.

CASE REPORT

- A 35-year-old male presented to cornea outpatient department with chief complaints of progressive diminution of vision in both eyes and photophobia since childhood. Visual acuity was finger counting close to face in both eyes.

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- On clinical examination, cornea had white rod and granule-shaped deposits involving the anterior layers of cornea sparing the peripheral cornea and limbus [Figure 1]. Clinically, Reis-Bücklers dystrophy, granular dystrophy, and Thiel-Behnke dystrophy were suspected differential diagnosis. The patient had no other significant ocular or systemic abnormality.
- The patient was advised corneal topography, pachymetry, anterior segment-optical coherence tomography (AS-OCT), and B-scan of both eyes. AS-OCT revealed homogeneous, hyper-reflective deposits at the level of Bowman's membrane, and anterior stroma [Figure 2]. B-scan revealed early cataractous changes in both eyes.
- Phototherapeutic keratectomy (PTK) was done in the right eye 1 month later, but no visual improvement was seen. Vision subsequently improved to 20/60 at the 3rd month follow-up after cataract extraction. Six months later, PTK was performed in the left eye and BCVA improved to 20/100.
- Two years later, the patient presented with worsening of vision to hand movements in both eyes due to recurrence of dystrophy and was planned for deep anterior lamellar keratoplasty in the left eye.
- Corneal button sent for histopathological examination revealed discontinuity of bowman's membrane along with abnormal subepithelial and anterior stromal eosinophilic deposits that stained positively with Masson's trichome but did not stain with Alcian Blue or Congo Red, thus confirming the diagnosis [Figure 3].
- Postoperatively, vision of the patient improved to 20/100 at 3 months follow-up in the left eye.

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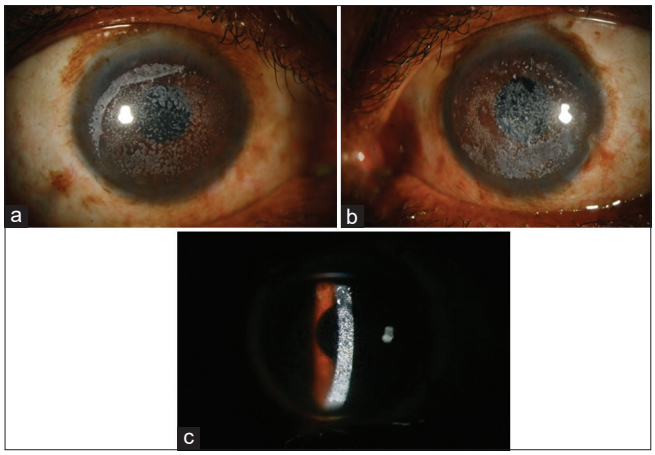

Figure 1: Slit-lamp photograph (a and b) (Diffuse illumination) – Deposits are seen involving the central and paracentral zones of cornea in both the eyes, sparing the peripheral cornea and limbus. Intervening clear spaces between the deposits are seen in central cornea but deposits are seen coalescing in superotemporal region and inferior portions of paracentral right and left cornea, respectively (c) Slit illumination showing characteristic rod and granule-shaped deposits in the region of anterior stroma sparing the posterior layers

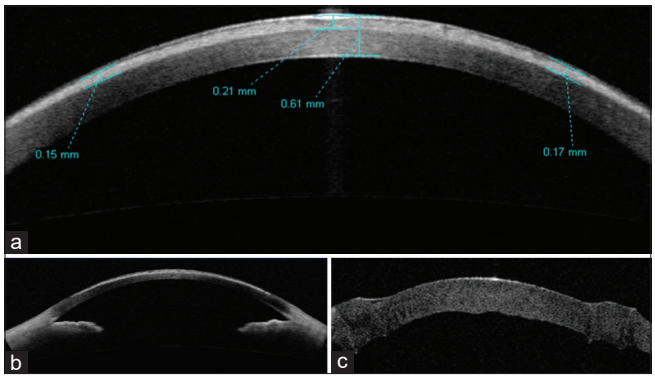

Figure 2: AS-OCT demonstrating (a) Hyper-reflective deposits affecting up to depths of 210 micron and 170 micron in central and mid-peripheral cornea, respectively. (b) Hyper-reflective and homogeneous deposits at the level of Bowman's membrane and anterior stroma sparing the peripheral cornea (c) Post-PRK decrease in hyper-reflective deposits and thinning of central cornea in the left eye

DISCUSSION

- Reis-Bücklers corneal dystrophy is an autosomal dominant progressive dystrophy initially described by Reis in 1917[1] and later by Bücklers[2] in 1949.
- The transforming growth factor beta-induced gene (TGFBI, OMIM 601692), located on chromosome 5q31, has been linked with RBCD.[3] Thus, genetic analysis helps in confirmation of the diagnosis.
- RBCD is clinically characterized by confluent geographic opacities at the level of Bowman's layer and histopathologically by band-shaped granular Masson-positive subepithelial deposits.[4]

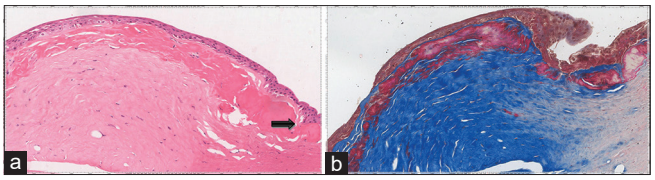

Figure 3: Histopathological findings of RBCD (a) Photomicrograph shows irregularly thickened squamous epithelium with focal saw tooth appearance (black arrow). Bowman's membrane is fragmented and subepithelial and anterior stroma shows amorphous eosinophil hyaline material deposits. Rest of stroma is densely fibrosed; H&E stain (10×) (b) Photomicrograph of Masson's trichome stains demonstrate diffuse Bowman's membrane loss, subepithelial band of fibrosis along with brilliant red deposit in subepithelial and superficial stroma. Rest of stroma is densely; fibrosed. Masson's Trichrome stain (10×)

- On light microscopy, characteristics of RBCD include-
  - Epithelium – degeneration, thinning, edema
  - Bowman's layer – absent and is replaced by band-shaped granular eosinophilic deposits which stain positive with Masson's trichome.
- On electron microscopy, crystalloid, rod-shaped bodies at the level of Bowman's membrane are seen.
- On confocal microscopy, highly reflective amorphous deposits on epithelial basal layer and anterior stroma can be noted.[5]
- Anterior OCT can help localize the precise level of deposits and help us judge the reflectivity and type of dystrophy. Thus, AS-OCT is useful modality for the diagnosis and management of RBCD.[6]
- Significant visual loss can occur, and recurrences are common after keratectomy and keratoplasty. Hence, multiple interventions may be needed.

CONCLUSION

AS-OCT can help localize the precise level of deposits in RBCD. Histopathology and genetic analysis remain the gold standard for diagnosis.

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Case Report

Juvenile Nasopharyngeal Angiofibroma: A Case Report in Bangalore, South India

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Abstract

Juvenile nasopharyngeal angiofibroma is a tumor almost exclusively seen in adolescent males, constituting <1% of all neoplasms in head-and-neck. They are benign and locally spreading and are highly vascular in nature with life threating complications and thus prove to be a challenge for anesthesiologist to maintain controlled hypotension to decrease blood loss and to provide a clear field of vision for endoscopic surgery. Here, we present a case report of a 19-year-old male presenting with a mass in his left nasal cavity, with nasal obstruction and recurrent epistaxis. CECT of paranasal sinuses (PNS) paranasal sinuses contrast imaging revealed an intensely enhancing mass lesion in the nasopharynx extending into posterior aspect of the left nasal cavity, left maxillary sinus, sphenoid sinus, and infratemporal fossa with no evidence of intracranial extensions. The approach to its surgical management and perioperative and intraoperative management was a combined multi-disciplinary effort of otorhinolaryngology surgeons and anesthesiologists.

Key words: Angiofibroma, Benign, Vascular

INTRODUCTION

Juvenile nasopharyngeal angiofibroma is a tumour almost exclusively seen in adolescent males, constituting less than 1% of all neoplasms in head and neck. They are benign and locally spreading and are highly vascular in nature with life threating complications and thus prove to be a challenge for anaesthesiologist to maintain controlled hypotension, invasive monitoring, decrease blood loss and provide a clear field of vision for endoscopic surgery

CASE REPORT

A 19-year-old male presented with chief complaints of nasal obstruction which was unilateral (left) for a period of 6 months, followed by nasal bleeding that lasted for 5–10 min actively for 2–3 episodes/day, about a volume of 3–5 mL for 3 months. He was prescribed decongestants and got relieved intermittently over the period of time. Now, on presentation, he had 8–10 episodes of painless epistaxis, loosing approximately 60–70 mL of blood, for which he was admitted in our center he had no history of headache, vomiting, blurring of vision. Endoscopic examination of the nose revealed that the mass was congested, compressible, filling the left inferior, and middle meatus [Figure 1]. There was no tenderness on palpation and no external facial deformity. Probe test revealed no attachments in the nasal cavity. On posterior rhinoscopy, the mass could be seen extending into nasopharynx.

The orodental examination was normal. General examination revealed no significant abnormality. Routine hematological investigations were found to be within normal limits. Computed tomography (CT) revealed an ill-defined enhancing soft-tissue mass lesion involving the left maxillary sinus, posterior aspect of the left nasal cavity, anterior aspect of nasopharynx, and sphenoid sinus with bony changes possibly nasopharyngeal angiofibroma with sinus extension, minimal bilateral ethmoid and sphenoid sinusitis and deviation of nasal septum to the left side [Figure 2].

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CECT of paranasal sinuses shows intensely enhancing mass lesion in the nasopharynx measuring approximately 7.0 (AP) × 4.7 (ML) × 5.7 (CC) and extending into posterior aspect of the left nasal cavity, left maxillary sinus, sphenoid sinus, infratemporal fossa, no evidence of intracranial extensions, and bilateral ethmoid and sphenoid sinus noted.

Anesthesia Management

The diagnosis of juvenile nasopharyngeal angiofibroma (JNA) was made from the history and a CT scan finding pertaining to the nasal and PNS. Patient did not receive pre-operative blood transfusion, neither have co-morbidities nor predictable difficult airway (the modified Mallampati score was 2). Apart from standard routine laboratory tests (complete blood count, coagulation profile, and liver and renal function tests), CECT SCAN and angiogram were performed. He underwent embolization of the feeding artery (maxillary artery) 24 h before surgery to reduce the intraoperative bleeding.

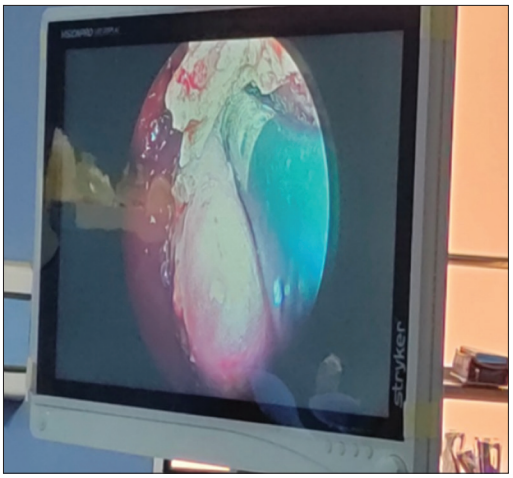

Figure 1: Endoscopic image of JNA

Figure 2: CECT PNS

After a thorough pre-anesthetic evaluation, written informed consent was taken and overnight fasting for 8 h, patient was taken into operation theatre. In the operation theatre, routine standard monitors (an electrocardiogram, oxygen saturation [SpO_2], and non-invasive blood pressure) were attached, and base line values were recorded. Two large bore IV cannula were secured with 16, 18 gauge on the upper limbs for peripheral lines. Patient was pre-medicated with intravenous glycopyrrolate 0.2 mg, intravenous ondansetron 4 mg, intravenous midazolam 1 mg, and with intravenous fentanyl (2 μg/kg). Anesthesia was induced with propofol (2 mg/kg) and neuromuscular blockade was achieved with vecuronium (0.1 mg/kg). After securing the oral cuffed flexometalic endotracheal tube of 8mm size, a throat pack was inserted. The patient was placed supine, in a 30°, reverse Trendelenburg position. The surgical approach was modified Denker's approach – medial maxillectomy.

For maintenance of anesthesia, patient was started on infusion dexmedetomidine 0.5 mcg/kg/h and vecuronium 4 mg/h infusion and N_2O: O_2:Isoflurane (50:50:>1). Hypotensive anesthesia was maintained intraoperatively throughout the surgery [Figure 3]. The tumour was excised intoto as shown [Figure 4] Blood loss was about 1800–2000 mL, patient was infused with crystalloids (intravenous [IV] ringer's lactate and IV normal saline) and there was 1-pint packed red blood cell intraoperative blood transfusion. Patient was hemodynamically stable throughout the procedure and was shifted to Intensive care unit and extubated next day.

Figure 3: Intraoperative endoscopic image showing clear surgical field & patient vitals

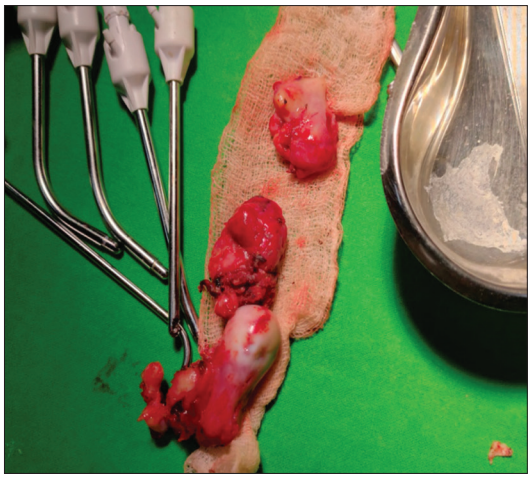

Figure 4: Picture showing excised JNA

Post-operative period was uneventful. The patient was shifted to ward on 2nd day and subsequently on 3rd day, no signs of bleeding noted and was discharged.

DISCUSSION

JNA is a rare tumor presenting mostly in adolescent males. Hippocrates described this tumor in the 5th century AD, but Friedberg first used the term angiofibroma in 1940.[1] The tumor is predominantly seen in adolescent males in the age group of 10–20 years, because hamartomatous nidus of vascular tissue in the nasopharynx activates to form angiofibroma when male sex hormones appear.[2] JNA originates close to the superior margin of sphenopalatine foramen, and further spreads locally into the pterygopalatine fossa, nasal cavity, and PNS.

It is made up of vascular and fibrous tissue. Mostly, the vessels are just endothelium-lined spaces with no elastic or muscular coat. This accounts for the severe bleeding as the vessels lose the ability to contract, so the bleeding cannot be controlled with application of adrenaline.

Patient most commonly presents with recurrent epistaxis, nasal obstruction, and mass in nasopharynx. They might also have conductive hearing loss, proptosis, and "frog-face deformity" swelling of cheek, infratemporal fossa, or involvement of IInd, IIIrd, IVth, and VIth cranial nerves will depend on the extent of tumor.

Diagnosis is based on clinical presentation. Biopsy of the tumor is attended with profuse bleeding and is, therefore, avoided. If it is essential to differentiate it from other tumors, biopsy can be done under general anesthesia with all arrangements to control bleeding and transfuse blood.

Radiological investigations and CT scan of the head with contrast-enhancement are the investigation of choice, it shows the extent of tumor, bony destruction, or displacements. Anterior bowing of the posterior wall of the maxillary sinus, often called "antral sign or Holman-miler sign," is pathognomic of angiofibroma. MRI is complementary to CT scans and shows any soft-tissue extensions present intracranially in the infratemporal fossa or in the orbit.

Recurrence has been suggested as a major complication in greater part of surgical literature,[5-8] despite the benign and unifocal origin of JNA. Tumor recurrence is primarily seen with high grade tumors with ICE, in part, due to failure to recognize skull base erosion.[2,9] Recurrence rate for JNA has been reported from 17% to 86%.[9]

Histologically, JNAs originate from myofibroblasts. The tumor usually spreads submucosally and is non-encapsulated. It is composed of intricate mixture of stellate and staghorn blood vessels with variable vessel wall thickness ranging from single layer of endothelium to variable smooth muscle coat, irregular fibrous stroma (loose edematous to dense and acellular) positive stains include c-Kit/CD117 and androgen receptor (75%).[8]

Surgery remains the main stay of treatment.[10] Endoscopic nasal microsurgery is a viable approach with prospectively lesser post-operative morbidity and intraoperative blood loss, but it is advocated only for limited lesions. However, for larger tumors, approaches such as trans palatal, lateral rhinotomy and midfacial degloving have been suggested. Pre-operative embolization of tumor is recommended with all of these approaches to limit the intraoperative blood loss.[3,4]

CONCLUSION

JNA, occurring exclusively in adolescent males, is a benign and vascular rare tumor of the nasopharynx. Diagnosed clinically with features of recurrent epistaxis, nasal obstruction, and mass in the nasal cavity.

A contrast CT is pathognomonic for the diagnosis of JNA and allows accurate staging of the tumor which is necessary for choosing the surgical technique, estimating prognosis, and reporting results. MRI and angiography are also preferred techniques for surgical planning.

Despite advances in surgical and anesthetic techniques, surgery for JNA remains a challenge for anesthesiologists' latter should be aware of advances in the management of these tumors, the latest drugs, monitoring modalities, and blood conservation strategies, as well as anesthetic techniques, which can help to provide optimal perioperative

care of these patients. Pre-operative embolization and controlled hypotension are major factors used to decrease blood loss during endoscopic resection of JNAs. Multimodal blood conservation techniques, in combination with hypotensive anesthesia, should be used to decrease blood loss and provide a drier field during endoscopic resection of a JNA.

Endoscopic surgery was preferred over open surgery under hypotensive general anesthesia as, in our case, to prevent intraoperative bleeding.

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Case Series

Lingual Frenectomy using Diode Laser – A Case Series

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Abstract

Ankyloglossia (tongue-tie) is a rare congenital oral anomaly that can cause difficulty breast-feeding, speech articulation, and difficulty in cleaning teeth thus hampering the oral hygiene. Frenectomy is a procedure in which frenum is completely excised and can be performed using scalpel, electrosurgery, and laser. This is a case series of 3-month follow-up of three lingual frenectomy cases performed using diode laser. Class II ankyloglossia and Class I ankyloglossia were noted in Case 1 and 3 and Case 2, respectively. Lingual frenectomy was performed under local anesthesia using diode laser. The healing was assessed after 1 week, 1 month, and 3 months.

Key words: Ankyloglossia, Diode laser, Frenectomy, Healing, Suture

INTRODUCTION

Lingual frenulum is a fold of mucous membrane that attach from floor of mouth to the base of tongue. "Ankyloglossia" also called tongue-tie originates from the Greek words "agkilos" (curved) and "glossa" (tongue).[1,2]

Wallace defined tongue-tie as "a condition in which the tip of the tongue cannot be protruded beyond the lower incisor teeth because of a short frenulum linguae, often containing scar tissue."[3] The exact etiopathogenesis is not known, but it has been put forward that there is a possible involvement of human Leucine-rich repeat-containing G-protein coupled receptor gene playing a genetic role.[2,4]

Free tongue is defined as the length from the insertion of the lingual frenum into the base of the tongue to the tip of the tongue. As tongue is a muscle, which is flexible in young children, also often difficult to stabilize, its measurement is determined by placing a dental instrument at the insertion point and approximating the tip of the tongue. Boley gauge is used for the purpose of measuring the distance.[5]

Kotlow's classification of tongue length which classified as:[5]

1. Clinically acceptable, normal range of free tongue: >16 mm
2. Class I: Mild ankyloglossia: 12–16 mm
3. Class II: Moderate ankyloglossia: 8–11 mm
4. Class III: Severe ankyloglossia: 3–7 mm
5. Class IV: Complete ankyloglossia: <3 mm

This case series will be discussing use of diode laser for the management of ankyloglossia.

CASE REPORTS

Case I

A 22-year-old male patient reported to the Department of Periodontology, D Y Patil School of Dentistry, Navi Mumbai, Maharashtra with c/o speech difficulty. General examination and physical examination were normal. On examination, Class II ankyloglossia was noted according to Kotlow's assessment. Patient had difficulty in pronouncing words starting from "s". After detailed examination, Lingual frenectomy using diode laser was performed for the patient [Figure 1].

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Case II

A 27-year-old male patient reported at the outpatient department of Department of Periodontology, D. Y. Patil School of Dentistry, Navi Mumbai, Maharashtra with c/o speech difficulty with receding gums in the lower front teeth. General and physical examination conducted was normal. On examination and Phase I therapy, Class I ankyloglossia was noted according to Kotlow's assessment. 31 was congenitally missing and 41 showed microdontia. Gingival recession developed on lingual aspect of mandibular teeth. After detailed examination and Phase I therapy, laser lingual frenectomy was performed [Figure 2].

Case III

A 26-year-old female patient reported to the Department of Periodontology with c/o difficulty in speech and protrusion of tongue while talking. On examination, Class I ankyloglossia was noted. Patient was asked to pronounce certain words starting with "s" where slight impairment in speech was noticed [Figure 3].

Figure 1: CASE I - Baseline

Figure 2: CASE II - Baseline

Surgical Procedure

Lingual frenectomy was performed using a diode laser (Biolase-Epic™, USA). An informed consent was taken. About 0.2% of lignocaine was injected in the frenum and tip of the tongue. A suture inserted through the dorsal surface of tongue facilitates manipulation of tongue during the procedure. Biolase diode laser with delivered optical power of 1.5 W maximum, with an initiated fiber optic tip of 400 mm in pulse mode, was used. The tongue was held with suture and the excision of tissue was done when diode laser worked in a contact mode. The laser tip was used slowly in a brushing method from apex to base excising the frenum. A diamond-shaped wound was seen after excision and protrusion of tongue was checked by asking the patient to touch the tip of tongue to the palatal surface of incisor. Bleeding was minimal and 4–0 non absorbable braided silk sutures were placed to enhance faster healing. Patients were prescribed analgesics and followed up for 3 months [Figures 4,5,6].

RESULTS

Healing was uneventful and satisfactory. The protrusion of tongue was improved in all cases. Patient was advised tongue exercises (physiotherapy) during the follow-up intervals.

DISCUSSION

Tongue tie is an abnormal condition of lingual frenum.[3,6] The frenum may be attached near the tip of the tongue and held close to the gingival margins of the lower anterior teeth.[6,7] Sometimes, it may extend across the floor of the mouth attaching to the mandibular alveolus.[6,8] In general, diastema is not formed between the mandibular central incisors because of the lingual frenum, but it can

Figure 3: CASE III - Baseline

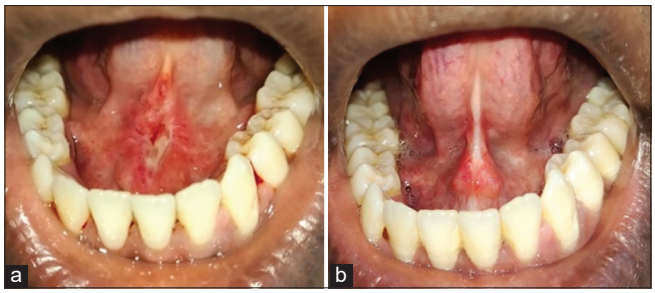

Figure 4: Case I: (a) Post-operative and (b) 3-month follow-up

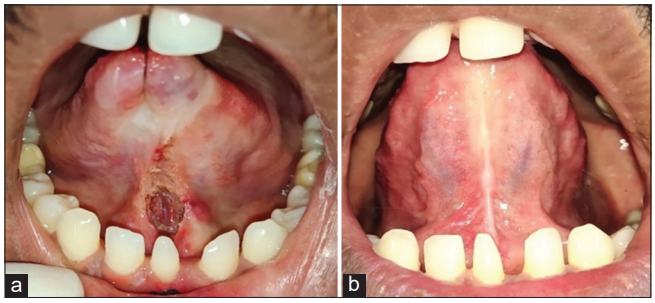

Figure 5: Case II: (a) Post-operative and (b) 3-month follow-up

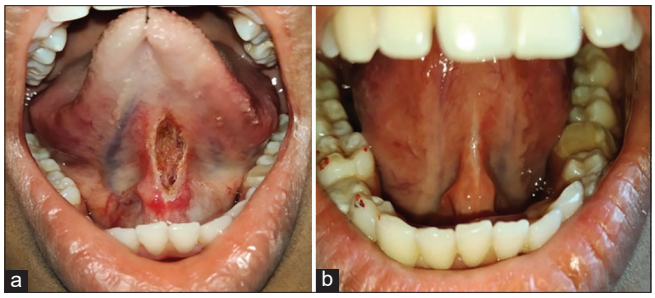

Figure 6: Case III: (a) Post-operative and (b) 3-month follow-up

cause tension in the floor of the mouth, pulling the tissue behind the mandibular incisors resulting in recession or the development of a diastema between the mandibular central incisors.[5,6] Some authors have claimed that there is development of anterior open bite due to the inability to raise the tongue to roof of mouth, which prevents the development of a normal swallowing pattern.[6,9]

Management of ankyloglossia can be done by various methods, by conventional technique such as frenectomy by simple excision of frenum; Z plasty, as explained by Kaban that has an advantage of scar lengthening and providing increased potential for the post-operative mobility of tongue; however, the technique is more difficult.[10]

Based on theories and principles first put forth by Einstein in the early 1900s, laser is an acronym for laser. In 1960, Maiman introduced the first actual laser system.[6,11] Laser light is a simulated single-photon wavelength. The lasing process occurs when an excited atom is stimulated to remit a photon before it occurs spontaneously. This stimulated emission of photons bring about a very coherent, collimated, and monochromatic ray of light.[12]

Laser technology is also considered as an alternative to the conventional technique, presenting several advantages such as shorter operative working time, tissue cauterization and sterilization, hemostasis, minimal local anesthesia requirement, and few post-operative complications such as pain, swelling, and infection.[13] Laser also has an advantage of accessibility and visibility due to the lack of insinuate instruments and bleeding at the operative field.[14] Laser also contribute to uneventful healing of the wound due to low level laser therapeutic effect and being bactericidal in nature.[15]

Erbium: YAG lasers and diode lasers are becoming popular over conventional techniques since laser is a less invasive method and it has ability to seal lymphatic channels resulting in reduced post-operative edema, sealing of nerve endings leading to reduced inflammatory response, and formation of a fibrin clot over the surgical wound protecting the wound from external irritation, causing less pain after surgery, and avoiding the use of analgesics.[16]

Basic concept of surgical laser is the photothermal interaction with tissue. In this process, the radiant light is absorbed by the tissue and transformed to heat energy causing changes in tissue structure. On contact with the tissue, laser light is converted to thermal energy leading to laser tissue interaction which when applied aptly can produce reaction varying from the incision, vaporization, and to coagulation.[10,17,18] Laser's wavelength has an affinity for melanin or dark pigments and is firmly absorbed by the blood hemoglobin, which contributes to their thermal effect. As a result, this laser works more effectively when the energy is applied in the presence of pigments; therefore, homeostasis occurs at this wavelength. Another economical alternative is electrosurgery; however, its use is limited to the milder form of ankyloglossia and a second visit is required for releasing the tongue.[10,19]

Physiotherapy of tongue was advised to the patients following the surgery.

Post-frenuloplasty tongue exercises are as follows:[20]

1. Push tongue in and out of mouth (5 repetitions)
2. Open the mouth as wide as possible and attempt to touch the tip of the tongue to the back of the upper teeth (five repetitions)
3. Move the tongue from one side of the mouth to the other, without moving the jaw (five repetitions)
4. Place food of choice on one side of the mouth between the cheek and back teeth. Using the tongue, move the food from one side of the mouth to the other, and then

back again (five repetitions). (Patients are instructed to perform the above series of exercises 3–5 times daily for several weeks postoperatively).

These exercises are not considered to increase muscle strength, but to:[21]

(i) Develop new muscle movements, involving elevation and protrusion of tip of the tongue
(ii) Encourage movements of tongue for cleaning the oral cavity such as sweeping of inside the cheeks, front, and back of the teeth, and licking right around both lips.

All subjects underwent tongue exercises after surgery as protrusion, position of tongue in the lingual papilla against the cheeks, and lateralization with food.[20,22,23]

CONCLUSION

Early diagnosis and prompt treatment is required in avoiding long-term effects of problems. It is important to assess the subjects before and after surgery, resulting in assurance in cases of lingual frenum alteration.

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Original Article

Comparative Evaluation of the Microbial Contamination of Various Suture Materials Used During Implant Placement: An *Ex Vivo* Study

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Abstract

Background: This study evaluated the bacterial adhesion on three different types of commercially available non-resorbable suture material (silk, Teflon-coated polyester poly-tetra-fluoro-ethylene [PTFE], and proline) used during implant surgery.

Methods: The study was a randomized clinical trial on a total of 180 partially or completely edentulous participants of either sex (102 males and 78 females) and age group above 18 years of age on whom three different suture materials were clinically placed on implant sites and the bacterial contamination between the suture materials, that is, silk, proline, and PTFE was then tested with the help of laboratory procedures after retrieving the sutures clinically and culturing the sutures in different media.

Results: The mean colony-forming unit (CFU) of silk was the highest followed by Proline and PTFE the least (PTFE < Proline < Silk). Comparing the mean CFU of three different sutures, analysis of variance and Tukey test also showed similar ($P > 0.05$) CFU between all the three sutures.

Conclusion: PTFE suture is best recommended for suture placement after implant placement with regard to the least microbial contamination followed by proline suture and the least favorable being silk suture.

Key words: Bacteria, Implant, Poly-tetra-fluoro-ethylene, Suture

INTRODUCTION

Since the turn of the century, sutures have been considered to be one of the most effective and useful method for the closure of surgical incisions and have becomes an integral part of most of all surgical procedures and, henceforth, correct closure and stabilization of surgical wound margins influence the success of a dental implant procedure.[1,2]

Depending on the materials used for the production of the suture surgical threads, sutures can be broadly categorized on the basis of natural and synthetics, on the basis of their origin, on the basis of being absorbable and non-resorbable, on the basis of their biological behavior and finally, on the basis of their structure, namely, monofilament, multifilament, and pseudo-monofilament.[3]

Hypoxic environment can be created by bacterial accumulation at the surgical site within and around the wound as well as inhibiting the activity of fibroblasts, which results in delayed wound healing.[4]

Although, the infection at surgical site is further aggravated by the formation of biofilm, wherein the encapsulated bacteria exists within a self-secreted extracellular polymeric slime matrix composed of polysaccharides, proteins, and nucleic acids.[5,6]

Surgical silk a non-absorbable, multifilament suture of organic origin retrieved from cocoons of silk worm constituted for the 70% by natural proteins and for the 30% by stranger material and dyed black is most widely used for the various surgical procedures in oral implantology. Unfortunately, the braided nature of the silk suture provokes bacterial adherence, resulting in a more intense

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and prolonged inflammatory response in gingival mucosa than the various new synthetic materials.[3]

Synthetic multifilament sutures such as Teflon-coated polyester poly-tetra-fluoro-ethylene (PTFE) grant ease of handling are characterized by a high resistance to traction, with superior and great flexibility, with a minimal tissue reaction, due to a biological and chemical inertia.[3]

Proline is a synthetic, monofilament, and non-absorbable polypropylene suture. Its advantages include minimal tissue reactivity and durability with an excellent tensile strength. Disadvantages include fragility, high plasticity, high expense, and difficulty of use as compared to standard nylon sutures.[7]

Therefore, the bacterial adherence of three different suture materials was evaluated on the basis of colony counts established, after culturing the sutures in different culture media.

MATERIALS AND METHODS

Study Design

The study was a randomized clinical trial on a total of 180 partially or completely edentulous participants from those attending the outpatients Department of Prosthodontics Crown Bridge and Implantology of either sex (102 males and 78 females) and age group above 18 years of age having no periodontal, systemic disease or psychosis, and requiring implant rehabilitation were selected.

Methodology

Implant surgical procedure

After implant placement, primary closure was done alternatively using black braided silk (Mersilk 4-0, Ethicon India Pvt. Ltd., Mumbai, Maharashtra, India), Teflon-coated polyester (PTFE) (Dental-A 4-0,CMC Medical Devices, Malaga, Spain) and Proline (polypropylene) sutures (Steriline Polypropylene-blue, 4-0, Peters Surgical India Pvt. Ltd., New Delhi, India). Buccal flaps were sutured using simple interrupted stitches. However, the three different suture materials were used in different patients to intraindividually compare bacterial colonization. All sutures were placed and removed by the same skilled operator to eliminate interexaminer variability.

A minimum of three knots per patient was tested for each type of suture. Follow-up visits were performed at 7 days after insertion.

Suture retrieval and sample culture

Sutures were removed with sterile instruments and then were placed in tubes diluted with 1 ml of normal sodium chloride saline (NS, Jedux Parenteral Pvt. Ltd., Barabanki, Uttar Pradesh, India). The collected samples were then immediately transported in sterile plain Vacutainer (Avantor Performance Materials Pvt. Ltd., Silvassa, Dadra and Nagar Haveli, India) [Figure 1].

Suture fragments were homogenized for 3 × 1min in an ultrasound bath and were shaken vigorously on the vortex mixer. Following vortexing, serial dilutions of normal sodium chloride saline were then made for each sample. Selective culture media was inoculated to detect microorganisms using a colony formation unit per unit surface area (colony-forming unit [CFU]/surface).

Sabouraud's dextrose glucose agar plates (HiMedia Laboratories, Mumbai, Maharashtra, India) supplemented with chloramphenicol was used for the identification of fungi. Blood agar plates (HiMedia Laboratories, Mumbai, Maharashtra, India) [Figure 2] were used for the detection of oral streptococci. MacConkey agar plate (HiMedia Laboratories, Mumbai, Maharashtra, India) was used for

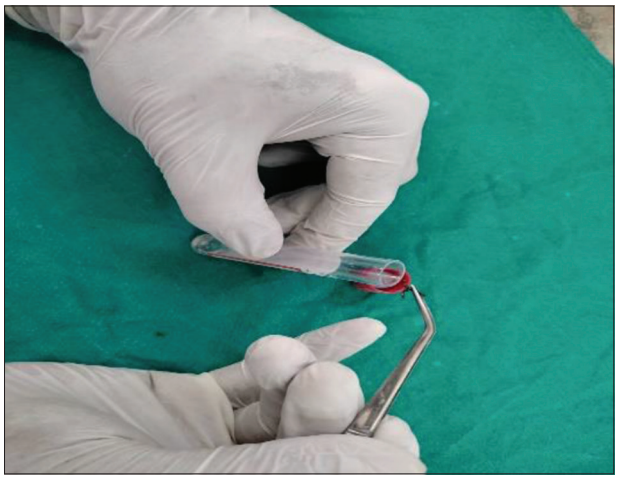


Figure 1: Suture collection in plain Vacutainer

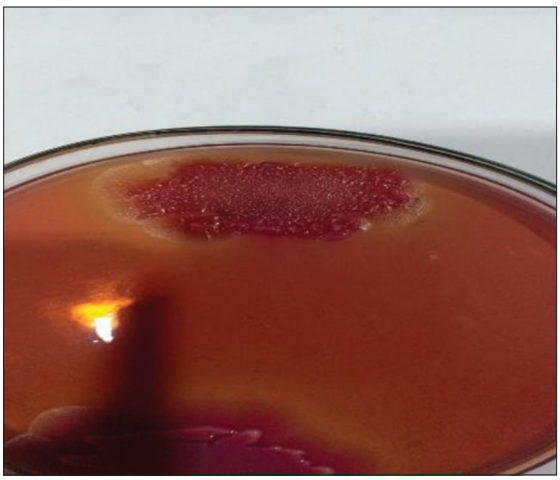


Figure 2: Colony-forming unit units on MacConkey agar plate

the detection of *Staphylococcus aureus* and Escherichia *coli*. These plates were then placed in GasPak jars to produce an anaerobic atmosphere with AnaeroGen. Colony counts were performed at 24, 48, and 72 h after incubation for each type of plate.

Dilution parameters and sample processing parameters for the *ex vivo* study were calculated according to the results obtained in the *in vitro* study.

RESULTS

This study evaluated and compared the microbial contamination of three different types of commercially available non-resorbable suture materials, namely, silk, Teflon-coated polyester (PTFE), and proline. Four bacterial strains, namely, *Streptococcus mutans*, *S. aureus, E. coli*, and *Candida albicans* were isolated and compared. Total 720 samples, 60 per suture per microorganism were screened.

The outcome measure of the study was the bacterial adhesion (i.e., CFU) around the three different suture materials which were assessed at 7–10 days after insertion of the implant.

The CFU of four different microorganisms (*S. mutans*, *S. aureus*, *E. coli,* and *C. albicans*) over three sutures (silk, PTFE, and proline) is summarized in Table 1 and also depicted in Graph 1. The CFU ($\log_{10}$ CFU/surface) of *S. mutans*, *S. aureus*, *E. coli,* and *C. albicans* ranged from 2.60 to 6.95, 2.78 to 7.48, 2.30 to 5.30, and 2.95 to 5.78, respectively, with mean (±SE) 4.81 ± 0.18, 4.85 ± 0.12, 3.56 ± 0.18, and 4.26 ± 0.26, respectively, and median 4.54, 4.70, 3.54, and 4.00, respectively. The mean CFU of *S. aureus* was the maximum followed by *S. mutans*, *C. albicans,* and *E. coli* the minimum (*E. coli* < *C. albicans* < *S. mutans* < *S. aureus*).

Comparing the mean CFU of four different microorganisms, analysis of variance (ANOVA) showed significantly different CFU among the microorganisms ($F = 6.85$, $P < 0.001$) [Table 2].

Further, comparing the difference in mean CFU between four different microorganisms, Tukey test also showed significantly ($P < 0.001$) different and lower CFU in *E. coli* as compared to both *S. mutans* and *S. aureus* [Table 2 and Graph 2]. However, it did not differ ($P > 0.05$) between other microorganisms (i.e., *S. mutans* and *S. aureus*, *S. mutans* and *C. albicans*, *S. aureus* and *C. albicans*, and *E. coli* and *C. albicans*), that is, found to be statistically the same. In other words, bacterial adhesions differ significantly between microorganisms.The CFU of four different

Table 1: The distribution and comparison of CFU (log10 CFU/surface) among four different microorganisms

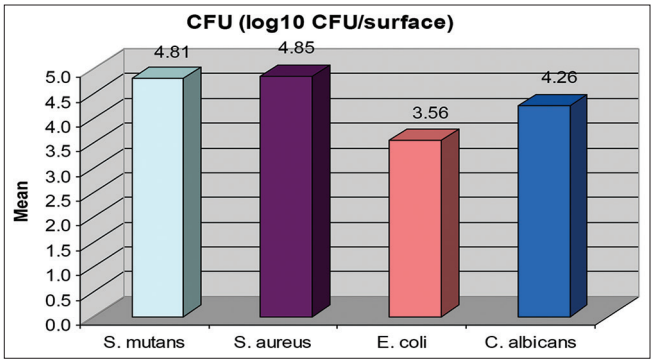
Microorganism	*n*	CFU (log10 CFU/surface) (Mean±SE)	F value	*P* value
Streptococcus mutans	64	4.81±0.18	6.85	<.001
Staphylococcus aureus	97	4.85±0.12		
Escherichia coli	20	3.56±0.18		
Candida albicans	11	4.26±0.26		

CFU: Colony-forming unit

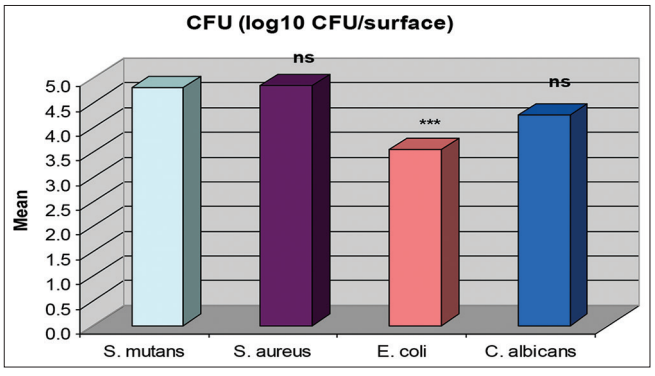
Table 2: Comparison (*P* value) of difference in mean CFU (log10 CFU/surface) between four different microorganisms by Tukey test

Comparison	Mean diff.	q value	*P* value	95% CI of diff.
S. mutans versus *S. aureus*	-0.04	0.29	>0.05	−0.5526–0.4725
S. mutans versus *E. coli*	1.25	5.63	<0.001	0.4298–2.061
S. mutans versus *C. albicans*	0.55	1.96	>0.05	−0.4871–1.591
S. aureus versus *E. coli*	1.29	6.06	<0.001	0.5036–2.067
S. aureus versus *C. albicans*	0.59	2.15	>0.05	−0.4208–1.604
E. coli versus *C. albicans*	-0.69	2.14	>0.05	−1.888–0.5013

diff: Difference, CI: Confidence interval, q value: Tukey test value. CFU: Colony-forming unit, *S. mutans: Streptococcus mutans, C. albicans: Candida albicans, E. coli: Escherichia coli*



Graph 1: The mean colony-forming unit (CFU) ($\log_{10}$ CFU/surface) of four different microorganisms



Graph 2: Comparison of difference in mean colony-forming unit (CFU) ($\log_{10}$ CFU/surface) between four different microorganisms. $^{ns}P > 0.05$ or $^{***}P < 0.001$ as compared to *Streptococcus mutans*

microorganisms was summarized in mean ± SE and compared by ANOVA (*F* value).

DISCUSSION

Surgical site infection is a common problem encountered after every surgical intervention. The formation of bacterial biofilm by attachment to the underlying foreign body or to the tissue substratum is another complication of any surgery. Hence, this study investigated different suture materials used at surgical sites and their contribution to surgical site infection. It was shown that any suture material can host or harbor bacterial biofilm formation, but not all suture materials are necessarily equivalent in this regard.[8]

Sutures used in the present study belong to the group of non-absorbable sutures; in particular, silk is a multifilament suture of organic origin and PTFE and proline suture are synthetic absorbable suture.

In support to this study, Edlich *et al.* also found same results as less accumulation of bacteria was seen around PTFE and proline sutures in comparison to silk sutures but, furthermore, put forth a statement denoting that the chemical structure of the suture was found to be the most important factor in the development of surgical infection rather the physical configuration.[9]

In contrary to this study, Racey *et al.*, 1978, and Banche *et al.*, 2007, found that silk has been a favored suture material in oral implantology, used as a comparison standard in assessing the usability and it is the most common suture material used.[10]

This study strongly indicates that, whenever possible, the first choice of suture between the present tested materials should be PTFE suture, but according to this study, there is a negligible amount of difference between PTFE and proline suture on the basis of the quantitative and qualitative parameters.

CONCLUSION

Within the limitation of this study, it was concluded that:

1. After 72 h of incubating the silk sutures, proline sutures, and PTFE suture in different culture media, four microorganisms were isolated to be *S. aureus*, *S. mutans*, *E. coli*, and *C. albicans* with the highest mean CFU units seen in *S. aureus* and the least mean CFU units seen in *E. coli*.
2. Higher CFUs of all four isolated microorganism were found in silk sutures as compared to proline suture with the least found in PTFE suture after 72 h of culturing the suture in different culture media.
3. PTFE suture is best recommended for suture placement after implant suture with regards to the least microbial contamination followed by proline suture and the least favorable being silk suture.

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Original Article

Evaluation of the Strength and Pattern of Relationship between Visual Field Sensitivity and Retinal Nerve Fiber Layer Thickness as Measured by Optical Coherence Tomography in Patients Having Primary Angle-Closure Glaucoma

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Abstract

Objective: The objective of the study was to evaluate the strength and pattern of relationship between visual field (VF) sensitivity and retinal nerve fiber layer (RNFL) thickness as measured by optical coherence tomography (OCT) in patients having primary angle-closure glaucoma.

Materials and Methods: In this hospital-based cross-sectional study, a total of 50 patients visiting the outpatient department of a tertiary care eye center in Kolkata and satisfying the inclusion criteria were randomly selected. The patients into groups underwent complete ocular examination. Total study was for 18 months (January 1, 2019–June 30, 2020). Subjects underwent detailed ophthalmic examination including slit-lamp examination, intraocular pressure (IOP) measurement, gonioscopy, stereoscopic fundus examination, automated VF testing, and Heidelberg Spectralis OCT fast RNFL scan.

Results: Regression analysis was used to correlate the VF parameters on standard automated perimetry (SAP) with the average and sectoral RNFL thickness in OCT. Data were analyzed using Microsoft Excel 2007 and GraphPad Prism 8.0.0. The mean (±SD) age of the study group was 51.79 ± 10.32 years. The mean (±SD) IOP of the population was 20.04 ± 3. Regarding the VCDR, maximum patients (*n* = 27) had 0.7 cupping followed by 0.8 (*n* = 26) and 0.6 (*n* = 22) cupping, respectively. Mean MD (±SD) and PSD (±SD) of the population were −10.28 ± 5.88 and 8.12 ± 3.77, respectively. Mean (±SD) superior and inferior hemifield sensitivities were 18.45 ± 7.71 and 20.43 ± 6.54, respectively. Mean (±SD) values of superior, inferior, temporal, and nasal RNFL thickness were 87.29 (±29.41), 79.08 (±31.96), 61.2 (±15.19), and 64.62 (±17.41), respectively. Mean TSNIT average (±SD) was 72.96 (±17.72). Plotting TSNIT avg. RNFL thickness against age, the slope showed a 0.393 μm yearly decline in average RNFL thickness.

Conclusion: As per this study, it was concluded that there is a direct correlation between the VF loss in automated perimetry and the RNFL loss in OCT. Therefore, OCT can be considered for monitoring the progression of glaucoma.

Key words: Primary angle-closure glaucoma, Retinal nerve fiber layer, Sensitivity, Visual Field

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INTRODUCTION

Glaucoma is a group of disorder characterized by progressive irreversible optic neuropathy consistent with excavation and undermining of the neural and connective tissue elements of the optic disk and specific pattern of visual field (VF) defects that are associated frequently

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but not invariably with raised intraocular pressure. It is associated with accelerated apoptosis of retinal ganglion cells (RGCs) that manifest as increased cupping of the optic disk and thinning of the retinal nerve fiber layer (RNFL).[1]

Glaucoma affects more than 67 million person worldwide, of whom about 10% or 6.6 million are estimated to be blinded by it. Glaucoma is the leading cause of irreversible blindness worldwide and is the second only to cataract as the most common cause of blindness overall. The incidence of primary angle glaucoma closure glaucoma was estimated at 2.4 million persons per year. In India, 12.8% of total blindness are reported to occur due to glaucoma. Asians represent 47% of those with glaucoma[2] and 7% of those with angle-closure disease. The prevalence of PACG in South India ranges from 0.5% to 4.30%,[3] whereas in East India, it was only 0.23%.[4]

Primary angle-closure glaucoma is defined as a progressive, chronic optic neuropathy in adults where intraocular pressure and other currently unknown factors contribute to damage and in which, in the absence of other identifiable causes, there is characteristic acquired atrophy of the optic nerve and loss of retinal ganglion cells and their axons. This is associated with an anterior chamber angle that is closed by gonioscopic appearance.

As the visual loss in primary angle-closure glaucoma can be silent, sustained, and often without symptoms it goes unnoticed, undetected, and undiagnosed in many cases. It is well known in clinical practice that RNFL defects are very early signs of glaucoma, since they present the first step in the glaucomatous morphological loss in the retina. RNFL changes precede the appearance of functional changes in the VF and thus have greater value as early indication of the disease.[5-7]

An accurate evaluation of RNFL and ONH damage thus seems to be crucial for an early diagnosis of glaucoma. Optical coherence tomography (OCT) represents an useful method for objective detection and quantification of glaucomatous RNFL atrophy.[8-10] It has been demonstrated to have high levels of reproducibility,[11] to incorporate age-matched normative data, and to allow non-invasive assessment of the peripapillary RNFL.

The Aim of this Study

The aim of the study was as follows:

1. To evaluate the strength and pattern of the relationship between VF sensitivity as measured by standard automated perimetry (SAP) and RNFL thickness as measured by SD-OCT in different stages of primary angle-closure glaucoma.
2. To determine the regional relationship between major areas of glaucomatous RNFL thinning identified by OCT and areas of decreased VF sensitivity identified by SAP in glaucomatous eyes.
3. To quantify the correlation between increasing age and RNFL thickness.
4. To find out the association between disc changes as measured by VCDR and average RNFL thickness.

MATERIALS AND METHODS

Population-based studies are important for the assessment of disease burden, health-care policy planning, and appropriate resource allocation. This is a hospital-based cross-sectional study which was conducted in patients visiting the outpatient department and glaucoma clinic of a tertiary eye care center in Kolkata. Fifty patients attending the outpatient department and glaucoma clinic were selected. The study commenced on January 2019 and concluded on June 2020.

The Institutional Ethics Review Board approved the study that adhered to the tenets of the Declaration of Helsinki.

Inclusion Criteria

All patients diagnosed as established cases of primary angle-closure glaucoma.

- Age between 18 and 70 years.
- IOP >21 mm of Hg at some stage

Glaucomatous optic neuropathy (GON) defined as vertical cup-disk asymmetry between fellow eyes of 0.2, a cup-disk ratio of 0.6, focal or diffuse neuroretinal rim narrowing with concentric enlargement of the optic cup, localized notching, or both as seen by stereoscopic ophthalmoscopy with +90 D lens.

- Glaucomatous VF defects in 24-2 SAP defined as those with
- On pattern deviation plot a cluster of ≥3 contiguous points with a sensitivity loss of $P < 5\%$ in the superior or inferior arcuate areas, at least one of which is depressed below the 1% level.
- Pattern standard deviation significant at $P < 5\%$
- An abnormal result in the glaucoma hemifield test.
- Closed angles obtained on gonioscopy
- Good quality scans obtained in peripapillary RNFL
- thickness evaluation by OCT, with a signal-to-noise ratio of>35;
- Good quality SAP
- performed at ±1 month from OCT imaging; with fixation losses below 20% and false positives and negatives below 20%
- Refractive error within a ±6 spherical diopter range, with less than ±3 cylinder diopters
- Informed written consent.

Exclusion Criteria

- Best-corrected visual acuity on the Snellen chart worse than 6/18.
- Corneal or lens opacity that interfered with clinical evaluation of the optic disk and posterior pole through an undilated pupil,
- Significant parapapillary atrophy that caused blind spot enlargement on the VF tests, interfered with VF readings, or causing false nerve fiber layer thickness data by OCT evaluation.
- Patients with tilted discs or any vitreal or retinal diseases were excluded, as well.
- Open-angle glaucoma,
- Secondary glaucomas,
- History of intraocular surgery, except uncomplicated cataract surgery
- Diabetes mellitus
- Diseases affecting VF, for example, pituitary lesions, demyelinating diseases, neurological causes, and AIDS.
- Patients on medications known to affect VF sensitivity (e.g., chloroquine).

On arrival at the examination center, the subjects were requested to sign an informed consent. In the case of illiterate subjects, the consent form was readout to them in their vernacular language in the presence of either a relative or a community volunteer. The left thumb impression was used as a signature for illiterate patients.

They then proceeded through various ophthalmic examinations and diagnostic procedures in the following order:

1. Ocular and medical history
2. Lensometry was performed where necessary
3. Refraction and recording of best-corrected visual acuity
4. Pupillary evaluation
5. Corneal pachymetry: The central corneal thickness was measured using the ultrasound pachymeter
6. Slit-lamp bio-microscopy, including van Herrick grading of the angle of the anterior chamber angle, was performed
7. Applanation tonometry: Intraocular pressure (IOP) recording with the Goldmann applanation tonometer was done. Calibration was done by trained senior glaucoma surgeons on a weekly basis
8. Gonioscopy: A Goldmann 3-mirror hand-held gonioscope was used, and the angle was graded according to the Shaffer system. Gonioscopy was performed in dim ambient illumination with a shortened slit that did not fall on the pupil. An angle was considered occludable if the pigmented trabecular meshwork was not visible in >270° of the angle in dim illumination. All subjects with occludable angles in one or both the eyes were deemed to have primary angle-closure disease (PACD). If the angle was occludable, indentation gonioscopy was performed, and the presence or absence of peripheral anterior synechiae was recorded. Laser iridotomy was performed in subjects with occludable angles after obtaining their consent. The rest of the examination was deferred to another convenient date following laser iridotomy
9. Grading of lens opacities (Lens Opacities Classification System II)
10. Fundus examination using +90 D lens
11. Optic disk evaluation was done using + 78D lens. The vertical cup-disk ratio was recorded, and a special note was made of peripapillary atrophy and optic disk/peripapillary hemorrhage, bayoneting sign, baring of circumlinear vessels, and laminar dot sign
12. Automated VF testing was done in all subjects using Humphrey field analyzer using central 24-2 SITA standard test
13. Heidelberg Spectralis OCT fast retinal nerve fiber layer (RNFL) scan was employed to determine RNFL analysis.

Statistical Analysis Plan

Regression analysis was used to correlate the VF parameters on SAP with the average and sectoral RNFL thickness in OCT. Data were analyzed using Microsoft Excel 2007 and GraphPad Prism 8.0.0.

$P < 0.05$ was considered to be statistically significant.

RESULTS

A total of 50 patients were enumerated who visited the outpatient department from January 2019 to June 2020.

Data from all the 50 subjects were analyzed.

The mean (±SD) age of the study group was 51.79 ± 10.32 years (Table 1). About 61% of the participants were male and 39% were female (Tables 2 and 3).

Table 1: Age distribution of patients

Age group (in years)	Number	Percentage
<20	0	0
20–30	4	4.45
30–40	4	4.45
40–50	29	32.22
50–60	31	34.45
60–70	22	24.45

Table 2: Gender distribution of the patients

Gender	Number	Percentage
Male	55	61
Female	35	39

The mean (±SD) IOP of the population was 20.04 ± 3.72 (Table 4).

About 60% of the patients had a visual acuity equal to or worse than 6/12 (Table 5).

Table 3: Laterality of the eye

Laterality of the eye	Number	Percentage
Right	43	48
Left	47	52

Table 4: Distribution of IOP in the study population

IOP (mmHg)	No. of patients
<10	0
10–15	4
15–20	38
20–25	40
25–30	7
30–35	1

IOP mean with SD: 20.04±3.72

Table 5: Distribution of BCVA in the study population

BCVA	No. of patients
6/6	15
6/9	15
6/12	30
6/18	30

Table 6: Distribution of vertical C/D ratio in the study population

Vertical C/D ratio	No. qof patients
0.4	1
0.5	8
0.6	22
0.7	27
0.8	26
0.9	6

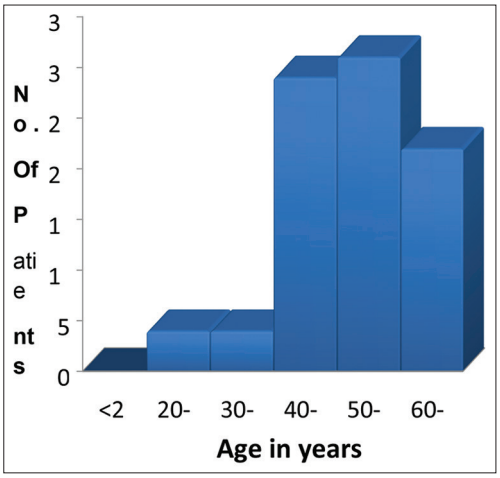

Figure 1: Bar chart showing age distribution of patients

Regarding the VCDR, maximum patients (n = 27) had 0.7 cupping followed by 0.8 (n = 26) and 0.6 (n = 22) cupping, respectively (Tables 6 and 7).

Mean MD (±SD) and PSD (±SD) of the population were −10.28 ± 5.88 (Figures 1 to 7) and 8.12 ± 3.77 (Figure 8), respectively.

Mean (±SD) superior and inferior hemifield sensitivities were 18.45 ± 7.71 and 20.43 ± 6.54, respectively (Figures 9 and 10).

Mean (±SD) values of superior, inferior, temporal, and nasal RNFL thickness were 87.29 (±29.41), 79.08 (±31.96), 61.2 (±15.19), and 64.62 (±17.41), respectively (Table 8).

Mean TSNIT average (±SD) was 72.96 (±17.72) (Figures 11 and 12).

Plotting TSNIT avg. RNFL thickness against age, the slope showed a 0.393 μm yearly decline in average RNFL thickness (Figures 13 and 14).

Plotting vertical cup-disk ratio against TSNIT average, we get a negative slope correlation with R^2 = 0.23 and $P < 0.0001$ (Figures 15 to 17).

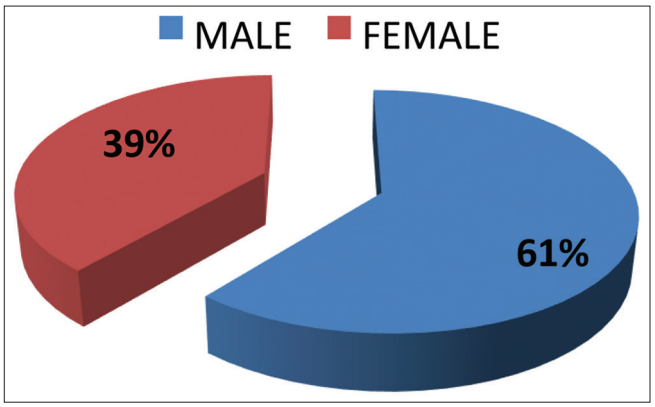

Figure 2: Pie chart showing gender distribution of the patients

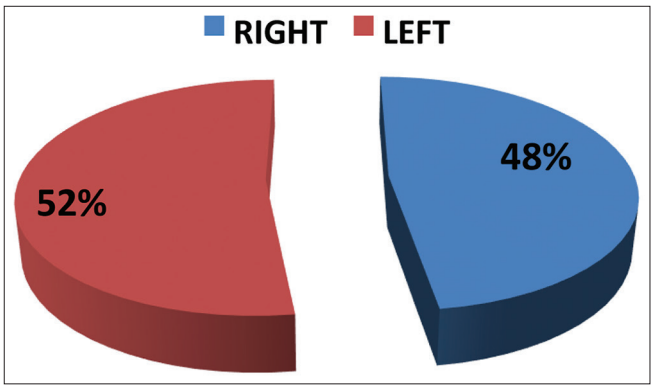

Figure 3: Pie chart showing laterality of the eyes

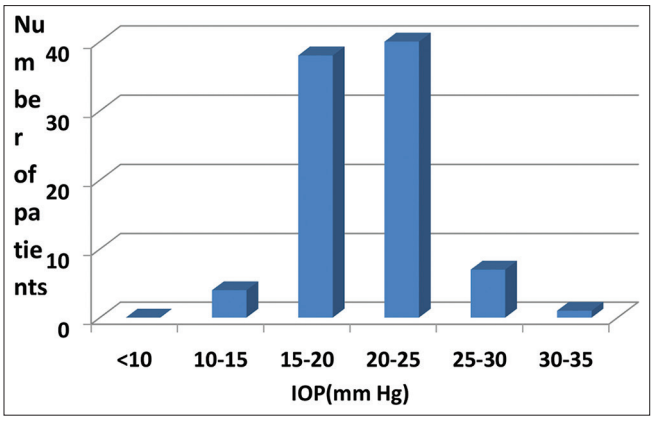

Figure 4: Bar chart showing distribution of IOP in the study population

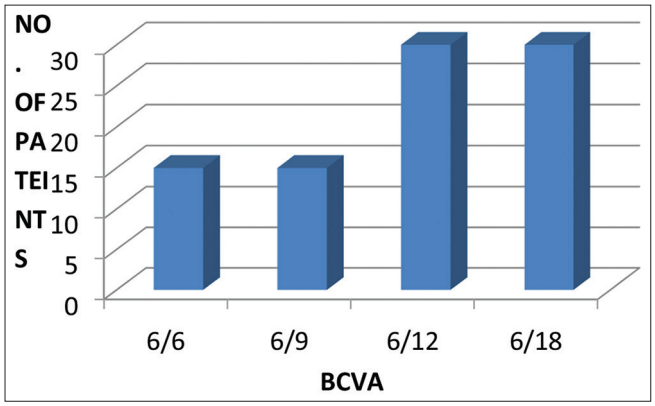

Figure 5: Bar chart showing distribution of BCVA in the study population

Table 7: Visual field parameters in the study population

Parameter	Mean	Standard deviation	Range
MD	−10.28	5.88	−26.82–[−1.35]
PSD	8.12	3.77	1.47–15.78
Superior hemifield sensitivity	18.45	7.72	0.24–29.28
Inferior hemifield sensitivity	20.43	6.54	1.33–29.9

Demographic Characteristics

No. of patients	50
No. of eyes	90
Minimum age	20 years
25% percentile	45 years
Median age	52 years
75% percentile	59.25 years
Maximum 70 years range	50 (20–70)
Mean	51.79 years
Standard deviation	10.32
Standard error of mean	1.088

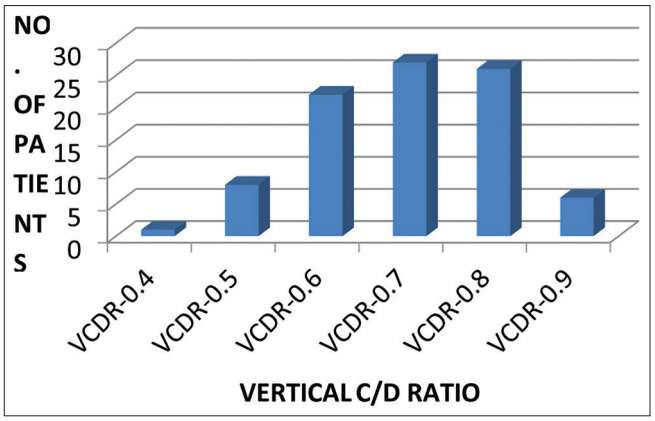

Figure 6: Bar chart showing distribution of vertical C/D ratio in the study population

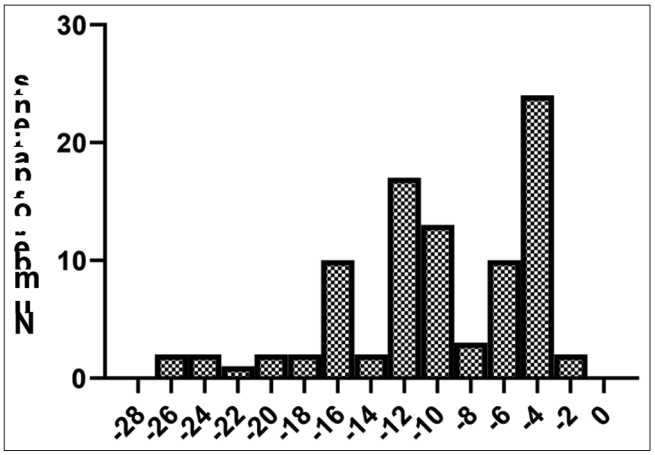

Figure 7: Histogram of frequency distribution of mean deviation

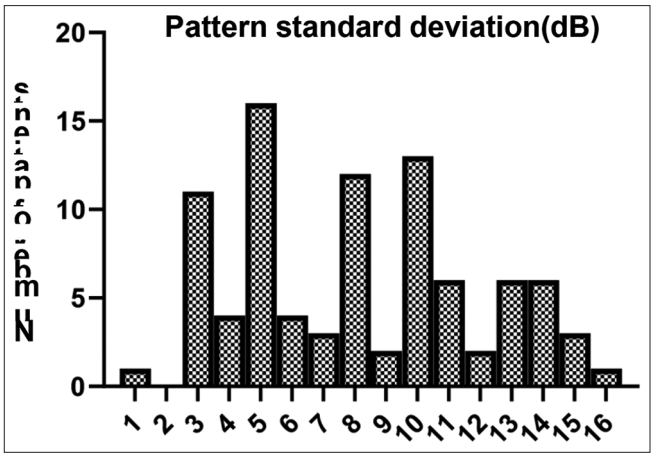

Figure 8: Histogram of frequency distribution of pattern standard deviation (dB)

DISCUSSION

Glaucoma is an optic neuropathy characterized by loss or retinal ganglion cells and their axons, the RNFL. Glaucoma is the leading cause of irreversible blindness worldwide and is the second only to cataract as the most common cause of blindness overall.[12] Primary angle-closure glaucoma is associated with or without raised intraocular pressure(IOP), but VF loss and specific

Goodness of fit	
R square	0.4187
Is slope significantly non-zero?	
F	63.39
DFn, DFd	1, 88
P value	<0.0001
Deviation from zero?	Significant

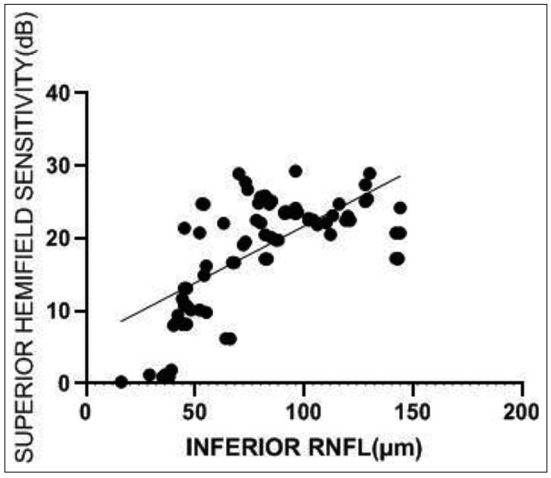

Figure 9: Inferior RNFL versus superior hemifield (scatter plot)

Goodness of fit	
R square	0.4252
Is slope significantly non-zero?	
F	65.11
DFn, DFd	1, 88
P value	<0.0001
Deviation from zero?	Significant

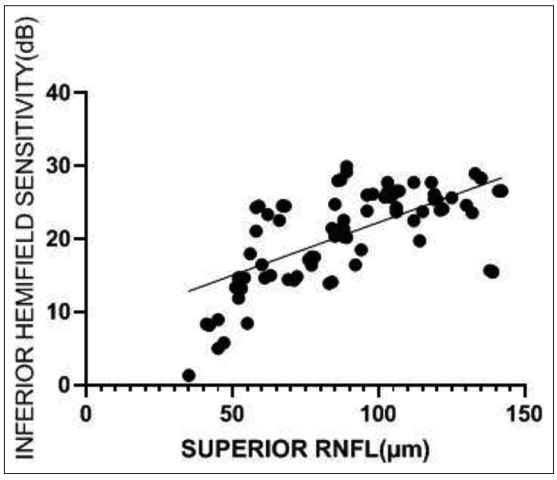

Figure 10: Superior RNFL versus inferior hemifield (scatter plot)

pattern of optic nerve damage are characteristic. As the disease progresses VF loss and optic nerve damage increases in a characteristic way. The major hurdle is in the diagnosis of PACG patients as these patients often present in the late stage when majority of the damage is already done. Therefore, both the parameters, that is,

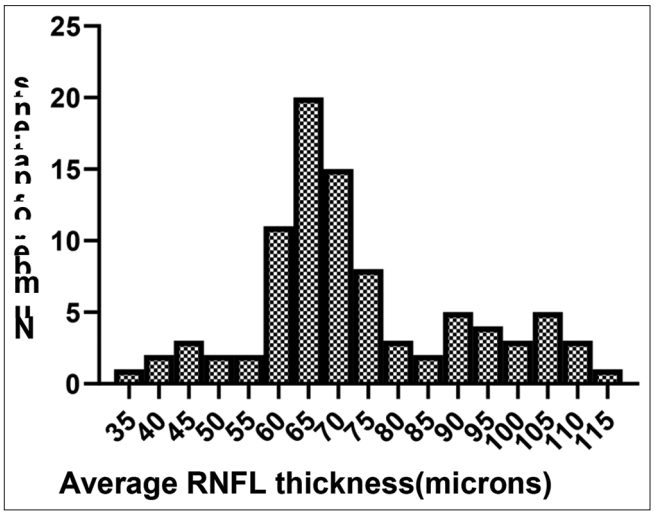

Figure 11: Histogram of frequency distribution of average RNFL

Goodness of Fit	
R square	0.05245
Is slope significantly non-zero?	
F	4.871
DFn, DFd	1, 88
P value	0.0299
Deviation from zero?	Significant

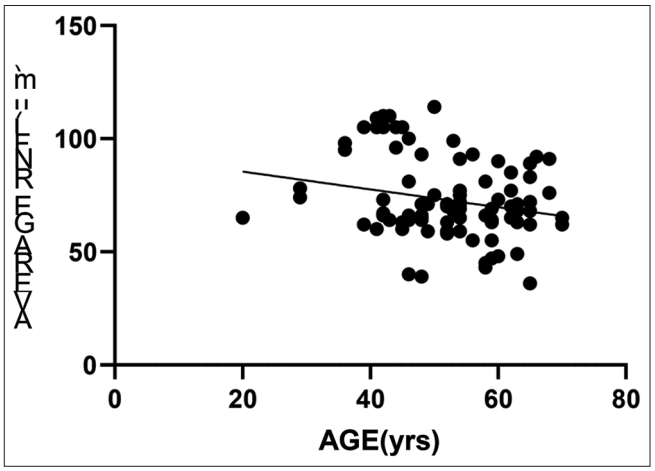

Figure 12: Age versus average RNFL (scatter plot)

VF loss and optic nerve damage, are essential for the detection of primary angle-closure glaucoma and also to detect its progression.

The mean (±SD) age of the study group was 51.79 ± 10.32 years. About 61% of the participants were male and 39% were female. It is to be noted that the mean age in this study was much lower than some other famous studies like Nilforushan *et al.*[13] in which was about 66.5 years or Ajtony *et al.*[14] in which it was 63.4 years. Hence, this study is looking at a much younger age group.

The mean (±SD) IOP of the population was 20.04 ± 3.72.

Goodness of fit	
R square	0.01185
Is slope significantly non-zero?	
F	1.055
DFn, DFd	1, 88
P value	0.3071
Deviation from zero?	Not significant

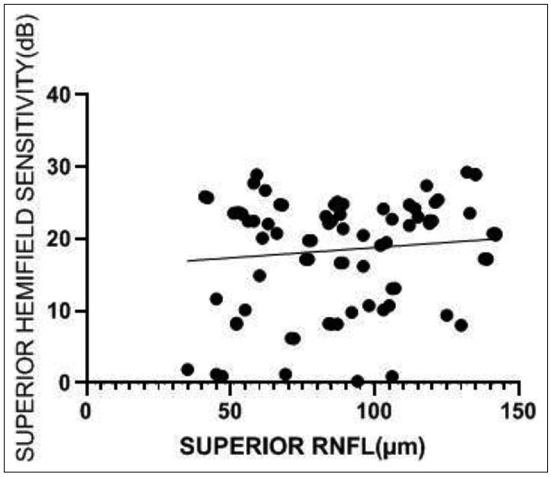

Figure 13: Superior RNFL versus superior hemifield (scatter plot)

Goodness of fit	
R square	0.02387
Is slope significantly non-zero?	
F	2.152
DFn, DFd	1, 88
P value	0.1459
Deviation from zero?	Not significant

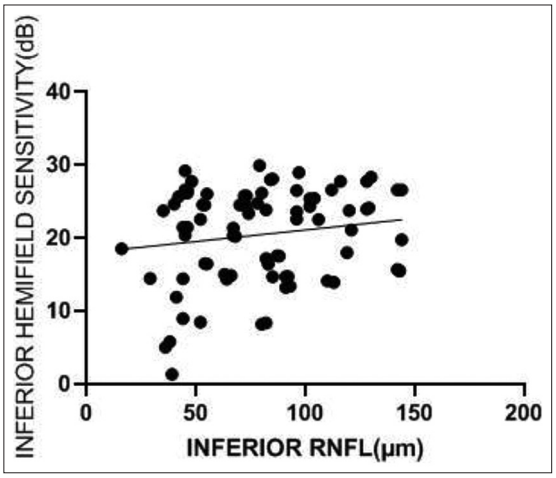

Figure 14: Inferior hemifield versus inferior RNFL (scatter plot)

Mean MD (±SD) and PSD (±SD) of the population were −10.28 ± 5.88 and 8.12 ± 3.77, respectively. In Nilforushan *et al.,* it was −1.3 ± 1.9 and 2.3 ± 1.2, respectively. In Ajtony *et al.*, it was about 4.33 ± 5.00 and 4.05 ± 3.31, respectively.[14]

Goodness of fit	
R square	0.2285
Is slope significantly non-zero?	
F	26.07
DFn, DFd	1, 88
P value	<0.0001
Deviation from zero?	Significant

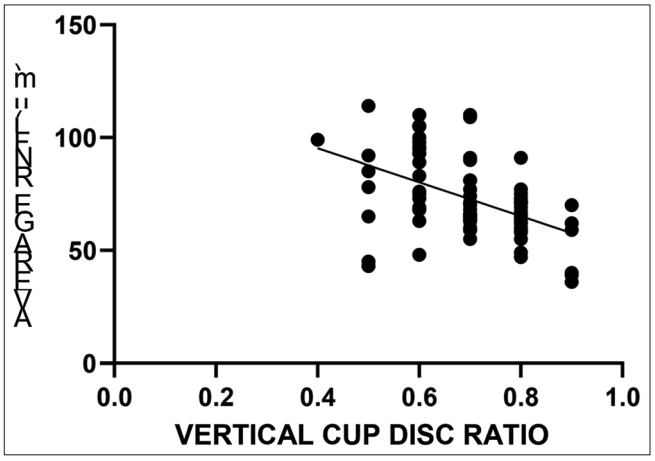

Figure 15: VCDR versus average RNFL (scatter plot)

Goodness of fit	
R squared	0.4205
Is slope significantly non-zero?	
F	63.86
DFn, DFd	1, 88
P value	<0.0001
Deviation from zero?	Significant

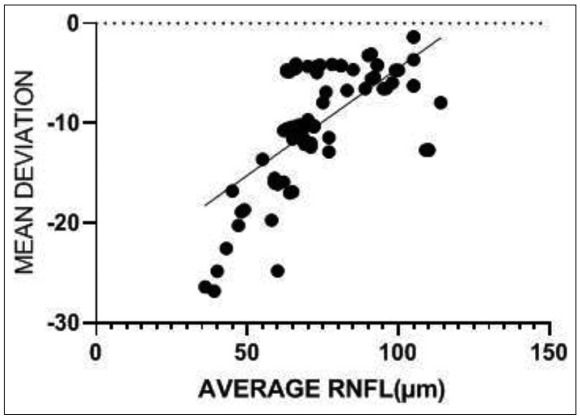

Figure 16A: Average RNFL versus mean deviation – linear regression (scatter plot)

Table 8: RNFL parameters in the study population

Parameter	Mean	Standard deviation	Range
Superior RNFL	87.29	29.41	35–142
Inferior RNFL	79.08	31.96	16–144
Temporal RNFL	61.20	15.19	26–90
Nasal RNFL	64.62	17.41	26–109
TSNIT average RNFL	72.96	17.72	36–114

Goodness of fit	
Degrees of freedom	87
R squared	0.6388
Sum of squares	1110
Sy.x	3.573

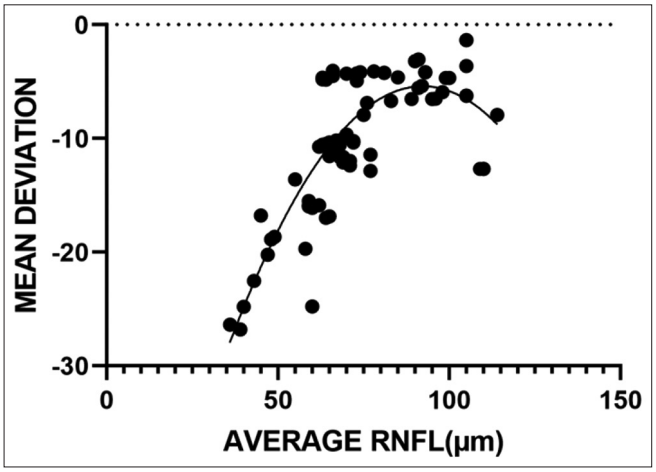

Figure 16B: Average RNFL thickness versus mean deviation: Non-linear regression (scatter plot)

Goodness of fit	
R square	0.2094
Is slope significantly non-zero?	
F	23.30
DFn, DFd	1, 88
P value	<0.0001
Deviation from zero?	Significant

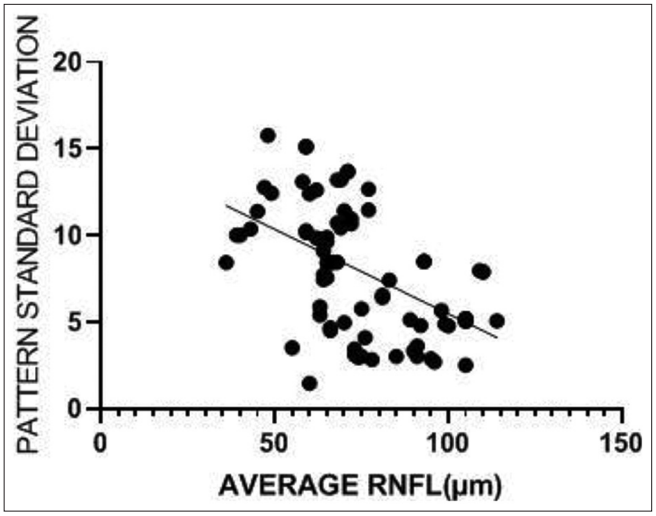

Figure 17: Average RNFL versus PSD (scatter plot)

Hence, this study is looking at subjects with advanced VF defects. It is to be mentioned here that both the above studies had pre-perimetric and glaucoma suspects in their consideration.

Mean (±SD) superior and inferior hemifield sensitivities were 18.45 ± 7.71 and 20.43 ± 6.54, respectively.

Mean (±SD) values of superior, inferior, temporal, and nasal RNFL thickness were 87.29 (±29.41), 79.08 (±31.96), 61.2 (±15.19), and 64.62 (±17.41), respectively.

Mean TSNIT average (±SD) was 72.96 (±17.72).

The mean RNFL thickness in Nilforushan *et al.* was 85.6 and 77.9 in Ajtony *et al.*, so this study is looking at patients with much more greater RNFL thinning (Table 8).

Regarding the VCDR, maximum patients (n = 27) had 0.7 cupping followed by 0.8 (n = 26) and 0.6 (n = 22) cupping, respectively.

About 60% of the patients had a visual acuity equal to or worse than 6/12.

Plotting TSNIT avg. RNFL thickness against age, we got a negative slope correlation with R^2 = 0.05 and P = 0.03 (<0.05), which was statistically significant.

The slope showed a 0.393 µm yearly decline in average RNFL thickness with increasing age. Other researchers like Ajtony *et al.* got a decrease of 0.36 µm/year.[14] Alamouti and Funk[15] reported a 0.44 µm yearly decline, whereas Kanamori *et al.*[16] calculated 0.22 µm per year using OCT II.

Plotting vertical cup-disk ratio against TSNIT avg., we get a negative slope correlation with R^2 = 0.23 and P < 0.0001, which was statistically significant. That is with increasing VCDR, the average RNFL decreases.

Plotting mean deviation against avg. RNFL thickness, we get a positive linear correlation slope with R^2 = 0.42 and P < 0.0001, which was statistically significant. That is, as the mean deviation became less negative, the average RNFL thickness increases.

When plotted using a non-linear regression method, the best-fit curve (quadratic) had a positive correlation with better fit (R^2 = 0.64).

Speaking of other authors, Ajtony *et al.*[14] got a positive correlation with R^2 = 0.723 with a non-linear (quadratic) regression method in the POAG group.

Arun *et al.*[17] got a negative correlation slope with R^2 =0.53 with linear regression analysis between absolute value of MD versus average RNFL thickness, with only POAG patients in the study group. Zangwill *et al.*[18] got a positive correlation with R^2 = 0.35–0.43 and in Nilforushan *et al.*[13] got a positive correlation with R^2 = 0.051. It is to be noted that both Zangwill *et al.* and Nilforushan *et al.* both had glaucoma suspects and ocular hypertensives in their study population hence the lower correlation. Ajtony *et al.*[14]

have clearly shown that in pre-perimetric glaucoma, the correlation was lower (R^2 = 0.015) than POAG group (R^2 = 0.723).

Plotting pattern standard deviation against average RNFL, we get a negative correlation slope with linear regression (R^2 = 0.21), $P < 0.0001$, which was significant statistically. This shows that with increase in PSD, the avg. RNFL thickness decreases. Ajtony *et al.* got a negative correlation with $R^2 = 0.474$.

Arun *et al.* got a negative correlation with $R^2 = 0.31$ with only POAG patients.[17]

Plotting superior hemifield sensitivity with inferior RNFL thickness, we get a positive correlation slope with $R^2 = 0.42$ and $P < 0.0001$, which was statistically significant. This shows that decrease of average superior hemifield retinal sensitivity was followed by a decrease in inferior RNFL thickness. Nilforushan *et al.* got a positive correlation slope with $R^2 = 0.107$, but it again had glaucoma suspects in its consideration. Arun *et al.* also got a positive correlation with $R^2 = 0.48$ with only POAG patients.[17]

Plotting inferior hemifield sensitivity with superior RNFL thickness, we get a positive correlation slope with $R^2 = 0.43$ and $P < 0.0001$, which was statistically significant. This shows that decrease of average inferior hemifield retinal sensitivity was followed by a decrease in superior RNFL thickness. Nilforushan *et al.* got a positive correlation slope with $R^2 = 0.068$, but it again had glaucoma suspects in its consideration. Arun *et al.* also got a positive correlation with $R^2 = 0.38$ with only POAG patients.[17]

To show that the reverse does not hold true, we plotted superior hemifield sensitivity with superior RNFL thickness and inferior hemifield sensitivity with inferior RNFL thickness. The first one had very low correlation with $R^2 = 0.012$ and $P = 0.3$, which was not statistically significant. Second one had a $R^2 = 0.023$ and $P = 0.14$, again not significant statistically.

CONCLUSION

In this study, the correlation of SD-OCT structural measures (RNFL thickness) with functional measures derived from SAP in a group of eyes with established primary angle-closure glaucoma was investigated.

A total of 90 eyes ($n = 90$) from 50 patients with established PACG were taken into consideration.

The mean (±SD) age of the study group was 51.79 ± 10.32 years; 61% of the participants were male and 39% were female.

The mean (±SD) IOP of the population was 20.04 ± 3.72.

Mean MD (±SD) and PSD (±SD) of the population were −10.28 ± 5.88 and 8.12 ± 3.77, respectively.

Mean (±SD) superior and inferior hemifield sensitivities were 18.45 ± 7.71 dB and 20.43 ± 6.54 dB, respectively.

Mean (±SD) TSNIT average RNFL thickness was 72.96 (± 17.72) μm.

Mean (±SD) values of superior, inferior, temporal, and nasal RNFL thickness were 87.29 (±29.41) μm, 79.08 (±31.96) μm, 61.2 (±15.19) μm, and 64.62 (±17.41) μm, respectively.

Regarding the VCDR, maximum patients ($n = 27$) had 0.7 cupping followed by 0.8 ($n = 26$) and 0.6 ($n = 22$) cupping, respectively.

About 60% of the patients had a visual acuity equal to or worse than 6/12.

Plotting TSNIT avg. RNFL thickness against age, we got a negative slope correlation which was statistically significant. The slope showed a 0.393 μm yearly decline in average RNFL thickness with increasing age.

Plotting vertical cup-disk ratio against TSNIT avg., we get a negative slope correlation with $R^2 = 0.23$ and $P < 0.0001$, which was statistically significant. That is with increasing VCDR, the average RNFL decreases.

Plotting mean deviation against avg. RNFL thickness, we get a positive linear correlation slope with $R^2 = 0.42$ and $P < 0.0001$, which was statistically significant. That is, as the mean deviation became less negative, the average RNFL thickness increases.

When plotted using a non-linear regression method, the best-fit curve (quadratic) had a positive correlation with better fit ($R^2 = 0.64$).

Plotting pattern standard deviation against avg. RNFL, we get a negative correlation slope with linear regression (R^2 = 0.21), $P < 0.0001$, which was significant statistically. This shows that with increase in PSD, the avg. RNFL thickness decreases.

We find good positive correlation between superior and inferior hemifield sensitivity with inferior ($R^2 = 0.42$) and superior RNFL thickness ($R^2 = 0.43$), respectively.

However, the vice-versa was not true.

In summary, the strength of the relationship between structure and function detected in our study is in good agreement with previous reports in the literature.

Based on the result of this study, there is a direct correlation between the VF loss in automated perimetry and the RNFL loss in OCT. Therefore, OCT can be considered for monitoring the progression of glaucoma.

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Original Article

Estimation of Serum Homocysteine Levels in Migraineurs With and Without Aura – A Cross-sectional Study

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Abstract

Introduction: Migraine is a primary and chronic-intermittent headache disorder that affects approximately 15% of women and 6% of men. Homocysteine is a sulfur containing amino acid which is associated with vascular damage and increased risk of cardiovascular diseases and stroke. Migraineurs with aura are known to be at increased risk of cardiovascular diseases and stroke as stated by several studies. This study was undertaken to see whether the homocysteine levels were increased in Migraineurs.

Aim: The aim of the study was to compare and correlate the levels of serum homocysteine in migraineurs with and without aura with those of controls.

Methodology: This was a cross-sectional and observational study done at Kamineni institute of medical sciences, Sreepuram, Nalgonda district, Telangana, from October 2010 to September 2013.The subjects were categorized into three groups: GROUP-I (Migraineur with Aura), GROUP-II (Migraineurs without Aura), GROUP-III: Controls, with 30 subjects in each group. Patients in the age group between 20 and 60 years of both sexes were included and patients on treatment for migraine, hypertension, and chronic kidney diseases were excluded from the study. Serum homocysteine levels were estimated by ELISA method on fasting blood samples. Statistical analysis was performed using SPSS software.

Results: The male to female ratio in Group-I was 1: 3.34 and in Group-II was 1:4. It was observed that maximum cases of Group-I fall in the age group of 31–40 years of age, and of Group-II in the age group of 20–30 years. The serum homocysteine levels in migraine with and without aura were significantly increased when compared with controls. Migraineurs with aura had high levels of serum homocysteine (30.87 ± 7.48 μmol/L) when compared with Migraineurs without aura (12.82 ± 2.56 μmol/L) and controls (9.57 ± 2.13 μmol/L).

Conclusion: As hyperhomocysteinemia is an independent risk factor for cardiovascular diseases and stroke, serum homocysteine levels must be estimated in patients diagnosed with Migraine headache.

Key words: Cardiovascular disease, Homocysteine, Migraine

INTRODUCTION

Migraine is a primary and chronic-intermittent headache disorder that affects a large proportion of the population, predominantly middle-aged women.[2] It affects approximately 15% of women and 6% of men.[1]

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Clinical diagnosis of migraine is based on International Classification of Headache Disorders-II criteria specified by the International Headache Society, which classifies migraine into two major groups; without aura (MWOA) and with aura (MWA).[3]

Homocysteine (Hcy) is a sulfur-containing amino acid. Circulating levels of homocysteine are usually low due to its rapid metabolism through one of two pathways:

(1) a cobalamine (vitamin B12) and folate dependent remethylation pathway that regenerates methionine, or (2) a pyridoxal 5' phosphate (PLP, vitamin B6) dependent

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trans sulfuration pathway that converts homocysteine into cysteine.

The occurrence of hyperhomocysteinemia indicates that homocysteine metabolism has in some way been disrupted and that the export mechanism is disposing into the blood excess homocysteine that has accumulated in the cell. This prevents toxicity to the cell but leaves vascular tissue exposed to the possibly deleterious effects of excess homocysteine.[4-6]

In 1995 Boushey *et al*. performed a meta-analysis of 27 studies correlating homocysteine to vascular disease. They concluded that a 1 μmol/L increase in Hcy concentrations was associated with a 10% increase in CHD risk.

Studies done in European countries have shown that homocysteine levels are altered in migraineurs. Prospective studies have linked migraine with increased incidence of stroke and cardiovascular diseases.[7,8] Hyperhomocysteinemia in Migraineurs with aura was associated with mutations in MTHFR gene.[9] The present study was undertaken to estimate the serum homocysteine levels in migraineurs and in controls.

Aim

The aim of the study was to compare and correlate the levels of serum homocysteine in migraineurs with and without aura with those of controls.

Objectives

The objectives of the study are as follows:

- To estimate serum homocysteine levels in cases and controls
- To compare and correlate the serum homocysteine levels in migraineurs with aura and without aura.

METHODOLOGY

This study was done at Kamineni Institute of Medical Sciences, Sreepuram, Nalgonda district, Telangana with approval of Institutional Ethics Committee.

A total of 60 cases, clinically diagnosed of migraine headache, reporting the general medicine department in Kamineni Hospital, Sreepuram, during the period from October 2010 to September 2013, were selected.

Type of Study

This was a cross-sectional study.

Inclusion Criteria

- Age group between 20 and 60 years of both sexes was included in the study.

Exclusion Criteria

The following criteria were excluded from the study:

- Patients who are already on treatment for migraine.
- Patients with disorders which can increase Homocysteine levels such as CAD, chronic kidney diseases, pre-eclampsia, and hypertension.
- In the present study, serum homocysteine levels were estimated in 60 migraine patients and 30 controls.

The Subjects were Categorized into 3 Groups

GROUP-I: Migraineurs with Aura: This group included 30 patients.

GROUP-II: Migraineurs without Aura: This group included 30 patients. People in case group were selected according to migraine diagnosis on the basis of ICDH-H standards and being not affected with heart and renal or any other serum homocysteine level effecting diseases.

GROUP-III: Controls: Thirty age- and sex-matched apparently healthy individuals reporting for health checkup.

Sample Collection

Patients were advised to avoid Protein rich meals late in the day before sampling. After about 8–10 h fasting, 5 ml of venous blood was drawn from the migraine patients and matched controls. The sample was centrifuged at 3000 rpm

Table 1: Division of total study population into different study groups

Category	No. of patients
Group-I: Migraine with aura	30
Group-II: Migraine without aura	30
Group-III: Controls	30
Total	90

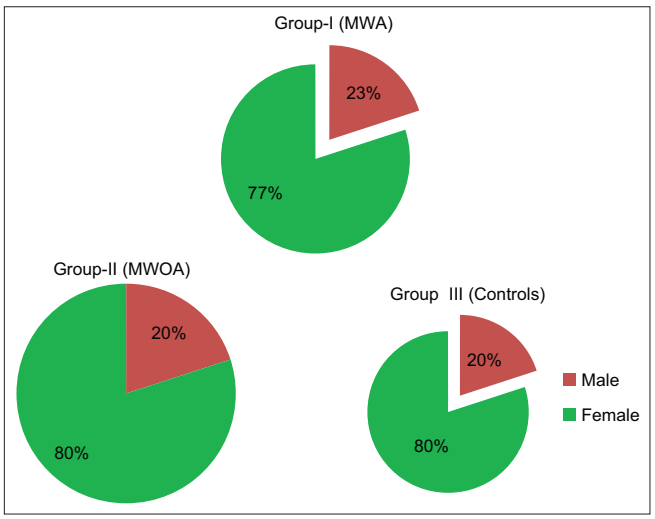

Chart 1: Sex-wise distribution of patients in study groups

for 10 min and serum was separated and stored in deep freezer at −20°C until processed.

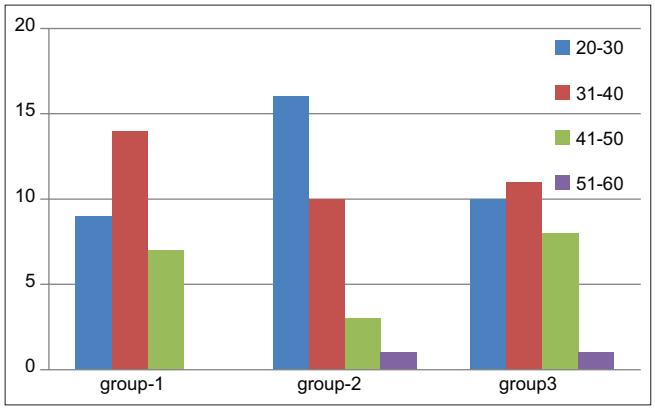

Chart 2: Age distribution among study groups

Table 2: Age distribution among study group

AGE (years)	Group-I (*n*=30)	Group-II (*n*=30)	Group-III (*n*=30)
20–30	9 (30%)	16 (53.3%)	10 (33.33%)
31–40	14 (46.66%)	10 (33.33%)	11 (36.66%)
41–50	7 (23.33%)	3 (10%)	8 (3.33%)
51–60	-	1 (3.33%)	1 (3.33%)
TOTAL (N)	30	30	30
MEAN±SD	35.53±6.78	32.23±7.83	35.4±8.71

Table 3A: Mean±S.D of serum homocysteine (5–15 μmol/L) in different groups

Group	Mean±S. D
Group-I (MWA) *n*=30	30.87±7.48
Group-II (MWOA) *n*=30	12.82±2.56
Group-III (Controls) *n*=30	9.57±2.13

Table 3B: Analysis of variance (Anova) for serum homocysteine levels levels (μ mol/L) in all the three groups

Source	df	Sum of squares	Mean square	F	significance
Between Groups	2	7887.25	3943.62	171.86	0.000
Within Groups	87	1996.36	22.95		
Total	89	9883.61			

Serum homocysteine was estimated by ELISA Kit method using standard curve.

Statistical Analysis

The statistical analysis was performed using SPSS software version 11.0. The descriptive results were expressed as mean and standard deviation. Significance of difference between and within groups was assessed by applying *post hoc* test and ANOVA study. The *P*-values were expressed along with mean values and standard deviation. $P < 0.05$ was considered statistically significant and values <0.001 were considered highly significant.

RESULTS

Group I, II, and III included 30 cases of Migraineurs with Aura, Migraineurs without Aura, and apparently healthy individuals, respectively [Table 1].

In the present study, the male to female ratio in Group-I is 1:3.34 and in Group-II is 1:4 [Chart 1].

It is observed that maximum cases of group-I fall in the age group of 31–40 years of age, and maximum cases of group-II fall in the age group of 20–30 years [Chart 2].

The average age of patients in Group-I was 35.53 ± 6.78 years and in Group-II was 32.23 ± 7.83 years and that of Group- III was 35.4 ± 8.71 years. According to this, there was no statistical significant difference between two groups [Table 2].

The serum homocysteine levels in migraine with and without aura are increased when compared with controls. Migraineurs with aura had high levels of serum homocysteine when compared with other two groups [Table 3A].

Serum homocysteine levels are significantly increased ($P = 0.000$) when compared within the groups and between the groups [Table 3B].

The mean level of homocysteine in case groups was significantly more than control group ($P < 0.001$) [Table 3C].

Table 3C: Multiple comparisons of serum homocysteine levels by *post hoc* test in all the three groups

Dependent variable	(I) group	(J) group	Mean difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Upper bound	Lower bound
Serum Hcy	Group-I	Group-II	18.11*	1.24	0.000	20.56	15.64
		Group-III	21.24*	1.24	0.000	23.70	18.78
	Group-II	Group-I	−18.11*	1.24	0.000	−15.64	−20.56
		Group-III	3.14*	1.24	0.013	5.60	0.68
	Group-III	Group-I	−21.24*	1.24	0.000	−18.78	−23.70
		Group-II	−3.14*	1.24	0.013	−0.68	−5.60

DISCUSSION

Migraine is a primary chronic intermittent headache disorder characterized by pulsating unilateral severe pain attacks with associated autonomic and gastrointestinal symptoms. In some patients, transient neurologic symptoms mostly visual disturbances can occur that are known as "migraine aura."

According to the present study, the incidence of migraine headache is more in females than in men. The ratio of female: male is 4:1. We found serum homocysteine levels to be significantly increased in MWA and MWOA. In addition, serum homocysteine levels were lower in MWOA than in MWA. Homocysteine might have a direct role to play in migraine causation, especially keeping in view the role of homocysteine in terms of vascular damage and migraine being regarded as a neurovascular disorder.

Several studies have shown association between plasma tHcy concentrations and CHD and Stroke.[10,11] They have reported elevated plasma tHcy as an independent risk factor for CHD and stroke.[12,13] These findings were supported by the results of a meta-analysis which indicated that total Hcy is a modest predictor of IHD and stroke risk in a healthy population independent of traditional cardiovascular risk factors.[15-17]

CONCLUSION

As hyperhomocysteinemia is an independent risk factor for cardiovascular diseases and stroke, serum homocysteine levels must be estimated in patients diagnosed with migraine headache. Migraineurs with aura must be kept under follow-up with supplementation of tetrahydrofolate and genetic analysis must be done to rule out MTHFR gene mutations[14] as they are at increased risk for stroke and cardiovascular episodes.

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Original Article

Impact of Diffuse Traumatic Brain Injury on Survival and Quality of Life in Eastern India

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Abstract

Introduction: Diffuse axonal injury (DAI) is a brain injury characterized mainly as axonal injury of the white matter. In DAI, there is microscopic damage to the axons in the brain neural tracts, corpus callosum, and brainstem and is associated with significant mortality and morbidity. The occurrence of DAI depends on the mechanism of injury; it is more common in higher energy trauma, especially traffic accidents. DAI is clinically defined by coma lasting 6 h or more after traumatic brain injury (TBI), excluding cases of swelling or ischemic brain lesions.

Aims: The aim of the study was to study the impact of diffuse TBI on survival and quality of life (QOL): A prospective and observational study from a Level 1 trauma care center in Eastern India and to study the impact of associated injuries such as musculoskeletal/thoracoabdominal/spinal trauma on overall survival and outcome.

Materials and Methods: A non-randomized, prospective, and observational study was conducted in Department of Neurosurgery, Level 1 Trauma Care Centre IPGME and R and SSKM Hospital, Kolkata from April 2020 to August 2021. One hundred patients were taken in our study.

Results: Mean age of our study population was 37 years with a mortality rate of 66%. The majority of the patients 66 (66%) had extended Glasgow outcome scale (GOSE) score 1–2, 6 (6%) patients had GOSE score 3–4, 12 (12%) patients had GOSE score 5–6 while 16 (16%) patients had GOSE score 7–8. The mean QOL (Index score) and QOL (visual analog scale score) of our study was 0.541 ± 0.5212 and 69.15 ± 22.703, respectively.

Conclusion: Patients with Glasgow coma scale <8 and longer stay in intensive care unit expired having GOSE 1–2 while patients with FOUR score more than 12, Marshall score 1, no requirement of airway/ventilatory support and no complications had better QOL.

Key words: Diffuse axonal injury, Survival and outcome, Traumatic brain injury

INTRODUCTION

Diffuse axonal injury (DAI) is a brain injury characterized mainly as axonal injury of the white matter.[1] It often follows brain trauma, which causes wide-ranging denaturation of white matter, focal hemorrhage, emergence of axonal retraction balls, and microglia clusters. DAI is often accompanied by other brain injuries, and this has caused patients severe brain damage or even placed them in a persistent vegetative state. According to reports made in recent years, the mortality rate of DAI is 42–62%.[2]

In DAI, there is microscopic damage to the axons in the brain neural tracts, corpus callosum, and brainstem and is associated with significant mortality and morbidity. The occurrence of DAI depends on the mechanism of injury; it is more common in higher energy trauma, especially traffic accidents.[3,4] DAI is clinically defined by coma lasting 6 h or more after traumatic brain injury (TBI), excluding cases of swelling or ischemic brain lesions.[4]

DAI is considered the most important factor in determining morbidity and mortality in victims of TBI and is the most

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common cause of post-traumatic coma, disability, and a persistent neurovegetative state.[3,4]

DAI causes cognitive, physical, and behavioral changes that compromise social reintegration, return to productivity, and quality of life (QOL) of patients and their families.[3-6] These changes persist beyond the acute phase of treatment and continue for a long period after the traumatic event. Because the brain tissue is functionally impaired but not destroyed, the brain may gradually regain normal function as the clinical condition stabilizes and neural connections are remodeled due to plasticity.[5,6]

DAI, and more generally TBI, often results in physical, cognitive, and behavioral impairments that can be temporary or permanent.[3-6] Research on outcome after TBI, using scales of function and performance in activities of daily living, depicts the individual and social consequences of these changes suffered by patients after TBI.

The outcome of patients after DAI has been linked to the number of lesions identified through imaging. When damage is extensive as evidenced by a positive head computed tomography for intracranial hemorrhage, DAI can be identified. Most often, however, DAI is diagnosed by magnetic resonance imaging and represents a common radiographic diagnosis in up to 50% of traumatic brain injuries.[7] It is believed that DAI is present in nearly all of those who sustain loss of consciousness due to a motor vehicle crash,[7] and DAI appears associated with coma following TB.

Aims and Objectives

The objectives of the study are as follows:

- To study the impact of diffuse TBI on survival and QOL: A prospective and observational study from a Level 1 trauma care center in Eastern India
- To study the mode of injury and clinicoradiological severity of the injury as per Glasgow coma scale (GCS) Score and FOUR Score at presentation, along with application of established Radiological Severity Scoring Systems (Marshall/Rotterdam) and to correlate the same with 30 days survival, short-term (180 days) functional status (as per extended Glasgow outcome scale [GOS-E]) and short-term (180 days) QOL (as per EQ5D)
- To study the impact of associated injuries such as musculoskeletal/thoracoabdominal/spinal trauma on overall survival and outcome.

MATERIALS AND METHODS

Study Design

This was a non-randomized, prospective, and observational study.

Study Setting

This study was conducted at Department of Neurosurgery, Level 1 Trauma Care Centre IPGME and R and SSKM Hospital, Kolkata.

Study Timelines

The duration of the study was April 2020–August 2021.

Period of Study

The study period was 18 months.

Study Population

All patients admitted to trauma care centre during the study period with diffuse TBI.

Sample Size

The sample size was 100 cases.

Inclusion Criteria

- All patients admitted to Trauma Care Centre with diffuse TBI were included in the study.

Exclusion Criteria

The following criteria were excluded from the study:

- Individuals/Legal guardian not willing to participate in the study
- Patients lost to follow-up.

Data Collection

All patients admitted to trauma care center with diffuse TBI between April 2020 and August 2021 will be included in this study while those not willing to participate in the study or lost to follow-up will be excluded from this study.

RESULTS AND DISCUSSION

Age

- Mean age of our study population was 37 years
- Similarly, in other studies, the mean age was <40 years – Humble *et al*.[8] the mean was 40 years, Moen *et al*.[9] it was 34 years and Moen *et al*.[10] it was 33 years
- Unlike our study, the study done by Matsukawa *et al*. had a higher mean age of 47 years.

Sex

- Male comprised 86% of our study population
- Similar male preponderance was also seen in other studies likes Matsukawa *et al*.[11] 85%, Chelly *et al*.[12] 81%, and Adams *et al*.[13] 79%.

Mode of Injury

- Out of 100 cases in our study, 88 cases (88%) were due to road traffic accidents (RTA) while 12 patients (12%) were due to fall from height

- Mortality from RTA was 64.8 % while that from fall from height was 75%
- Similar to our study, RTA was the main mechanism of injury reported in other studies likes Adams *et al*.[13] (RTA [69%], Fall [18%]), Skandsen *et al*.[14] (RTA [60%], Fall [27%]), and Hilario *et al*.[15] (RTA [89%], Fall [11%])
- Unlike our study, fall (54%) was the main mechanism of injury in the study of Matsukawa *et al*.[11]

GCS

- There was statistically significant association between GCS with mortality and GOSE in the present study. About 90.3% of patients with GCS <8 having GOSE 1–2, expired. All patients with GCS 13–15 survived. Seven out of eight patients with GCS 13–15 had GOSE 7–8 while one had GOSE 6
- In our study, the majority of the patients presented with severe GCS (62%) followed by moderate (30%) and mild GCS (8%). The findings were comparable to the results of other studies Plata *et al*.[16] Mild GCS 3%, moderate GCS 14%, severe GCS 83%, and Chelly *et al*.[12] Mild GCS 3.5%, moderate GCS 12.9%, severe GCS 83.6% indicating that severity of head injury plays an important role in the mortality of head injury patients
- Patients with GCS <8 had poor QOL.

Four Score

- There was statistically significant association between FOUR score with mortality and GOSE score. Most of the patients with FOUR score more than 12 survived while majority of the patients with FOUR score <12 had GOSE score 1–2
- Patients with FOUR score more than 12 had better QOL.

Need for Airway/Ventilatory Support

- Mechanical ventilation was required for 63 (63%) patients in our study out of which 56 (88.9%) died indicating that patients requiring airway/ventilator support had poor prognosis
- Patients not requiring airway/ventilator support had better QOL
- Similarly, a higher rate of ventilatory support was required for 77 patients (98.7%) in the study of Chelly *et al*.[12]

Marshall Score

- In our study, 78% patients had Marshall score 1, 18% had Marshall score 2, and 4% had Marshall score 3
- With increasing Marshall score, GOSE score decreased and vice versa
- Marshall score 1 had higher QOL than Marshall score 2–3
- Unlike our study, other studies had majority of the patients with Marshall score 2- Skandsen *et al*.[14] had 45% patients with Marshall score 2 while Matsukawa *et al*.[11] had 35% with Marshall score 2.

Rotterdam Score

- In our study, 96% patients has score 1–2, 4% patients had score 3–4 while there were no patients with score 5–6
- Unlike our study, the study of Moen *et al*.[10] had 38% patients with score of 1–2, 53% patients with score of 3–4 while 8% patients had score 5–6.

GOSE

- In our study, the majority of the patients 66 (66%) had GOSE score 1–2, 6 (6%) patients had GOSE score 3–4, 12 (12%) patients had GOSE score 5–6 while 16 (16%) patients had GOSE score 7–8.
- In contrary to our study, other studies had minimum patients with GOSE 1-2 - Plata *et al*.[16] ([13.6%] GOSE 1–2, [36.3%] GOSE 3–4, [22.7%] GOSE 5–6, [27.2%] GOSE 7–8), Hilario *et al*.[15] ([12%] GOSE 1–2, [40%] GOSE 3–4, [22%] GOSE 5–6, [26%] GOSE 7–8) and Moen *et al*.[9] ([2%] GOSE 1–2, [15%] GOSE 3–4, [30%] GOSE 5–6, [50%] GOSE 7–8).

Length of Stay in Intensive Care Unit (ICU) and Hospital

- In both ICU and in hospital, mean length of stay was more for those who survived and for patients with GOSE 3–4
- Mean ICU stay of our study was 6.5 days while mean hospital stay of our study was 10.3 days
- Similarly, the study of Humble *et al*.[8] had a mean ICU stay of 6 days and a mean hospital stay of 11 days
- Unlike our study, the study of Chelly *et al*.[12] had a longer ICU stay of 19.6 ± 13.8 days while the study of Plata *et al*.[16] had a longer hospital stay of 20 ± 8 days
- Patients with longer stay in ICU had poor QOL (Index score).

Body Regions

- Head was the most common region involved in all cases of our study (100%) resulting in the death of 66 patients (66%) followed by extremities in 23 patients (23%) resulting in the death of 16 subjects (69.6%). Nine patients (9%) presented with spine injuries and 2 patients (2%) presented with abdominal injuries, both of which had 100% mortality. Eight patients (8%) presented with chest injuries out of which 6 died (75%).

Complications

- In our study, 14 patients were complicated with sepsis while decubitus ulcer and seizure occurred in six and four patients, respectively

- QOL (Index score) was better in patients with no complication.

QOL and Mortality

- The mean QOL (Index score) and QOL (visual analog scale score) of our study was 0.541 ± 0.5212 and 69.15 ± 22.703, respectively
- Total mortality rate of present study was 66%.

CONCLUSION

- Total mortality rate of present study was 66%
- All patients were managed conservatively
- RTA accounted for 88 cases (88%) resulting in the death of 57 patients (64.8%) while fall from height accounted for 12 cases (12%) resulting in the death of 9 patients (75%)
- About 90.3% of patients with GCS <8 having GOSE 1–2, expired. All patients with GCS 13–15 survived. Seven out of eight patients with GCS 13–15 had GOSE 7–8
- Patients with GCS <8 had poor QOL
- Most of the patients with FOUR score more than 12 survived and had better QOL while majority of the patients with FOUR score <12 had GOSE score 1–2
- 56 out of 63 patients (88.9%) requiring airway/ventilator support expired having GOSE score 1–2
- Patients not requiring airway/ventilator support had better QOL
- With increasing Marshall score, GOSE score decreased and vice versa
- Marshall score 1 had higher QOL than Marshall score 2–3.
- In both ICU and in hospital, mean length of stay was more for those who survived and for patients with GOSE 3–4
- Patients with GOSE 1–2 had stayed more days in ICU (6.65 ± 2.64) out of the total days spent in hospital (7.56 ± 3.6)
- Patients with longer stay in ICU had poor QOL (Index score)
- QOL (Index score) was better in patients with no complication
- Mean QOL (Index score) of the study population was 0.541 ± 0.521.

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Original Article

Comparative Study of Leg Wrapping Versus Leg Elevation for the Prevention of Hypotension in Spinal Anesthesia for Elective Cesarean Section

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Abstract

Background: The quality of the block required and the time required for the surgery influence the choice of local anesthetic drug. Lignocaine, the first amide local anesthetic agent was accepted for clinical use in the early 1950s.

Aim: This study aims to compare leg wrapping versus leg elevation for the prevention of hypotension in spinal anesthesia for elective cesarean section.

Materials and Methods: This is the prospective randomized controlled study comprised 60 full-term pregnant mothers with singleton uncomplicated pregnancy belonging to ASA Class 1 or 2, scheduled for elective cesarean section under spinal anesthesia, who were allocated randomly to either group blood pressure in the leg wrapped group (BLW) (leg wrapping) (n = 30) or group BLE (leg elevation) (n = 30) who were admitted in Government Maternity Hospital, Tirupati. Hypotension is defined as fall in systolic blood pressure to 90 mmHg or fall more than 20% from baseline blood pressure. Hypotension was treated immediately by increasing the rate of ringer lactate administration and by giving mephentermine 6 mg intravenously.

Results: Significant difference in systolic and diastolic blood pressure was present in the first 4–14 min. There is a significant fall in mean arterial pressure in the leg elevation group when compared to the leg wrapping group from 4 to 14 min. The BLW was stable, decrease in the blood pressure noted in 3 (10%) patients, compared to 10 (33.33%) patients in the leg elevated group (BLE). The difference in occurrence of hypotension in the study groups was statistically significant.

Conclusion: We conclude that the leg wrapping with elastic crepe bandage just before subarachnoid block significantly decreases the incidence of spinal hypotension as well as it causes a marked reduction in the use of vasopressor agents when compared to the leg elevation.

Key words: Hypotension, Leg elevation, Leg wrapping, Spinal anesthesia

INTRODUCTION

The quality of the block required and the time required for the surgery influence the choice of local anesthetic drug. Lignocaine, the first amide local anesthetic agent, was accepted for clinical use in the early 1950s. Following introduction of lignocaine into clinical practice, it was widely used in spinal anesthesia. Because of transient effects, it is no longer used for spinal anesthesia. The first local anesthetic with a long duration of action, bupivacaine, is now the most commonly used local anesthetic drug.[1]

Spinal anesthesia blockade up to the level of T4 is required to provide adequate anesthesia for cesarean section surgeries.[2] Because of sympathetic blockade, hypotension is inevitable during spinal anesthesia. Prevention of spinal anesthesia-induced hypotension in cesarean section has been referred to as the Holy Grail in obstetric anesthesia.[3,4] Despite enormous development in the knowledge of anesthetic drugs and techniques, hypotension in spinal anesthesia is still a major problem. Hypotension is defined

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as a drop of 20% in systolic blood pressure from baseline or a systolic blood pressure of <90 mmHg.[5]

Hypotension causes dizziness, nausea, and vomiting, which makes the experience uncomfortable for the mother. In severe cases, neuraxial blockade-induced hypotension can result in loss of consciousness, pulmonary aspiration, apneic attacks, and even cardiac arrest. Sustained hypotension can impair uteroplacental perfusion, leading to fetal hypoxia and acidosis.[6] Several studies were conducted to know the ideal treatment, which can be adopted to prevent hypotension during spinal anesthesia. Different techniques in use include IV fluid administration, pre-emptive and intraoperative vasopressor usage, and certain non-invasive physical methods. Intravenous fluids, either crystalloid or colloid, were used to increase intravascular volume and reduce hypotension. Although simple and easy, this technique cannot be used in cardiac patients and gestational hypertension.[7] Colloid usage carries the risk of allergic responses and anaphylaxis. The relevance of preload in preventing spinal hypotension is presently debatable.[8]

Physical methods such as left side table tilt (12.5–15°) and left uterine displacement using wedge relieve aortocaval compression, which, in turn, increase venous return. However, some studies have proven that these techniques do not significantly prevent hypotension.[9,10] Venous pooling, which occurs due to peripheral vasodilation resulting from sympathetic blockade, is one of the most common reasons for spinal anesthesia-induced hypotension. Methods for compression of legs such as elastic crepe bandages, Esmarch bandages, compressive stockings, and leg elevation were studied for their effect on preventing spinal hypotension by reducing venous pooling of blood. These methods are non-invasive, simple, and easy but also have a better fetal outcome and improvement in venous return without increasing cardiac workload;[11,12] nevertheless, localized ischemia and maternal discomfort rarely occur. The goal of this study was to see if leg wrapping and leg elevation, two promising and simple strategies for preventing spinal anesthesia-induced hypotension during elective cesarean sections, were effective.

MATERIALS AND METHODS

This is the prospective randomized controlled study comprised 60 full-term pregnant mothers with singleton uncomplicated pregnancy belonging to ASA Class 1 or 2, scheduled for elective cesarean section under spinal anesthesia, who were allocated randomly to either group BLW (leg wrapping) (n = 30) or group BLE (leg elevation) (n = 30) who were admitted in Government Maternity Hospital, Tirupati.

Inclusion Criteria

The following criteria were included in the study:

- Full-term, uncomplicated parturients scheduled for elective cesarean section
- ASA Grade 1–2
- Written and informed consent.

Exclusion Criteria

The following criteria were excluded from the study:

- Allergy to the drug – bupivacaine
- Patients of cardiovascular disease
- Fetal anomaly
- Pregnancy-induced hypertension
- Multiple gestation
- Contraindication for spinal anesthesia.

This study includes 60 pregnant women who were scheduled for an elective cesarean surgery. All pregnant mothers were thoroughly examined and investigated preoperatively and explained about the anesthetic technique. Written and informed consent was obtained from parturients and attendants.

Pregnant mother characteristics including weight, height, age, and gestational age were recorded. All the pregnant mothers were kept overnight fasting before surgery. For all parturients, intravenous line was secured using with an 18 Gauge cannula. All the pregnant mothers were given injection pantoprazole 40 mg intravenously and injection ondansetron 4 mg intravenously 30 min before the surgery.

Pregnant mothers were shifted to operation table and standard monitors such as pulse oximeter, non-invasive blood pressure cuff, and electrocardiogram leads were connected. Baseline blood pressure and heart rate were measured. Intravenous fluid preloading was given with 20 ml/kg of ringer lactate solution over 15–20 min just before the spinal anesthesia.

Group BLW pregnant mothers (n = 30) had the both lower limbs wrapped just before administration of spinal anesthesia. Leg wrapped with help of crepe bandage (15 cm width, 4 m stretched length) from ankle to mid-thigh in both legs in turns; during wrapping, legs were lifted at a 45° angle, after wrapping, legs were placed in neutral position and covered. The crepe bandages were wrapped tightly enough that the women will be comfortable and not painful. Care was taken to avoid compressing the legs to greater than arterial pressure by checking for capillary pulsation in the toes. All parturients had legs wrapped by the same person in around 3 min to eliminate bias introduced by method or altered force of wrapping.

Group LE (n = 30) pregnant mothers had their legs elevated immediately after spinal anesthesia such that they were at a 30° angle to the horizontal plane and covered.

Anesthesia Technique

Spinal anesthesia was performed under strict aseptic conditions in all pregnant mothers in the right lateral position using a 25 gauge Quincke's spinal needle in the L4-L5 interspace through midline approach. All parturients were given injection of 0.5% hyperbaric bupivacaine in the dose of 0.06 mg/cm of height.[13] All pregnant mothers were given oxygen at 6 L/min through Hudson's face mask. The time of injection of spinal drug is noted as 0 min.

Maximum sensory block achieved and time to maximum sensory block were noted for all pregnant mothers. Fluid replacement was maintained with ringer lactate solution. Electrocardiography and oxygen saturation were monitored continuously and blood pressure and heart rate were measured every 2 min up to 20 min and every 5 min up to 60 min. Time from spinal to baby delivery and baby delivery to end of surgery were noted. Total duration of surgery and any intraoperative complications such as nausea, vomiting, hypotension, bradycardia, and dyspnea were recorded.

Hypotension is defined as fall in systolic blood pressure to 90 mmHg or fall more than 20% from baseline blood pressure. Hypotension was treated immediately by increasing the rate of ringer lactate administration and by giving mephentermine 6 mg intravenously. Total dose of mephentermine used was noted. Parameters were monitored and recorded in a specially prepared pro forma by other postgraduates who have not aware of the technique applied. Leg wrapping was removed after surgery. Pregnant mothers of the leg elevation group were resumed to supine position after surgery. Pregnant mothers of two groups were monitored for 10 min after surgery.

Statistical Analysis

Data were entered into Microsoft Excel and analysis was done using SPSS 24 version. Categorical data were represented in percentages and proportions. Continuous or quantitative data represented in means. Test of significance Chi-square was used for categorical data and unpaired *t*-test was used to compare means among two groups. $P < 0.05$ is taken as statistically significant.

RESULTS

Parturients with uncomplicated singleton pregnancy of term gestational age were included in this study. The mean age of group BLW was 25.2 years, group BLE was 25.9 years. There is no statistical difference in age comparison among the groups. The gestational age of two groups was comparable and there is no significant statistical difference between the groups ($P = 0.59$). All patients were comparable with regard to weight. The mean weight of the parturients of group BLW was 57.73 kg, group BLE was 58.07 kg. There is no statistical difference observed among the groups [Table 1].

The mean heart rates were comparable in the two groups. Increase in mean heart rate observed in leg elevation (BLE) throughout the procedure. There were significant heart rate changes from 4 to 14 min after spinal anesthesia in BLE group compared to BLW group [Graph 1].

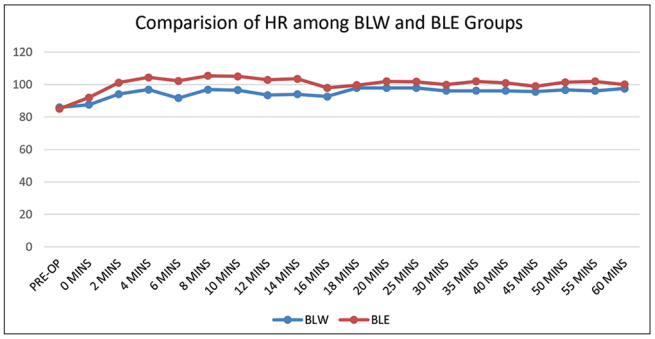
Significant difference in systolic and diastolic blood pressure was present in the first 4–14 min. Thereafter, there is no significant difference in both the groups. Mean arterial blood pressure was noted in both the groups and was comparable. There is significant fall in mean arterial pressure in the leg elevation group when compared to the leg wrapping group from 4 to 14 min. Mean arterial blood pressure values are shown in Table 2.

During this study, parturients of both the groups maintained saturation of 99–100%. All parturients were supplemented with oxygen 6 L/min through face mask. There was no significant difference among the study groups [Graph 2].Mean length of surgery in group BLW was 47.6 min, group BLE was 49.1 min. Duration of surgery was comparable in both the groups. No statistical difference was observed in both the groups [Table 3].

The blood pressure in the leg wrapped group (BLW) was stable, decrease in the blood pressure noted in 3 (10%) patients, compared to 10 (33.33%) patients in the leg elevated group (BLE). The difference in occurrence of hypotension in the study groups was statistically significant. *P*-value was 0.02 (<0.05) when the leg wrapped group BLW was compared with the leg elevation group BLE. This was statistically significant [Table 4].

Table 1: Comparison of anthropometry

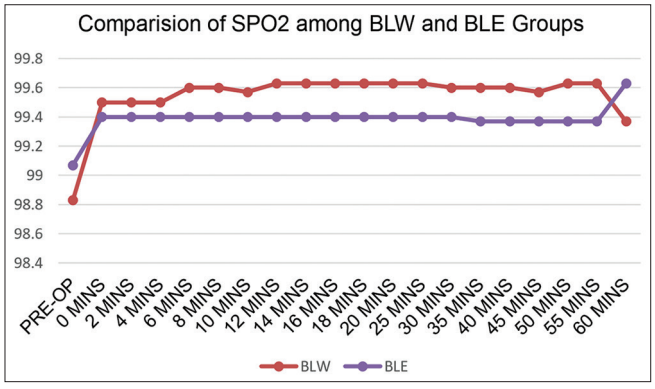
Group	Bilateral leg wrapping	Bilateral leg elevation	*P*-value
Weight in kg	57.73±4.38	58.07±4.11	0.76
Height in cm	149.97±5.40	150.83±4.58	0.56



Graph 1: Comparison of heart rate among the groups

Table 2: Comparison of mean arterial pressure

MAP in min	Group	Mean	SD	*P*-value
Pre-operative	BLW	84.40	7.70	0.738
	BLE	84.97	5.12	
0 min	BLW	88.50	9.48	0.429
	BLE	90.07	5.13	
2 min	BLW	85.20	5.55	0.291
	BLE	83.70	5.35	
4 min	BLW	85.37	7.62	0.0001
	BLE	78.40	4.56	
6 min	BLW	83.90	7.86	0.0001
	BLE	75.07	4.85	
8 min	BLW	84.20	6.77	0.001
	BLE	78.97	4.97	
10 min	BLW	80.97	5.24	0.016
	BLE	84.47	5.63	
12 min	BLW	84.47	6.95	0.001
	BLE	79.10	5.12	
14 min	BLW	85.63	5.62	0.037
	BLE	88.73	5.63	
16 min	BLW	84.80	7.68	0.091
	BLE	81.93	4.95	
18 min	BLW	82.53	6.47	0.091
	BLE	79.90	5.34	
20 min	BLW	79.93	5.71	0.216
	BLE	78.03	6.04	
25 min	BLW	77.53	4.97	0.904
	BLE	77.70	5.61	
30 min	BLW	79.40	5.59	0.200
	BLE	81.27	5.56	
35 min	BLW	68.27	7.33	0.187
	BLE	70.70	6.78	
40 min	BLW	82.73	6.39	0.078
	BLE	85.53	5.67	
45 min	BLW	81.90	5.68	0.170
	BLE	83.97	5.83	
50 min	BLW	83.00	5.55	0.608
	BLE	83.73	5.48	
55 min	BLW	84.77	5.25	0.229
	BLE	86.50	5.79	
60 min	BLW	70.83	9.68	0.087
	BLE	74.60	6.85	



Graph 2: Comparison of SPO_2 among the study groups

In the leg wrapped group BLW, one parturient had nausea, in the leg elevation group BLE, two parturients had nausea. None had vomiting in BLW and BLE group. This was not statistically significant. In the leg wrapped group,

Table 3: Comparison of time from delivery to end of surgery and duration of surgery

Parameters	Bilateral leg wrapping (Mean±SD)	Bilateral leg elevation (Mean±SD)	*P*-value
Delivery to end of surgery in minutes	40.5±2.78	41.9±3.78	0.10
Duration of surgery	47.6±2.65	49.1±3.71	0.07

Table 4: Comparison of incidence of hypotension

Hypotension	BLE	BLW	*P*-value
Absent	20 (67)	27 (90)	0.02
Present	10 (33)	3 (10)	
Total	30 (100)	30 (100)	

mephentermine usage was 6 mg in two parturients, 12 mg in one parturient. In the leg elevation group, mephentermine usage was 6 mg in 10 parturients, 12 mg in three parturients. Below table shows significant no. of parturients required rescue mephentermine in BLE group than BLW group [Table 5].

DISCUSSION

The main contribution for spinal hypotension is venous pooling in abdomen and legs, therefore, this study was done to investigate if leg wrapping prevents spinal hypotension in cesarean section and also decided to compare leg elevation technique with leg wrapping for the same. The aim of this study was to evaluate and compare the hemodynamic changes, the incidence of hypotension, and need for usage of vasopressor in spinal anesthesia for elective cesarean section between leg wrapping and leg elevation.

Sixty parturients were randomly assigned to the group BLW (n = 30) and BLE (n = 30). In this study, parturients were comparable in demographic data. No significant difference in both groups comparing age, weight, height, and gestational age. In this study, 1.8 ml of 0.5% bupivacaine was used for all parturients.

Kunal *et al*.[14] had used 2.5 ml of 0.5% hyperbaric bupivacaine for all patients in their study. Dosage of hyperbaric bupivacaine (0.5%) is according to height, as the mean height in their study was 164 cm. However, this study was conducted in South India, where the average height was 152 cm for females. In this study, the mean height was 149.97 cm in the BLW group and 150.83 cm in the BLE group.

Maximum spinal block level, time to reach maximum block, time from spinal to delivery of baby, time from delivery to

Table 5: Comparison of side effects and mephentermine usage among the study groups

Nausea	BLE	BLW	*P*-value
Absent	28 (93)	29 (97)	0.554
Present	2 (7)	1 (3)	
Total	30 (100)	30 (100)	
Mephentermine			
Nil	17 (56.7)	27 (90)	0.013
6 mg	10 (33.3)	2 (6.6)	
6+6 mg	3 (10)	1 (3.4)	
Total	30 (100)	30 (100)	

end of the surgery, and total duration of surgery were also noted and compared. In terms of clinical data, there was insignificant difference between the groups. There was no influence by leg elevation on maximum block level or time to achieve maximum block level. In a study conducted by Rout *et al*.[15] also, they had concluded that leg elevation to 30° had not influenced block height.

Here, in this study, it was observed that there is a decrease in the occurrence of hypotension, reduction in necessity of rescue vasopressor mephentermine in the leg wrapping group BLW when compared to the leg elevation group BLE. The incidence of spinal hypotension in the leg wrapped group BLW was 3 patients (10%) whereas in the elevated leg group BLE was ten patients (33.33%) (P = 0.0282). This observation implies that leg wrapping significantly prevents spinal hypotension compared to the leg elevation. Leg elevation had no discernible effect on the occurrence of hypotension. Leg wrapping prophylactic efficacy in prevention of spinal hypotension has already been researched.

Rout *et al*.[15] also compared leg wrapping and leg elevation to prevent spinal hypotension in elective cesarean section. In comparison to the control group (53%), leg elevation and wrapping with an elastic Esmarch bandage resulted in a considerable reduction in the frequency of post-spinal hypotension (18%). Only leg elevation failed to significantly reduce the incidence of hypotension according to their findings (39 %). Das and Swain[15] also concluded that the occurrence of hypotension in the leg wrapped group is 13.33% compare to 63.33% in the control group, which was statistically significant (P = 0.002). Bhagwanjee *et al*.[16] compared 24 parturients undergoing elective cesarean section who were randomly assigned to have their legs wrapped with elastic Esmarch bandages immediately following spinal anesthesia or to serve as controls, and they discovered that the incidence of hypotension was significantly lower in the leg wrapped group (16.7%) than in the control group (83.3%) (P = 0.0033). Similar results were found in a study by Van Bogaert *et al*.[17] who concluded that incidence of hypotension was significantly decreased by wrapping (15.8%) as compared with controls (45.5%) (P = 0.012), elevation did not avoid hypotension (P–0.38). Khedr *et al*.[18] have also concluded that wrapping and elevation of leg were more effective in preventing post-spinal hypotension in parturients in elective cesarean section. Kunal *et al*.[14] have also concluded that hypotension can be reduced by wrapping the legs with elastic crepe bandage with a subsequent reduction in the use of potent vasopressor (10%) compared to the control group (33.33%) where wrapping was not done.

A considerable difference in heart rate was observed in this study among the study groups. There were significant heart rate changes from 4 to 14 min after spinal anesthesia. In the leg wrapping group BLW, heart rate was stable before and after delivery, but there was a rise in heart rate in the leg elevation group BLE before delivery of a baby. After delivery, there was a slow fall in heart rate in group BLE, but still heart rate was significantly higher while compared to the leg wrapping group. This rise in heart rate might be a compensatory response to hypotension. The occurrence was considerably higher in group BLE and due to the usage of mephentermine, which was high in group BLE. Similar results were observed by Das and Swain[19] in his study concluded that there were significant heart changes from 4 to 15 min following spinal anesthesia in the control group compared to the leg wrapped group. Kunal *et al*.[14] concluded that a rise in heart rate was observed in the control group but not in the leg wrapping group before delivery. In their study after baby delivery, there was no disparity in heart rate in group BLW and control group, but in this study, there was a considerable difference in heart rate in group BLW and group BLE. This might be as we used mephentermine as a rescue vasopressor, whereas in their study, they used phenylephrine as a rescue vasopressor.

In this study, there was a considerable fall in mean arterial pressure in group BLE at 4–14 min, but significant decrease in the mean arterial blood pressure was not noted in group BLW. Das and Swain[19] found a significant change in MAP from 4 to 15 min after spinal anesthesia in the control group compared to the leg wrapped group. Kunal *et al*.[14] found that at the 4, 6, and 8 min, there was a highly substantially lower MAP in the control group than in the leg wrapped group. Bagle *et al*.[20] found a significant drop in MAP at 3, 6, 9, and 12 min in the control group but not in the leg wrapped group.

The requirement of rescue mephentermine was less in the leg wrapped group BLW, a dose of 6 mg intravenously for two parturients and 12 mg for one parturient, whereas in the group BLE, requirement of rescue mephentermine was 6 mg iv in 10 parturients and 12 mg iv in three parturients. Thus, the requirement of mephentermine was significantly low in the group BLW compared to the leg elevation group. The study conducted by Das and Swain[19]

showed that in the control group, a significant number of parturients required rescue vasopressor compared to the leg wrapped group. The study conducted by Bagle *et al*.[20] also showed that vasopressor requirement per parturient was considerably high in the control group compared to the leg wrapped group. Similar result was seen in the study conducted by Kunal Singh *et al*.[14] .

During this study, pregnant mothers were observed for any untoward side effects such as nausea, vomiting, bradycardia, and dyspnea. In group BLW, one parturient had nausea. In group BLE, two parturients had nausea. None had vomited in BLW and BLE groups. This was not statistically significant. Similarly, none had bradycardia or dyspnea in both groups. In the study conducted by DAS and Swain,[15] there is a significant difference in incidence of nausea, vomiting, and shivering in the control group compared to the leg wrapped group. In the study conducted by Hasanin *et al*.,[21] there was insignificant difference in leg elevation and control groups regarding intraoperative and post-operative nausea and vomiting.

Limitations

In this study, the hemodynamic changes were observed and analyzed in parturients but the fetal outcome was not studied.

CONCLUSION

We conclude that the leg wrapping with elastic crepe bandage just before subarachnoid block significantly decreases the incidence of spinal hypotension as well as it causes a marked reduction in the use of vasopressor agents when compared to the leg elevation. Thus, the leg wrapping technique eventually results in better hemodynamic stability. As leg wrapping with the elastic crepe bandage is cheap, easy, readily available, and non-invasive, the technique can be recommended along with other routinely used techniques like left uterine displacement with a wedge for preventing the spinal hypotension and for better maternal and fetal care.

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Original Article

Study of Morphological and Morphometric Variations in Dry Adult Human Scaphoid Bone with its Clinical Implication in the Population of Haryana

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Abstract

The osteological description of the scaphoid bone in anatomical texts is virtually confined to articular facets. Scaphoid bone is most commonly injured among the carpal bones. Scaphoid fractures heal slowly due to the limited circulation of the bone. Scaphoid fractures have to be identifying on time to avoid the malunion of fractures. The present study included 60 dry human scaphoid bones (30 right and 30 left). The morphometric parameters included length of scaphoid, width of scaphoid, primary and secondary height of tubercle, and waist circumference were studied and measurements were taken with the help of Vernier caliper. The present study showed the mean values of all parameters observed higher on the right sided scaphoid in comparison to left-sided scaphoid which explains the fact that most of the populations of Haryana are right dominant. Detailed knowledge of the above parameters of scaphoid bones plays a significant role in better understanding of injury patterns and carpal kinematics and also helpful for orthopedicians, hand surgeons, clinical anatomists, and morphologists.

Key words: Anatomists, Fracture, Human, Length of scaphoid, Scaphoid

INTRODUCTION

The scaphoid is the largest element in proximal carpal row. It has a long axis that is distal, radial, and slightly palmar in direction. A round tubercle on the dorsolateral part of its palmar surface is directed anterolaterally.[1] Scaphoid articulates with other carpal bones, namely, lunate, trapezium, and capitate. It is connected with lunate bone by mean of the scapholunate ligament and instability can occur when scapholunate ligament get disrupted.[2]

The scaphoid is most commonly fractured carpal, accounting for approximately 60% of all carpal fractures and an estimation incidence of 1.5 fractures per 100,000 person years. The injury occurs predominantly in young health adults.[3,4] Unfortunately, these fractures are associated with high incidence of delayed union, non-union, and avascular necrosis because of the tenuous blood supply.[5,6] In particularly, radial artery is the major blood supply to the scaphoid bone. There is excellent collateral circulation through the dorsal and volar branches of anterior interosseous artery.[7] The middle and distal portions of the scaphoid bone are supplied bone which are supplied by the lateral and distal branches of the radial artery through its palmar and dorsal branches, whereas the proximal portion of the bone has poor blood supply.[8]

Fracture of scaphoid takes place at any age, even in children. In males, it may occur between age groups of 20 and 30 years of age.[9] Surgeons performing operative fixation of scaphoid fractures using a headless compression screw such as the Herbert screw and corticocancellous bone grafting for non-union need to be familiar with these morphological and morphometric variations of the scaphoid bone.[10]

The purpose of this study was to establish the normal range of morphometric data for the human scaphoid bone with reference to screw fixation. In addition, we wanted to

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examine the morphological variation between two sides in different individual.

MATERIALS AND METHODS

A total of 60 dried adult scaphoid bones (30 right and 30 left) were obtained from the Department of Anatomy, Pt. B.D Sharma Postgraduate Institute of Medical Sciences (PGIMS), Rohtak, Haryana. The scaphoid bones were of unknown sex, age, religion, and race. The bones which had previous signs of fracture were excluded from the present study. The side determination of the bones was done by anatomical features to identify the possible morphological and morphometrical variations. Measurements were obtained using the digital Vernier caliper.

Instruments Used for the Present Study Were

1. Vernier calipers of 0.02 mm accuracy for measuring the length and breadth of scaphoid
2. A non-stretchable thread for measuring circumference
3. A hand lens was used to count the number of foramina.

Morphological Parameters

1. The scaphoid tubercle was assessed based on its shape (either conical or pyramidal)
2. Dorsal sulcus was assessed by the presence primary and secondary sulci
3. Presence of nutrient foramina on the tubercle and sulci
4. The shapes of scapholunate articular surface, that is, half-moon shaped or crescentic were recorded.

Morphometric Parameters

The following morphometric parameters were studied:

Scaphoid length

The length of the scaphoid was calculated as the distance between the most prominent points on its proximal articular surface and that on the tubercle.

Width of waist

The width of the scaphoid waist was measured as the narrowest part of the scaphoid across its capitate articular surface in direction perpendicular to the longitudinal axis (narrowest angle of waist) [Figure 2].

Primary height of scaphoid tubercle

Primary height of the tubercle was defined as the distance between the most prominent point the tubercle to the intersection of the anterior and superior ridges of the scapholunate articular surface [Figure 3].

Secondary height of scaphoid tubercle

Secondary height of the tubercle was defined as the distance between the most prominent points of the tubercle to the deepest point of the waist [Figure 4].

Circumference of waist

Circumference was measured by placing a non-stretchable thread around its base [Figure 5].

Statistical Analysis

The mean and standard deviation were calculated. The data were analyzed using SPSS software 20.0.

RESULTS

The scaphoid bone is a unique carpal bone in its shape, function, and its three-dimensional orientation. It interconnects the proximal and distal rows of carpal bones on the radial aspect of the wrist to perform various functions. The morphometrical comparison was done on both sides of the bone.

Morphological Feature of Scaphoid Bone

Morphological variation was seen in the scaphoid bone with references of shape of tubercle, dorsal sulcus, number of nutrient foramen on tubercle, ridge for SCIL, and sulcus for FCR tendon given in Table 1.

The comparison of morphometric parameters was done on both sides of the bone. The mean values of all the parameters were found to be higher in right-sided scaphoid in comparison to left-sided scaphoid except the secondary height of tubercle. The mean values and standard deviation of all parameters are shown in Table 2.

Table 1: Morphological parameters of the right and left scaphoid bone (mm)

S. No.	Parameters	Left sided (*n*=30)	Right sided (*n*=30)
1	Shape of tubercle		
	Conical	22	26
	Pyramidal	8	6
2	Dorsal sulcus		
	Single	22	25
	Double	8	5
3	Presence of ridge for SCIL	27	28
4	Presence of sulcus for FCR	20	25
5	Nutrient foramen range	2–16	2–14

Table 2: Morphometric parameters of the right and left scaphoids (mm)

S. No.	Parameters	Left sided (*n*=30)	Right sided (*n*=30)	*P*-value
		Mean±SD (mm)	Mean±SD (mm)	
1.	Scaphoid length SL	26.10±2.53	26.22±2.25	0.86
2.	Scaphoid width SW	9.57±1.15	9.86±1.11	0.27
3.	Primary height of tubercle	12.84±1.51	13.31±1.10	0.23
4.	Secondary height of tubercle	9.25±0.72	9.13±1.00	0.64
5.	Waist circumference	34.78±2.85	34.99±2.56	0.77

DISCUSSION

Morphology and morphometry of scaphoid have a clinical significance in the management of scaphoid fractures.[11] It has unique three-dimensional orientations and connects the proximal and distal rows of carpal bones on the radial aspect of the wrist to perform various functions.[12] In acute scaphoid fractures, internal fixation is the only well-established line of treatment alternative to casting.[13] In healthy young individuals, the only carpal bone of the wrist to get fractured is scaphoid.[14]

Figure 1: Measurement of scaphoid length

Figure 2: Measurement of width of waist

Morphological Parameter

In the present study, we observed that all scaphoid bone has particular anatomical features, that is, presence of scaphoid tubercle, dorsal sulcus, waist, and validate articular surface for the attachment of lunate bone and also passage for the tendon of flexor carpi radialis.

The number of nutrient foramina over the tubercle on the left scaphoid was ranging from 2 to 14 on left side and 2–16 on right side which was in consonance with the previous study done by Babu *et al*.[15]

Shapes of scaphoid tubercle on the left side were conical in 22 (40%) and 24 (53%) on the right side. On the other hand, pyramidal on the left and right sides was 8 (60%) as well as 6 (47%). This parameter is compared in Table 1 with the previous authors. The above comparison of parameter shows that the percentage prevalence of change in shapes of tubercle in the present study was comparable to those recorded by Khullar *et al*.[18] The tubercle gives attachment to the flexor retinaculum and few fibers of abductor pollicis brevis.[17] The force exerted by this muscle may explain the varied shapes of the tubercle [Table 3].

The presence of sulcus on dorsal aspect was noted on 60 bones shows 22 single sulcus and eight double sulcus on the left side, and on the right side, 19 bones have single and 11 have double sulcus; these were near to equivalent with Babu *et al*.[15] [Table 4].

In the present study, ridge was found and was measured 27 on the left side and 28 on the right side; the absence

Table 3: Comparison of the prevalence of the various shapes of the tubercle in the present study with the previous studies

Workers	No. of scaphoids studied (*n*)	No. of scaphoids with conical tubercle *n* (%)	No. of scaphoids with pyramidal tubercle *n* (%)	No. of scaphoids with round tubercle *n* (%)
Ceri *et al*.[16]	200	142 (71)	55 (27.5)	0 (0)
Purushothama *et al*.[17]	100	58 (58)	42 (42)	0 (0)
Khullar *et al*.[18]	50	36 (72)	13 (26)	1 (2)
Present study (2022)	60	44 (73)	12 (26)	0 (0)

Table 4: Comparison of the percentage prevalence of the sulcus on scaphoid bone in the present study with the previous studies

Workers	No. of scaphoids studied, (*n*)	No. of scaphoids with single sulcus on dorsal surface, *n* (%)	No. of scaphoids with double tubercle on dorsal surface, *n* (%)
Babu *et al*.[15]	100	54 (58)	46 (50)
Present study (2022)	60	31 (53)	29 (47)

of ridge determines the weak attachment of SCIL ligament or even absence of ligament which results in dislocation of scaphoid bone. The comparison is showing in Table 5.

Furthermore, sulcus for FCR was recorded and was showed 20 scaphoid bones contain sulcus for FCR on the left side and 25 bones on the right side out of 60 bones; the present study may be related to the greater carpal instabilities in such cases Khullar *et al*.[18] Table 6.

Figure 3: Primary height of scaphoid tubercle

Morphometric Parameters

In the present study, the mean length of scaphoid was 26.22 ± 2.25 mm and 26.10 ± 2.53 mm on the right and left side scaphoid, respectively, which was similar to the findings of Khullar *et al*. while findings of the previous studies of Chandra *et al*.,[10] Purusthothama *et al*.,[17] Babu *et al*. (2018),[15] and Aparna *et al*.[19] were not similar. Knowledge of the mean values of the length of the scaphoid bones is very helpful to assess the screw length for internal fixation preoperatively. The present study showed that the mean length of right sided scaphoid was higher than the left-sided scaphoid which explains the fact that most of the population in Haryana is right -handed dominant [Table 2].

The mean value of width of waist, and secondary height of tubercle and circumference of waist were found to be similar to the Khullar *et al*.[18] while findings of the previous studies of Chandra *et al*.,[10] Purusthothama *et al*.,[17] Babu *et al*. (2018)[15] and Aparna *et al*.[19] were not similar [Table 7].

The mean value of primary height of tubercle showing in Table 2 was found to be similar with Khullar *et al*.[18] and Babu *et al*. (2018),[15] on the other hand, higher than the previous author due racial variation or differentiation in mode of taking the parameter.

Table 5: Comparison of the percentage prevalence of the ridge for SCIL on scaphoid bone in the present study with the previous studies

Workers	No. of scaphoids studied, (*n*)	No. of scaphoids with presence of ridge for SCIL, *n* (%)	No. of scaphoids with absence of ridge for SCIL, *n* (%)
Ceri *et al*.[16]	200	163 (81.5)	37 (18.5)
Purushothama *et al*.[17]	100	81 (81)	19 (19)
Khullar *et al*.[18]	50	37 (74)	13 (26)
Present study (2022)	60	45 (75)	15 (25)

Table 6: Comparison of the percentage prevalence of the sulcus for FCR on scaphoid bone in the present study with the previous studies

Workers	No. of scaphoids studied, (*n*)	No. of scaphoids with presence of sulcus for FCR, *n* (%)	No. of scaphoids with absence of sulcus for FCR, *n* (%)
Ceri *et al*.[16]	200	158 (79)	42 (21)
Purushothama *et al*. (2011)[17]	100	80 (80)	20 (20)
Khullar *et al*.[18]	50	38 (76)	12 (24)
Present study (2022)	60	45 (75)	15 (25)

Table 7: Comparison of findings of the present study with the previous studies

Parameters	Purushothama *et al*.[17]		Chandra *et al*.[10]		Babu *et al*. (2018)[15]		Aprana *et al*.[19]		Khullar *et al*.[18]		Present study	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Length	22.33	22.65	21.97	22.42	23.7	24.1	23.1	23.29	25.76	26.65	26.22	26.11
Width waist	6.88	7.06	6.97	6.91	6.2	7.4	7.46	7.88	10.55	10.35	9.86	9.57
Primary height of tubercle	9.41	9.18	9.34	9.34	13.1	13.1	10.73	11.17	13.99	14.11	13.31	12.84
Secondary height of tubercle	6.45	5.96	6.52	6.31	6.4	6.9	7.98	8.18	9.32	9.99	9.13	9.25
Waist circumference	30.06	31.35	30.5	30.47	32.4	41.2	27.91	28.17	33.1	33.93	34.99	34.78

Figure 4: Secondary height of scaphoid tubercle

Figure 5: Waist circumference measurement

The differences in the morphometric parameters of scaphoid bone between the present and previous studies are due to age, gender, race, native place, and living habits of the population.

CONCLUSION

Knowledge of the morphometric data obtained from the present study is useful for the orthopedicians, hand surgeons, radiologists, and clinical anatomists for surgical reduction with internal fixation to follow-up the reunion of fractured scaphoid bones also to necrosis factor. When designing new implants for scaphoid fixation, manufactures should be cognizant of the dimensions of scaphoid. Knowledge of the average length of screws may be helpful in planning operating room inventory.

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Original Article

Clinical Study and Management of Pseudocyst of Pancreas

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Abstract

Background and Objective: Pseudocyst is a common complication of pancreatitis. This study is to know the various etiologies and relative frequency of pseudocyst in relation to age and sex, establish an accurate diagnosis by relevant investigations, and to study the various modes of management such as conservative, percutaneous drainage, and surgery.

Patients and Methods: Thirty patients with signs and symptoms of pseudocyst of pancreas admitted in Department of General Surgery, Meenakshi Medical College Hospital and Research institute, Kanchipuram, during November 2018 to October 2020 were studied. Data related to the objectives of the study were collected. Collected data were analyzed by comparing with various standard studies.

Results: The majority of patients belonged to the age group of 31–50 years, which constituted 15 (50%) patients in the study. M: F = 5:1. Most common etiological factor was alcohol; most common mode of presentation was pain abdomen and tenderness. Incidence of palpable mass was in 80% of the patients studied, but with the usage of USG and CT-scan, pseudocyst was detected in all the cases. The results of internal drainage were excellent, which was done in 60% of the patients in our study. The post-operative complications include pain abdomen and wound infection seen in nine patients in our study.

Interpretation and Conclusion: (a) Pseudocyst is the most common complication of pancreatitis. (b) Early diagnosis with the aid of USG/CECT abdomen and timely management – internal drainage for mature cysts, external drainage for complicated cysts results in good prognosis.

Key words: CT scan, External drainage, Internal drainage, USG

INTRODUCTION

Acute pancreatitis usually characterized by the acute onset of symptoms in a previously healthy individual and the disappearance of those symptoms as the attack resolves; in contrast, patient with chronic pancreatitis may have prior attacks or symptoms of either exocrine or endocrine insufficiency before the current attack, and their symptoms may persist even after resolution of the current attack. Complications of pancreatitis, including peripancreatic effusions, acute pseudocyst, and pancreatic necrosis, are known been differentiated. The ability to study these lesions noninvasively at multiple points in times has allowed the distinction between acute and chronic pseudocyst, two seemingly similar entities with quite different natural history and treatment requirements.

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Aims and Objectives

The objectives of the study are as follows:

- To study various modes of clinical presentation (clinical profile) of patients with pseudocyst of pancreas admitted in Meenakshi Medical College Hospital and Research institute, Kanchipuram during the period-October 2018 to October 2020.
- To analyze the risk factors, clinical features, complications, and relative frequency of pseudocyst of the pancreas in relation to age and sex.
- To establish an accurate diagnosis by various investigative procedures such as USG abdomen, CECT abdomen, Barium meal, ERCP.
- To evaluate the changing trends and relative efficacy of various modes of management such as conservative, percutaneous drainage, and surgery.

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Inclusion Criteria

The following criteria were included in the study:

a. Patients diagnosed as pseudocyst of pancreas with the help of clinical examination and diagnostic procedure such as USG abdomen, CECT Abdomen, Upper GI endoscopy, Barium meal, and ERCP.
b. Admitted patients of both sexes and all age groups.

Exclusion Criteria

The following criteria were excluded from the study:

a. All the true cysts of the pancreas.
b. Neoplastic cystic swellings of the pancreas.
c. Parasitic cysts (Hydatid cyst) of the pancreas.
d. Congenital cysts of the pancreas.

PATIENTS AND METHODS

Source of Data

Data were collected from patients who presented with signs and symptoms of the pancreatic pseudocyst to Department of General Surgery, Meenakshi Medical College Hospital and Research institute, Kanchipuram for treatment.

Design of the Study

It was a prospective study.

The clinical study of 30 cases of pseudocyst of the pancreas was conducted by selecting patients presenting to Department of General Surgery, Meenakshi Medical College Hospital and Research institute, Kanchipuram, during a period of 2 years from November 2018 to October 2020.

Method of Collection of Data

All the patients with suspected pseudocyst of the pancreas were investigated, offered individualized treatment, and followed up. The institution where this study was conducted is equipped to carry out all necessary investigations, which helped in diagnosing and treating the cases. These include an ultrasound scan, computed tomography, upper gastrointestinal endoscopy (UGIE), ERCP, and barium meal, which was immensely helpful in arriving at the diagnosis of pseudocyst of the pancreas.

Plan for Data Analysis

The clinical outcomes were documented using a standard proforma. The collected data were analyzed by comparing them with various standard studies on the pseudocyst of the pancreas.

Mode of Selection

This study includes both adults and pediatric age group patients. Patients with a diagnosis of pancreatitis were admitted and monitored. If, during the course of their illness, they developed symptoms suggestive of the pancreatic pseudocyst, ultrasonography of the abdomen was done, and if it confirms the presence of the pseudocyst, those patients were included in our study. Those patients only with acute or chronic pancreatic or peripancreatic fluid collection without evidence of encapsulation on USG or who refused operation were excluded from the study.

The diagnosis of pseudocyst was made in all patients by USG abdomen initially. In addition, a CECT scan of the abdomen was performed in all 30 patients to define the exact size, location, extent, and relation of the pseudocyst to adjacent viscera, cyst wall thickness (maturity), and to diagnose any complications. UGIE was performed in 25 patients to look for the indentation of the posterior wall of the stomach/duodenum caused by the pseudocyst and to plan the surgical approach accordingly. Barium meal was done in selected (five) patients to know the compression effect on adjacent organs – mainly the stomach.

Demographic data were collected, including the age and sex of the patient, as well as the etiology of pancreatitis. Every patient with a pseudocyst had serial USG studies to monitor the progression of the cystic collection. All patients with acute pseudocyst were managed conservatively by withholding oral intake, IV fluids, analgesics, and antibiotics as long as they had pain abdomen, vomiting, or ileus. They were then followed up if the cyst did not regress. Follow-up continued till the cyst wall is matured. All mature cysts were treated surgically. Data such as duration of hospital stay, conservative management, and its results and surgical procedure done and their results, complications if any, the progress of the pseudocyst on follow-up were carefully recorded.

OBSERVATIONS AND RESULTS

The results obtained in our study during the period-October 2018–October 2020 at Department of General Surgery, Meenakshi Medical College Hospital and Research institute, Kanchipuram, were analyzed as follows:

In our study of 30 patients, the age of patients was from 2 years to 65 years. Pseudocyst of the pancreas was common in the age group 31–50 years (50%) with a mean age of 37 years. This is probably due to alcohol use, which is common in this age group [Table 1].

In our study of 30 patients, there were 25 (83.3%) male patients and 5 (16.6%) female patients, indicating that the disease is more common in males with a male to female ratio of 5:1. This was due to a higher alcohol intake in males [Table 2].

Table 1: Age distribution

Age in years	No. of patients	Percentage
≤(%)	3	10
11–30	8	26.6
31–50	15	50
≥0.	4	13.3

Table 2: Sex distribution

Sex	No. of patients	Percentage
Male	25	83.3
Female	5	16.6

Table 3: Symptoms

Symptoms	No. of patients	Percentage
Abdominal pain	30	100.0
Nausea/vomiting	24	80.0
Abdominal distension	24	80.0
Anorexia/Weight loss	6	20
Fever	4	13.3
Jaundice	1	3.3
Hematemesis	1	3.3

Table 4: Signs

Signs	No. of patients	Percentage
Abdominal tenderness	30	100
Mass abdomen	24	80
Ascites	2	6.6
Ileus/intestinal obstruction	1	3.3

Table 5: Risk factors

Risk factors	No. of patients	Percentage
Alcohol	20	66.6
Idiopathic	5	16.6
Blunt trauma	4	13.3
Biliary disease	1	3.3

The most common symptom was upper abdominal pain, which was present in all patients (100%), followed by nausea/vomiting, which was present in 80% of the patients, and abdominal distension (mass) present in 80% of the patients [Table 3].

The most common sign was upper abdominal tenderness, which was present in all patients (100%), followed by mass per abdomen, which was present in 80% of the patients [Table 4].

The most common risk factor was alcohol, which was present in 66.6% of the patients, followed by idiopathic in 16.6%, blunt trauma was present in 13.3%, and biliary disease in one patient (3.33%) [Table 5].

Table 6: Associated complications

Complications	No. of patients	Percentage
Infection	4	13.3
Ascites	2	6.6
Gastric outlet obstruction	1	3.33
Biliary tract obstruction	1	3.33
Rupture	1	3.33
Hemorrhage	1	3.33

Table 7: Investigations

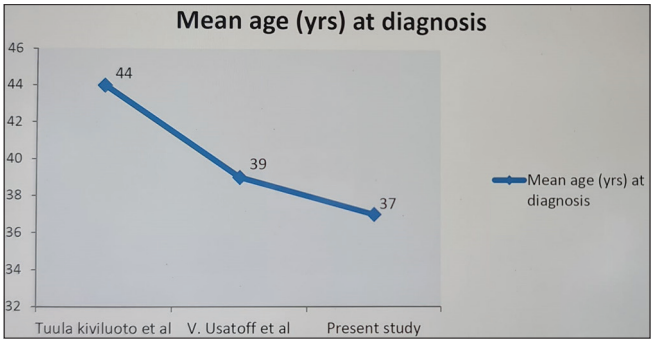
Investigation findings	No. of patients	Percentage
Increased Serum amylase	12	40
Increased Ascitic amylase	2	6.6
USG (+ve)	30	100
CECT scan (+ve)	30	100
Upper GI endoscopy	17	56.6
Barium meal	5	16.6
ERCP	2	6.6

Table 8: Treatment

Treatment	No. of patients	Percentage
Conservative	6	20.0
Percutaneous aspiration	1	3.33
External catheter drainage	5	16.66
Open Cystogastrostomy	12	40
Laparoscopic Cystogastrostomy	2	6.66
Cystojejunostomy	2	6.66
Cystoduodenostomy 1	1	3.33
Distal pancreatectomy + splenectomy	1	3.33

Table 9: Immediate post-operative complications

Complications	No. of cases	Percentage
Wound infection	4	13.3
Pain	5	16.66
Mortality	1	3.3



Graph 1: Comparison of mean age at diagnosis with Kiviluoto *et al*.[5] and Usatoff *et al*.[2]

Infection was the most common complication found in 13.3% of patients, followed by ascites (6.66%), one case each with gastric outlet obstruction, biliary obstruction/

jaundice, and ruptured pseudocyst (3.33% each), and there was one case of hemorrhage presenting as massive hematemesis (3.33%) [Table 6].

USG was the basic investigation done in all patients (100%). Contrast-enhanced CT scan (with oral and intravenous contrast) was performed in all 30 patients to assess the exact size, location, wall thickness, and relation of the pseudocyst to adjacent organs and also to look for associated complications and guide the appropriate modality of treatment. CECT scan also provided information about the status of the pancreatic parenchyma and pancreatic duct, that is, any evidence of pancreatic necrosis, main pancreatic duct dilatation or calculi, etc.….

UGIE was done in 17 cases, and Barium meal was done in 5 (16.6%) of the patients with complaints suggestive of adjacent organ compression – mainly stomach. Two patients (6.6%) who needed an ERCP: One patient with jaundice due to extrinsic biliary compression by the pseudocyst underwent ERCP with endoscopic sphincterotomy and common bile duct stenting. Another patient with a ruptured pseudocyst and massive ascites was managed initially with external catheter drainage. An ERCP at a later date showed pancreatic duct disruption – a pancreatic duct stent was placed with subsequent resolution of ascites. Serum amylase was raised in 12 (40%) patients who presented with a picture of acute on chronic pancreatitis. Ascitic fluid amylase was done in 2 (6.6%) of the patients, and the result was positive [Table 7].

After thorough clinical evaluation and investigative workup, our 30 patients with pseudocyst of the pancreas were offered individualized treatment as follows.

Surgery was the mainstay of treatment in the majority of the patients-with cystogastrostomy being the most commonly performed procedure in 14 patients (46.66%) – 12 patients underwent open cystogastrostomy, and two patients with appropriately located pseudocysts in the lesser sac arising from the body of pancreas and indenting the posterior gastric wall were offered laparoscopic anterior trans-gastric cystogastrostomy (mean operating time = 110 min; mean hospital stay = 6 days). Conservative management was successful in 6 (20%) patients. External catheter drainage was needed in 5 (16.66%) patients, especially those with infected pseudocysts/ascitis, and in one patient who had ruptured pseudocyst with gross ascites. Percutaneous USG-guided aspiration sufficed in 1 (3.33%) patient with a small collection in the sub-hepatic pouch. The other surgical procedures performed were: Roux-en-Y Cystojejunostomy in 2 (6.66%) patients, cystoduodenostomy was done in 1 (3.33%) patient. One patient who presented with massive hematemesis and was found to have splenic artery pseudoaneurysm with hemorrhagic pseudocyst in the tail of the pancreas underwent distal pancreatic-splenectomy. In all the surgical cases, the pseudocyst fluid was rich in amylase, and the cyst wall biopsy was negative for malignancy [Table 8].

Immediate post-operative pain was present in 16.66% of patients and wound infection in 13.3%. The total duration of hospital stay ranged from ten to 15 days One patient with pancreatic tail pseudocyst with active bleeding splenic artery pseudoaneurysm who underwent splenic artery ligation and distal pancreatics plenectomy died in the immediate post-operative period (post-operative day 1) due to hemodynamic instability and shock.

Follow-up

The patients were followed up for a period of 3–6 months. Two patients developed recurrence but refused readmission/further treatment. Three cases were lost to follow-up [Table 9].

DISCUSSION

A pseudocyst is a well-circumscribed fluid collection with no associated necrosis of tissue that is present for four or more weeks after disease onset. The development of the pseudocyst requires disruption of the pancreatic duct, and this occurs in the context of acute pancreatitis (10–15% of cases), trauma, or duct obstruction in chronic pancreatitis (20–40% of cases).[1,2] Most of the results of our study were compared with two standard studies by Kiviluoto *et al*.[3] (1989) and Usatoff *et al*.[4] (2000). Out of 30 cases, three were of the pediatric age group, and the rest 26 cases belonged to the adult group.

Sex Distribution

Out of 30 cases, 25 patients were male and five patients were female. This is compared with the study of Usatoff *et al*.[4] (2000) and Kiviluoto *et al*.[3] (1989). Alcohol is the most common risk factor for acute/chronic pancreatitis and the subsequent development of pseudocyst. In our study, the incidence of pseudocyst of pancreas predominated in males (25 Males Vs. five Females) with an M: F ratio of 5:1. This is because of the fact that alcohol consumption is more common in males compared to females. Our results are comparable with that of Kiviluoto *et al*.,[3] where the M: F ratio was 4:1.

Age Distribution

In this study, the common age group was 31–50 years (50% cases) and was compared with a study group of Kiviluoto *et al*.[3] (1989) and Usatoff *et al*.[4] (2000).

These findings are probably due to the increased frequency of alcohol consumption in this age group (31–50 years).

Four patients were over the age of 51 years in our study. There were only three patients in the pediatric age group, the cause of pancreatitis/pseudocyst formation was blunt trauma abdomen in one child, and in the remaining two children, the reason was unknown/idiopathic. The mean age at diagnosis in this study was 37 years, which is comparable to the study by Usatoff *et al*.,[4] in which the mean age at presentation of pseudocyst was 39 years [Graph 1].

Symptoms

In our study, the most common symptom patients presented with was pain abdomen and mass per abdomen. These symptoms were compared with the study group of Kiviluoto *et al*.[3] (1989) and Usatoff *et al*.[4] (2000). All 30 patients in our study group presented with pain abdomen, and 24 patients had a mass per abdomen (80%).

Risk Factors

The most common risk factor in our study was alcohol (66.6%). This is compared with the study group of Kiviluoto *et al*.[3] In our study, alcohol was the commonest risk factor for the development of pseudocyst of the pancreas, especially in males.

Complications

Complications occur in about 10% of cases and the four main complications are infection, rupture or internal fistulation, bleeding, and mass effect.[5] The most common complication in our study was an infection, followed by ascites. This is compared with the results of Usatoff *et al*.[4] (2000).

Pseudocysts are initially sterile, but infection can occur in up to 25% of cases.[5,6] Four patients in our study had infected pseudocysts and were managed by percutaneous/external catheter drainage with the widest possible drains placed under image (USG) guidance along with appropriate antibiotics and supportive care. The progress of the patients were assessed with repeated scans, and the drains needed to be flushed regularly. Two patients required repositioning/reinsertion of the drains. One patient presented acutely with massive, generalized, and enzyme-rich pancreatic ascites secondary to a ruptured pseudocyst. Paracentesis revealed turbid fluid with a high amylase level. Adequate drainage with wide bore drains placed under USG guidance was attempted. The patient received parenteral nutrition, and octreotide was administered to suppress pancreatic secretion.

An ERCP demonstrated duct disruption, and the patient underwent pancreatic duct stent placement with subsequent resolution of ascites. One patient in our study presented in the emergency setting with massive hematemesis and hemoglobin of 4.5 g%. The patient was resuscitated with four units of blood transfusion, and a triple-phase contrast-enhanced CT scan of the abdomen was performed, which revealed a hemorrhagic pseudocyst in the tail of the pancreas with a splenic artery pseudoaneurysm.

The bleeding risk is increased in the presence of local infection. This situation carries high mortality (20%).[7] On exploration, splenic artery pseudoaneurysm densely adherent to adjacent structures and associated with distal pancreatic necrosis was found. We performed a distal pancreatic-splenectomy with proximal ligation of the feeding vessel with necrosectomy. The patient went into irreversible hemorrhagic shock and succumbed to death on 1st post-operative day.

Recent data suggest that symptomatic and high-risk peripancreatic pseudoaneurysms should be promptly identified and treated. Nowadays, transcatheter embolization is also a good option with comparable results in stable patients.[8]

Treatment

The most important factor dictating the mode of treatment is local expertise. 57 Treatment commonly performed in our study was internal drainage in 53.3%. This is compared with a study group of Kiviluoto *et al*.[3] (1989) and Usatoff *et al*.[4] (2000). Conservative management was done in 20% of the patients, and percutaneous aspiration in 3.3% of patients in our study group. About 16.6% of the cases in our study, especially those with infected pseudocysts/ascites, underwent external catheter drainage. A well-matched population-based study comparing percutaneous (n = 8121) with open surgical drainage (n = 6409) in 14,914 patients with pancreatic pseudocysts revealed a longer length of hospital stay and twice the mortality (5.9% vs. 2.8%) for the former.[9] In our study, surgery was the mainstay of treatment in a majority of the patients – with cystogastrostomy being the most commonly performed procedure in 14 patients (46.66%) – 12 patients underwent open cystogastrostomy, and two patients with appropriately located pseudocysts were offered laparoscopic cystogastrostomy (mean operating time = 110 min; mean hospital stay = 6 days). The other surgical procedures performed were: Roux-en-Y Cystojejunostomy in 2 (6.66%) patients, cystoduodenostomy was done in 1 (3.33%) patient.

Post-operative Complications

In our study, the most common complication was persistent pain abdomen followed by wound infection in the immediate post-operative period. This is compared with the study group of Kiviluoto *et al*.[5] (1989) and Usatoff *et al*.[2] (2000). Immediate post-operative complications in our series include: Pain abdomen present in 16.6% of the patients and wound infection in 13.3% of the patients. The total duration of hospital stay in our study was 10–15 days.

Mortality

In our study, 1 patient (3.3%) with pancreatic tail pseudocyst and actively bleeding splenic artery pseudoaneurysm who underwent splenic artery ligation and distal pancreatic-splenectomy died in the immediate post-operative period (post-operative day 1) due to hemodynamic instability and shock.

Follow-up

In all surgical cases, the pseudocyst wall biopsy was negative for malignancy in our study. Most patients in our study were followed up to periods varying from 3 to 6 months. There were no complications except recurrence in two patients who refused admission. Three of the patients were lost to follow-up.

CONCLUSION

- The disease is most commonly seen in the age group 31–50 years, mostly in males
- The most common cause of pseudocyst is alcohol-induced, followed by idiopathic.
- The most common presentation is pain abdomen with abdominal tendernessand mass per abdomen.
- Ultrasonography was the most useful initial investigation for diagnosis and follow-up. CECT abdomen better delineated the size, location, and relation of the pseudocyst to adjacent viscera and was instrumental in the diagnosis of associated complications. Few patients required UGI endoscopy, ERCP, Barium meal, etc.
- Acute pseudocysts were treated conservatively; infected cysts and ruptured cyst required external drainage. Percutaneous aspiration resulted in recurrence in our case.
- Anastomoses of pseudocyst to the nearby bowel, either cystogastrostomy or cystojejunostomy, was done in the majority of the cases with good results.
- Laparoscopic surgery for internal drainage of pseudocyst of the pancreas is a safe procedure and offers all the benefits of minimally invasive surgery, but needs expert skills.
- Endoscopic drainage of pseudocysts could not be performed in our study setup due to a lack of necessary equipment and expertise.
- The most common post-operative complications were – wound infection and pain abdomen.
- Mortality was seen in – 1 case (3.3%) – with splenic artery pseudoaneurysm and hemorrhage into pseudocyst who died due to severe hemodynamic compromise.
- The total duration of hospital stay ranged from 10–15 days
- Follow-up was done for 3–6 months; three cases were lost to follow-up. Recurrence was seen in two cases, who refused admission.

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Original Article

Sociodemographic Profile of Suicide Attempters in a Tertiary Health-care Setup

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Abstract

Introduction: According to the World Health Organization, globally (2012) suicide is the second leading cause of death between 15 and 29 years of age with one person committing suicide every 40 s. In 2012, India accounted for the highest suicidal rate. Hence, we decided to establish the sociodemographic profile of suicide attempters in our hospital.

Aim: The aim of our study was to establish the sociodemographic profile of suicide attempters who were referred from other departments of our hospital to psychiatry outpatient department for opinion.

Materials and Methods: The study was conducted in the Department of Psychiatry at Government Kilpauk Medical College, Chennai, over a period of 6 months from March 2015 to August 2015. One hundred and ten consecutive suicide attempters referred from other departments to psychiatry outpatient department were enrolled for this study and their sociodemographic profile was established.

Results: Highest number of suicide attempts was present in age group between 20 and 30 years. Percentage of suicide attempts was higher in females when compared to males. Among educated people, highest number of suicidal attempts was present in those who have completed below twelfth standard education. Individuals with no formal education accounted for the lowest percentage of suicide attempts. Suicide attempts were more common in employed persons, while housewives had the least number of attempts. Highest percentage of suicide attempts was seen among those individuals with a monthly income of less than Rupees 10,000, while the lowest percentage was seen in individuals with monthly income of more than Rupees 25,000. Slightly, higher rate of suicidal attempts was present in married population when compared to unmarried population.

Conclusion: Establishing sociodemographic profile of suicide attempters would help us to identify sections of population prone for suicidal tendency, and hence, we can prevent those individuals from making such attempts by professional counseling.

Key words: Professional counseling, Sociodemographic profile, Suicide attempters

INTRODUCTION

Suicide is a complex, multidimensional phenomenon that has been studied from philosophical, sociological, and clinical perspective. Suicidal behavior and suicidality can be conceptualized as a continuum ranging from suicidal ideation to suicide attempts and completed suicide. Attempted suicide is defined as a potentially self-injurious action with a nonfatal outcome, for which there is evidence, either explicit or implicit that the individual intended to kill himself or herself. The action may or may not result in injuries.[1]

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Suicidal and self-harm tendencies are widely prevalent among the population. More than one lakh lives are lost every year due to suicide in India. In the three decades (from 1975 to 2005), the suicide rate increased by 43%. The southern states of Kerala, Karnataka, Andhra Pradesh, and Tamil Nadu have a suicide rate of >15, while in the Northern States of Punjab, Uttar Pradesh, Bihar, and Jammu and Kashmir, the suicide rate is <3. Higher literacy, a better reporting system, lower external aggression, higher socioeconomic status, and higher expectations are the possible explanations for the higher suicide rates in the southern states.[2]

Suicide, attempted suicide, and different form of suicidal behavior are on the rise worldwide. Suicide is the leading

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cause of death globally among all the age groups. According to the World Health Organization (WHO) 2002 on violence on health, about 815,000 people died due to suicide all over the world in the year 2000 itself.[3]

There is a wide disparity about incidence of suicide and gender. Some western countries show higher incidence in males, and in developing countries, more incidence was seen in females. The studies by Garfinkel *et al*.[4] Otto[5] and Kotila *et al*.[6] showed that the higher incidence of suicide occurs in adolescent females. There is male-female disparity in completed suicides among various nations of the world. Female suicide completion rate is high in Sri Lanka, China, and also in India. Suicide attempts in women are less violent, less lethal and have less disfigurement. One theory says that lower rate of suicide in women is due to lower rate of alcohol dependence and abuse in women. Women are more likely to seek medical attention when they are depressed and they are more accommodative than men, having a better network with friends and family. Suicidal attempts before puberty are rare.

Married persons had lesser incidence of suicides, while single individuals, individuals who never got married, divorced, and widowed individuals had a higher incidence of suicide. Unmarried persons had a higher percentage of suicide according to Ponnudurai *et al*.[7] and Latha *et al*.[8] Family history of suicide is a risk factor for suicide. Homosexual men and women also had a higher suicidal tendency. A study by Fleischmann *et al*.[9] showed that most of the suicide attempters were married than single in India.

Lewis and Sloggett found no association between educational attainment and suicide risk.[10] Shah and Chatterjee[11] and Shah and Bhandarkar[12] found a curvilinear relationship between educational attainment and suicide risk, while Pompili *et al*. concluded with a high risk of suicide among the better educated.[13] Lusyne and Page also found higher risk of suicide among the better educated, but merely for women.[14] According to a study by Ramdurg *et al*., 63% of the suicide attempts were present in individuals with educational level up to matriculation or beyond matriculation.[15]

Higher the social status higher is the suicidal risk. Professionals and physicians had a high risk for suicide. Furthermore, other occupations such as law enforcement, dentists, artists, mechanics, lawyers, and insurance agents also had a higher risk. At the same time, unemployment also had significant role in suicide. According to Ramdurg *et al*., employed individuals had a higher suicidal rate than the unemployed persons, and also, the level of stressors were more in employed persons.[15] A study by Tara *et al*. found that 55% of the suicide attempts were present in individuals with unskilled workers.[16]

According to a previous study by Sudhir kumar CT and Chandrasekaran,[17] most of the suicide attempts occurred in low socioeconomic status.

Aims and Objectives

The aim of the study was to establish the sociodemographic profile of suicide attempters who were referred from other departments of our hospital to psychiatry outpatient department for opinion.

MATERIALS AND METHODS

The study was an observational study conducted in the Department of Psychiatry at Government Kilpauk Medical College and Hospital. It was conducted for 6 months from March 2015 to August 2015. All the suicidal attempters, referred from other departments to psychiatry outpatient department for opinion, have been selected for this study. Hundred and ten consecutive samples were selected for this study. The study was approved by the Institutional Ethics Committee. Informed written consent was obtained from all the participants and for those below 18 years, consent was obtained from their respective parents also.

Inclusion Criteria

All self-injurious behavior cases, referred from other departments to psychiatry outpatient department for opinion, were included in the study. All such subjects aged 15 and above.

Exclusion Criteria

Acutely ill subjects, subjects aged <15 years, were excluded from the study.

Each individual was interviewed with a semi-structured pro forma for about half an hour to one hour in the psychiatry outpatient department. Individuals' sociodemographic profile was registered, and each was enquired about mode of attempt, reason for attempt, whether any intent or not, and any previous suicide attempts, history of illness, history of substance abuse, if present its pattern, family history of suicide and substance abuse, any physical and psychiatric illness of the life partner. Counseling was given on the same session of the day and if needed medications were also given with their consent.

Semi-structured Pro forma

A semi-structured pro forma was prepared for this study. It consisted of name, age, sex, place, educational

status, occupational status, income status, and marital status.

RESULTS

Data were collected according to aforementioned pro forma and the sociodemographic profile was established.

Table 1 shows that highest number of suicide attempts was present in age group between 20 and 30 years. This accounts for 49. 1% (n = 54) of cases. Lowest percentage of suicide attempts was present in age group 40 and above accounting for 8.2% (n = 9) of cases. This is depicted in Figure 1.

Table 2 shows that the frequency of suicide attempts (n = 59) was higher in females. As shown in Figure 2, the percentage of suicide attempts was 53.6% in females compared to 46.4% (n = 51) in males.

Table 3 shows that highest number (n = 70) of suicidal attempts was present in those who have completed <12th standard and its percentage was 63.6%. Individuals who had no formal education (n = 13) accounted for lowest percentage (11. 8%) of suicide attempts. This is depicted in Figure 3

Table 4 shows that suicide attempts were more common in employed persons (n – 63), the percentage was 57.3%, while housewives (n = 12) had the least number of attempts accounting for only 10.9% of attempts. This is depicted in Figure 4.

Table 5 shows that highest percentage of suicide attempts was present in individuals with monthly income of <10,000 per month, they contribute to 65.5% (n = 72) of total attempts. Lowest percentage (3.6%; n = 4) was seen in individuals with monthly income of more than 25,000 per month. This is depicted in Figure 5.

Table 6 shows that there was a slightly higher rate of suicidal attempts present in married population than that in unmarried population. The percentage of suicidal attempts in unmarried population (n = 54) was 49.1%, compared to percentage in married population (n = 56) 50. 9%**.** This is depicted in Figure 6.

Table 1: Age group variation of suicide attempters

Age	Frequency	Percent	Valid Percent	Cumulative Percent
15–20	30	27.3	27.3	27.3
20–30	54	49.1	49.1	76.4
30–40	17	15.5	15.5	91.9
40 and above	9	8.1	8.1	100.0
Total	110	100.0	100.0	

Table 2: Gender variation of suicide attempters

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	51	46.4	46.4	46.4
Female	59	53.6	53.6	100.0
Total	110	100.0	100.0	

Table 3: Educational status of suicide attempters

Education	Frequency	Percent	Valid percent	Cumulative percent
No formal education	13	11.8	11.8	11.8
Up to 12th	70	63.6	63.6	75.4
>12th	27	24.6	24.6	100.0
Total	110	100.0	100.0	

Table 4: Occupational status of suicide attempters

Occupation	Frequency	Percent	Valid percent	Cumulative percent
Student	16	14.5	14.5	14.5
Housewife	12	10.9	10.9	25.5
Employed	63	57.3	57.3	82.7
Unemployed	19	17.3	17.3	100.0
Total	110	100.0	100.0	

Table 5: Income status of suicide attempters

Income per month	Frequency	Percent	Valid Percent	Cumulative Percent
<10,000	72	65.5	65.5	65.5
10,000–25,000	34	30.9	30.9	96.4
>25,000	4	3.6	3.6	100.0
Total	110	100.0	100.0	

Table 6: Marital status of suicide attempters

Marital status	Frequency	Percent	Valid Percent	Cumulative Percent
Unmarried	54	49.1	49.1	49.1
Married	56	50.9	50.9	100.0
Total	110	100.0	100.0	

DISCUSSION

Age

In our study, self-injurious behavior most commonly occurred between the age groups of 20 and 30 years (49.1%). Most of the studies related to suicide had shown that common age groups for suicide attempt were between

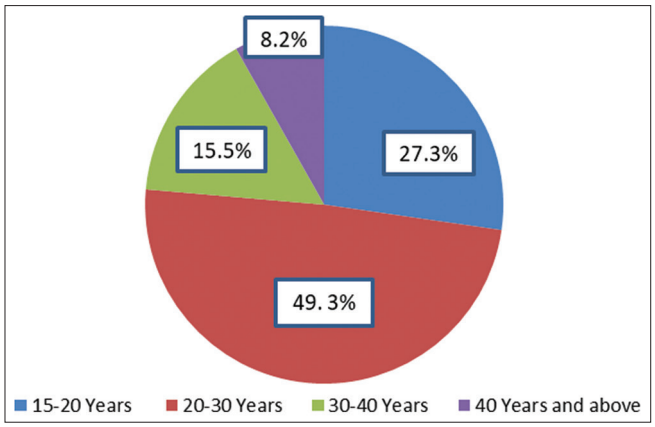

Figure 1: Age group of suicide attempters

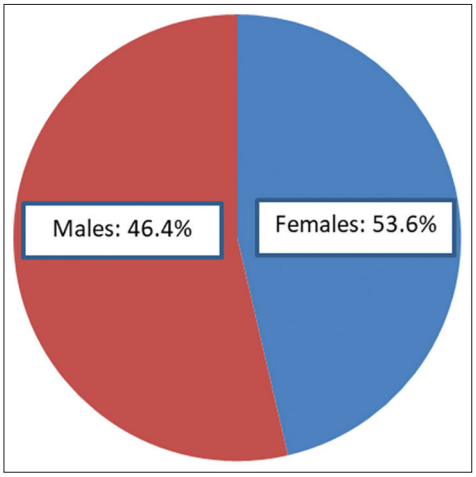

Figure 2: Gender distribution of suicide attempters

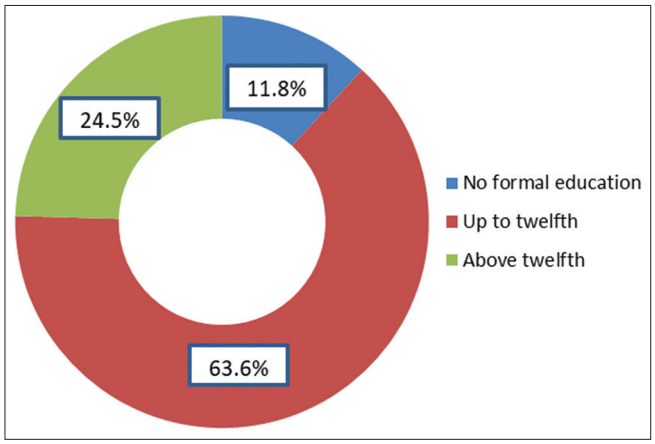

Figure 3: Educational status of suicide attempters

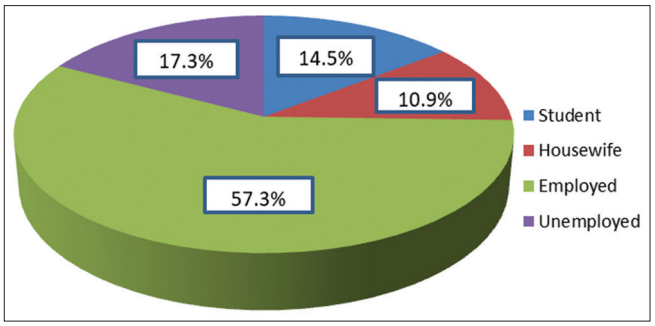

Figure 4: Employment status of suicide attempters

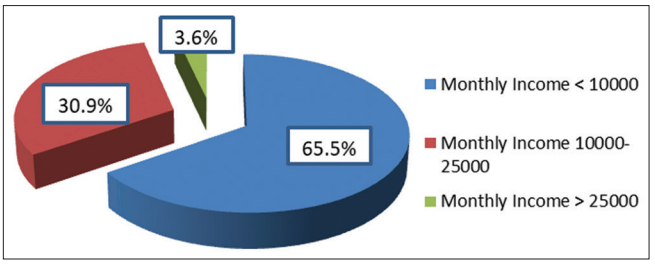

Figure 5: Income status of suicide attempters

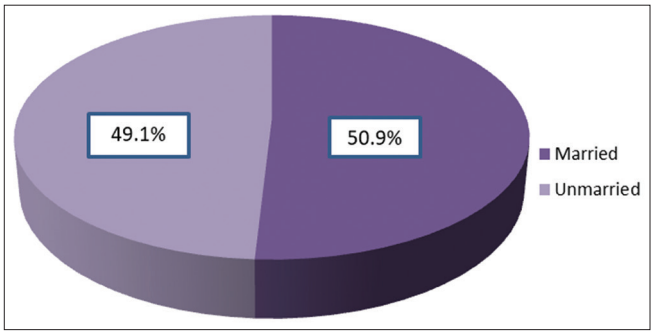

Figure 6: Marital status of suicide attempters

15 and 30 years. Tara and Ramana Rao[16] had shown that common age groups for suicides were between 15 and 35 years, so our study had similar findings to these previous studies. Lewinsohn *et al*.[18] had shown that adolescents had more risk factors for suicide such as hopelessness, recent stressful events, family violence, and lower academic achievement. The previous study by Shaffer and Fisher[19] had shown that suicidal behavior increases markedly during adolescence. It has been found in a study by Morgan *et al*.[20] that the incidence of attempted suicide was greatest in young adults.

Gender

Our study showed that the frequency of suicidal attempts was commonly more in female gender (53.6%). Tara and Ramana Rao[16] had shown that 60% of the suicidal attempters was female in their studies. White,[20] Otto,[5] and an Indian study by Sudhirkumar *et al*.[17] had all shown that females were the common gender in suicide attempts. Girls outnumbered the boys in attempting suicide according to Garfinkel *et al*.,[4] Otto,[5] and Kotila *et al*.[6] Our study also had findings similar to many previous studies.

Education

Our study revealed that educated individuals especially those who have completed below 12th standard had more vulnerability for suicidal behavior (n = 7) (63.6%).

A study by Lajos Bálint[21] revealed that higher educational attainment was significantly associated with decreased risks of suicide. This result is akin to our study. According to a study by Pompili *et al*.,[13] individuals with higher educational achievement may be more prone to suicide risk when facing failures, public shame, and high premorbid functioning. A study by Ramdurg *et al*.[15] also found out that suicide attempts were present more in individuals with educational level up to matriculation or beyond matriculation. These two findings are contrary to our findings.

Occupation

Our study found out that, compared to unemployed participants, the participants with employment had a high suicidal rate (57.3%). Our study had findings similar to previous study results of Ramdurg *et al*.[15] They had shown that more suicidal attempts were present in employed persons than unemployed persons and they assessed the stressor scores which were high in employed persons. When dealing with psychosocial stressors in relation to employed persons, the level of stressors was more in individuals with employment than individuals with unemployment. A study by Tara and Ramana Rao[16] had shown that 55% of the participants attempted suicides were only unskilled workers. However, a study by Beautrais[22] had shown that one of the risk factors for suicide was unemployment.

Marriage

Our study results showed that there was a slight increase in suicide attempts in married populations (50.9%) when compared to unmarried populations (49.1%). Fleischmann *et al*.[9] showed that increased frequency of suicides were present in married than unmarried persons and Ramdurg *et al*.[15] also showed similar findings. Our study had similar findings as these previous studies. However, unmarried persons had a higher percentage of suicides according to Ponnudurai *et al*.[7] and Latha *et al*.[8]

Economic Status

The frequency of suicidal attempts was more common in individuals with income of less than Indian National rupees 10,000 per month in our study. Morgan[20] and White[23] had shown, that most of the suicide attempts came under lower middle socioeconomic status not from very low socioeconomic status. Our study also had similar findings as previous studies. A study by Ramdurg *et al*.[15] had also shown that participants with low socioeconomic status had a high suicidal rate.

CONCLUSION

In summing up, this study results show, that common age group for suicidal attempts was between 20 and 30 years. Female gender had higher percentage of suicidal attempts than male population, those with educational level below 12th standard had a higher suicidal vulnerability. More suicidal attempts were seen among employed, regarding income status suicide commonly occurs in groups having income less than Rupees 10,000 per month. Married persons had high suicidal rate when compared to unmarried persons.

Thus, we have established the sociodemographic profile of suicide attempters among the cases referred to our psychiatric outpatient department. Greater emphasis and care to these vulnerable sections would go a long way in preventing suicidal attempts among them.

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Original Article

Comparative Study of Analgesic Efficacy of 0.5% Ropivacaine Versus 0.5% Levobupivacaine in Combined Femoral Nerve and Sciatic Nerve Block in Lower Limb Surgeries

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Abstract

Aim : To compare the analgesic efficacy of 0.5% Ropivacaine Versus 0.5% Levobupivacaine in Combined Femoral Nerve and Sciatic Nerve Block in Lower Limb Surgeries.

Methodology : A Prospective, randomized, and double-blinded study is conducted in 50 patients of both gendrs between 18 and 60 years posted for the lower limb surgeries were randomized into two groups of 25 members each. Group R: Received 0.5% ropivacaine separately. 20mL for femoral nerve and 20mL for sciatic nerve block. L: Received 0.5% levobupivacaine separately, 20 ml for femoral nerve and 20mL for sciatic nerve block.

Results : Onset of sensory block was assessed by pinprick test and motor blockade by modified bromage scale for every 5min in the first 20 min and then every 10 min till complete blockade occurs. Statistical analysis was done by Chi-square test and unpaired t-test to know the statistical significance. P <0.05 was considered statistically significant. Results showed that demographic data are comparable between both groups. The study results showed that 0.5% levobupivacaine had earlier onset of sensory and motor block, prolonged duration of sensory and motor blockade, and longer duration for first rescue analgesia than 0.5% ropivacaine. There were no post – operative complications among the study subjects in both R and L groups.

Conclusion : Both levobupivacaine and ropivacaine can be used in combined femoral and sciatic nerve blocks with safety and good efficacy but levobupivacaine is preferable over ropivacaine due to its early onset of block and prolonged post – operative analgesic efficacy.

Key words: 0.5% Levobupivacaine, 0.5% Ropivacaine, Femoral and sciatic nerve block, Lower limb surgeries, Motor block, Sensory block

INTRODUCTION

Peripheral nerve blocks (PNBs) have gained trend in extremity surgeries for optimal pain relief in perioperative periods. Advancement in the newer techniques such as peripheral nerve stimulator and ultra sound anesthesia has shifted anesthetic technique from general anesthesia and central neuraxial blockade to peripheral nerve block for isolated limb surgery. The best option for long duration operations is regional block anesthesia where both general and central neuraxial anesthesia are risky. It does not require fasting, special preparation, or pre-operative optimization and can be given in emergency conditions. PNBs are also preferred for lower limb surgeries and orthopedic surgeries because of peripheral location of surgical site and the potential to block pain pathways at multiple levels. Furthermore, better cardiorespiratory stability is observed with PNBs compared to the central neuraxial blockade, which has side effects such as hypotension, bradycardia, meningitis, postdural headache, and neurological deficit.

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However, still there is no consensus on whether certain types of patients benefit more from a general, regional, or mixture of the two types of anesthesia and anesthesiologist may have different priorities and preferences. The onset of action of a peripheral nerve block is longer than spinal (subarachnoid block) and the success rate of a satisfactory block is generally lower than the neuraxial block; however, it is useful in elderly patients. Relief these regional blocks provide, make them worthwhile techniques to perform especially in the critical ill patients.

Ropivacaine was one of the first local anesthetic agents that came as a probable substitute for bupivacaine. Ropivacaine the S-enantiomer of S-1 propyl -2 6 pipe coloxylidide is an amino – amide local anesthetic agent with a chemical formula similar to that of bupivacaine levobupivacaine, the S-enantiomer of bupivacaine is the newest local anesthetic agent to enter into clinical practice. Research studies shown the enantiomers (R-dextrobupivacaine and the S-levobupivacaine) of bupivacaine possess anesthetic activity but the S-enantiomer had significantly lower cardiovascular system (CVS) and central nervous system (CNS) related toxic effects than bupivacaine, while having similar duration of sensory blockade. Levobupivacaine has proved to be safer and effective with a longer duration of analgesic effect compared with ropivacaine for neuraxial and peripheral nerve block.

The present study is aimed to compare the analgesic efficacy of 0.5% ropivacaine versus 0.5% levobupivacaine in the lower limb surgeries using femoral and sciatic nerve block with nerve stimulator. The objectives were to study duration of sensory block, motor block, duration of post-operative analgesia, and incidence of any post-operative complications.

MATERIALS AND METHODS

This was a prospective, randomized, and double-blinded study.

Study Setting

The study was conducted at Tertiary care hospital – Rangaraya Medical College, Government General Hospital, Kakinada.

Study Population

Fifty patients undergoing lower limb surgical procedure in the age range of 18–60 years.

Study Period

The study period was from December 2021 to May 2022.

Inclusion Criteria

Patients in the age range of 18–60 years of age, American Society of Anesthesiologists Grade I and II, and Undergoing lower limb surgeries were included in the study.

Exclusion Criteria

Patient refusal, associated hepatic or renal disease, infection at the site of block, risk of bleeding, known allergy to local anesthetic, and h/o any neuromuscular disease/neuropathy were excluded from the study.

After taking written informed consent, 50 patients of both genders between 18–60 years posted for the lower limb surgeries were randomized into two groups of 25 members each. All patients had preanesthetic check-up which included history taking, general examination, and systemic examination. Routine investigations such as hemoglobin, urine examination, blood sugar, blood urea, serum creatinine, bleeding time, and clotting time were done for all. Other specific investigations were done depending on history and examination. All patients were kept nil by mouth for at least 6 h. After taking the patient to operation theater, multipara monitor was attached, baseline pulse rate, blood pressure, respiratory rate, and oxygen saturation.

SPO_2 was recorded. An intravenous line was secured with a wide bore cannula (18 G) and injection DNS was started at 100 mL/h.

Block Technique

The selected drugs either 0.5% ropivacaine or 0.5% levobupivacaine for giving the block were drawn up in a syringe and were kept ready in a bowl. Resuscitation and emergency medications were kept available and ready to use.

Sciatic Nerve Block

Sciatic nerve was blocked by classic approach of Labat technique.

Standard regional anesthesia tray with sterile towels, 4 × 4 inches gauze packs, 20 mL syringe with local anesthetic, sterile gloves, marking pen, surface electrode, one 1.5 inch 25G needle for skin infiltration, 10 cm long short bevel insulated stimulating needle, and peripheral nerve stimulator were kept. The land marks are (1).greater trochanter, (2). posterior superior iliac spine, and (3) needle insertion site 4 cm distal to the mid-point between the two land marks. The patient was placed in lateral decubitus position with slight forward tilt; the foot on the side to be blocked was positioned over the dependent leg, so that twitches of the foot or toes can be easily noted. After cleaning with antiseptic solution, local anesthetic was infiltrated at the needle insertion site. Needle was introduced perpendicular to the skin; the nerve stimulator was set to deliver 1 – 1.5 mA current. The goal was to achieve visible or palpable twitches of the hamstrings, calf muscles, and foot. The current was gradually decreased until the twitches are seen at 0.3–0.5 mA current (approximately at a depth of 5–8cm). 20 mL of local anesthetic was injected.

Femoral Nerve Block

Patient was placed in supine position. Ipsilateral extremity was abducted 10–20 degrees and slightly externally rotated with lateral side of the foot resting on the table. The land marks are inguinal ligament, inguinal crease, and femoral artery. Needle insertion site is just below the inguinal crease, 1–2 cm lateral to the pulse of femoral artery. Needle is connected to nerve stimulator, set at current of 1 mA and introduced at 30–45 degree angle to the skin cephalad direction. The position of the needle is adequate when patellar twitches are elicited with current output between 0.3 and 0.5 mA. After negative aspiration, 20 mL of LA was injected.

Group R: Received 0.5% ropivacaine 20 mL separately for femoral nerve and 20 mL for sciatic nerve block.

Group L: Received 0.5% levobupivacaine 20 mL separately for femoral nerve and 20 mL for sciatic nerve block.

Onset of sensory block was assessed by pinprick test and motor blockade by modified bromage scale for every 5 min in the first 20 min and then every 10 min till complete blockade occurs. Intraoperative monitoring of blood pressure, pulse rate, O_2 saturation, and respiratory rate was done at 5 min interval.

Postoperatively, duration of motor block was assessed by the time elapsed from the maximum to the lowest Bromage scale, duration and quality of sensory block by pinprick test, and visual analog scale (VAS) score every 15 min in the first 2 h and every 4 h till, complete regression of block occurs.

RESULTS

Statistical analysis was done by Chi-square test and unpaired *t*-test to know the statistical significance. $P < 0.05$ was considered statistically significant.

Results showed that demographic data are comparable between both groups, as shown in Table 1.

Onset of sensory blockade in Group R was 16.24 m compared to 10.24 min in Group L with a significant $P = 0.001$. Onset of motor blockade in Group R was 20.64 min compared to 16.78 min in Group L with $P = 0.001$ which is significant [Table 2 and Figure 1].

Duration of sensory blockade in Group R is 564.05 min compared to 715.28 min in Group L, with $P = 0.001$ which is highly significant. Duration of motor blockade in Group R is 494.80 min compared to 599.150 in Group L. $P = 0.001$ is statistically highly significant [Table 2 and Figure 2].

Table 1: Demographic variables are similar in both L and R group

VARIABLES		GROUP R	GROUP L	P VALUE
AGE(MEAN VALUE)		43.41	41.94	> 0.05
GENDER	MALE	34 (68%)	40 (80%)	> 0.05
	FEMALE	16 (32%)	10 (20%)	
WEIGHT(MEAN)		66.540	67.580	> 0.05
ASA GRADE	GR 1	36 (72%)	35 (70%)	> 0.05
	GR 2	14 (28%)	15 (30%)	
DURATION OF SURGERY(MEAN)		96.500	99.400	> 0.05

Table 2: Onset, duration of sensory and motor blockade, and time to rescue analgesia in L and R group

PARAMETERS		LEVOBUPIVACAINE (N=25)	ROPIVACAINE (N=25)	P VALUE
ONSET OF BLOCKADE (min)	SENSORY	10.24 ±1.27	16.24±1.32	0.001
	MOTOR	16.78±1.26	20.64±1.43	0.001
DURATION OF BLOCKADE (min)	SENSORY	715.28±11.08	564.05±8.02	0.001
	MOTOR	599.15±15.96	494.80±16.86	0.001
TIME TO FIRST RESCUE ANALGESIA (min)		801.2±12.85	629.45±11.82	0.001

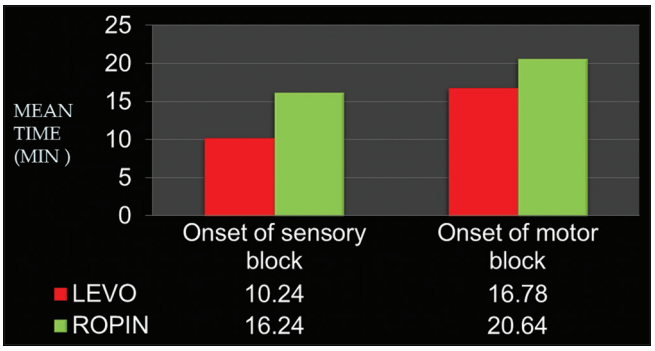

Figure1: Comparison of mean time of onset of sensory and motor block in Group L and Group R

Time to first rescue analgesia was 629.450 min in Group R compared to 801.218 min in Group L with a significant $P = 0.001$ [Table 2 and Figure 3].

There were no post-operative complications among study subjects in both R and L Groups.

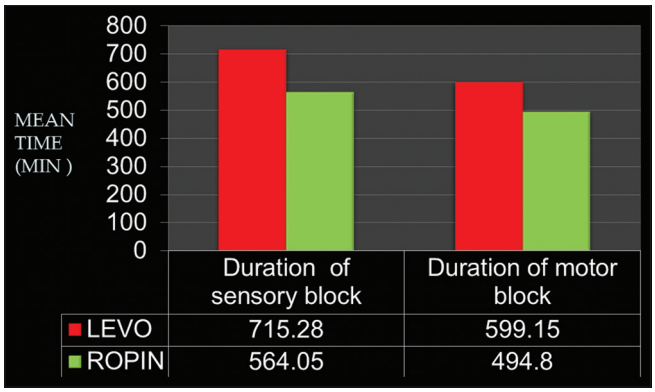

Figure 2: Comparison of duration of sensory and motor block in Group L and Group R, more in Group L

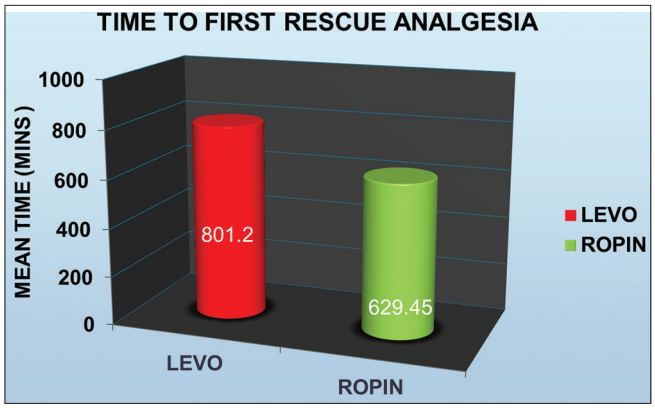

Figure 3: Comparison of time to first rescue analgesia in Group L and Group R, more in Group L

DISCUSSION

PNBs have gained trends in extremity surgeries for optimal pain relief in perioperative periods. They also provide better hemodynamic stability and offer advantages of shorter recovery time especially in elderly and high-risk patients. This analgesia method is considered the safest with regard to the development of complications typical for endotracheal intubation and neuraxial block. Skill full application of these blocks broadens the anesthesiologist's range of options in providing optimal anesthetic care.

Many comparative studies between ropivacaine and bupivacaine proved that ropivacaine produced less CVS and CNS adverse effects, less motor block, and almost equal duration of sensory block and pain free hours. This advantageous discovery caused many clinicians to move from bupivacaine to ropivacaine for all types of neural blockades. However, with clinical use, it was found that, with ropivacaine latency of sensory analgesia was two-thirds of bupivacaine. Hence, it is less effective in prolonging post-operative analgesia.

Research studies have shown that the enantiomers (R-dextrobupivacaine and the S-levobupivacaine) of bupivacaine possess anesthetic activity but the S-enantiomer had significantly lower CVS-and CNS-related toxic effects than bupivacaine, while having similar duration of sensory blockade. Levobupivacaine has proved to be safer and effective with a longer duration of analgesic effect compared with ropivacaine for neuraxial and peripheral nerve block.

The present study is aimed to compare the analgesic efficacy of 0.5% ropivacaine versus 0.5% levobupivacaine in the lower limb surgeries using femoral and sciatic nerve block with nerve stimulator. The objectives are to study duration of sensory block, motor block, duration of post-operative analgesia, and incidence of any post-operative complications. Results of study were comparable between both groups in terms of demographic data [Table 1]. Onset of sensory blockade in Group R was 16.24 min compared to 10.24 min in Group L with significant $P = 0.001$. Onset of motor blockade in Group R was 20.64 min compared to 16.78 min in Group L with $P = 0.001$ which is significant [Table 2 and Figure 1].

In study by Malav *et al*.[2] group in November 2017, results were equivalent with respect to the onset of sensory and motor blockade and in demographic variables. Group L compared to Group R had significantly longer median (95% confidence interval). Duration of sensory block was 647.50 min versus 535 min as well as motor block was 1065.0 min and 945 min, respectively. In the present study, duration of sensory blockade in Group R is 564.05 min compared to 715.28 min in Group L, with $P = 0.001$ which is highly significant. Duration of motor blockade in Group R is 494.80 min compared to 599.150 in Group L. $P = 0.001$ which is statistically highly significant [Table2 and Figure 2]. Results of present study are similar to Malav *et al*. group with regard to duration of motor and sensory blockade.

Kumar and Kaushik (2018)[3] did a comparative study in orthopedic surgeries of the lower limb under combined femoral and sciatic nerve block [International Journal of Innovative Research in Medical Science, 3(05), 2024–2027].

In their prospective study, 50 patients in the age group of 20–65 years of both sexes were included who were posted for the lower limb surgeries. Patients were randomly divided into two groups of 25 each, Group A: 20 mL each of 0.5% ropivacaine for femoral and sciatic nerve blocks. Group B: 20 mL of 0.5% ropivacaine with Fentanyl 25 μg each for femoral and sciatic nerve blocks. In their study, significant difference was not seen by adding fentanyl but the technic was found to be useful for prolonged analgesia [Table 3]. Similar to above study present study is also found useful in providing prolonged analgesia postoperatively also.

Chauhan *et al*.[4] group in September 2020 did a comparative study of block characteristics and post-operative analgesia

Table 3: Sensory and motor block in both groups after induction of anesthesia

Onset/duration min/h	Group A (*n*=25)	Group B (*n*=25)	*P* value
Mean onset of sensory block (min)	12.54+3.25	13.22+2.54	NS
Mean onset of motor block (min)	18.22+2.45	18.78+3.44	NS
Total duration of sensory block (h)	14.56+0.22	13.95+1.23	NS
Total duration of motor block (h)	12.88+1.28	13.05+1.88	NS

Kumar and Kaushik (2018). NS: Not significant

of 0.5% levobupivacaine with 0.5% ropivacaine in ultrasound guided supraclavicular block for orthopedic forearm surgeries. In their study, mean time for onset and peak effect of sensory block was drastically reduced and the total duration of sensory block was effectively prolonged in Group L patients. Onset time of sensory block was 90.33 s in Group L while it was 192.33 s in Group R. Duration of sensory block was 428.5 min in Group L compared to 345.17 min in Group R ($P < 0.05$). Onset time and total duration of motor block was 265.67sec and 331 min in Group L and 283 s and 310 min in Group R ($P > 0.05$). Duration of post-operative analgesia was for 12 h in Group L and 7.7 h. in Group R ($P < 0.001$). This difference was highly statistically significant. Similar to their study, in the present study, also onset is quick and duration of sensory block is prolonged in L group compared to R group. Duration of motor block is also more in L group with significant $P = 0.001$.

In the present study, postoperatively, duration of motor block was assessed by the time elapsed from the maximum to the lowest Bromage scale and duration and quality of sensory block tested by pinprick test and VAS score every 15 min in the first 2 h and every 4 h till complete regression of block occurs. Time to first rescue analgesia was 629.450 min in Group R compared to 801.218 min in Group L with a significant $P = 0.001$.Time to rescue analgesia is longer in Group L compared to Group R, in concurrence with Chauhan *et al*. study.

CONCLUSION

From the present study, it can be concluded that both levobupivacaine and ropivacaine are useful in combined femoral and sciatic nerve blocks with safety and good efficacy. Levobupivacaine can be preferred over ropivacaine due to its early onset and prolonged post-operative analgesic efficacy.

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Original Article

Craving Typologies and Risk of Relapse in Alcohol Use Disorder

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Abstract

Introduction: The types of cravings and their relationship with the risk of relapse have been studied widely, yet, no single model completely explains them. The present study was undertaken to classify the different typologies of craving and predict the risk of relapse in patients with alcohol use disorder (AUD).

Materials and Methods: A total of 40 male patients between an age group of 18–60 years having AUD seeking de-addiction and excluding comorbid drug dependence except tobacco, comorbid psychiatric disorders, acute alcohol intoxication or patients already taking anti-craving, and aversive or psychotherapy consented for the study. Craving Typology Questionnaire and Advance Warning of Relapse (AWARE) were administered.

Results: There was an overlap in craving typologies. Craving type could not be correlated with the onset of AUD or predictors of relapse. There was no correlation between AWARE score and the onset of alcohol dependence and duration of illness. The presence of physical complications closely correlated with AWARE score.

Conclusion: Craving types overlap in most patients of AUD. The risk of relapse is similar in all craving typologies. The presence of physical complications due to alcohol use is associated with higher risk of relapse.

Key words: Alcohol use disorder craving, Alcohol use disorder risk of relapse, Craving types

INTRODUCTION

Alcohol use disorder (AUD) is a major global health burden. Alcohol has a deleterious effect on the physical and mental health. AUD is defined by the standard Diagnostic And Statistical Manual (DSM) or International Classification of Diseases (ICD) criteria such as tolerance development, withdrawal symptoms, reduced control over alcohol intake, and craving. De-addiction, to restore the patients physical, mental, familial, occupational, and social well-being is essential.

The urge to use alcohol is present in 54–72% of AUD subjects and has a multi-faceted construct.[1,2] A three-pathway psychobiological model for craving-reward, relief, and obsessive has been suggested.[3] They depend on genetic loading, personality make up, and environmental factors. The presence of craving is associated with poor therapeutic outcome and increased risk of relapse.[4-7] It also plays a crucial role in the transition from controlled drinking to AUD.[8] Different pathways and neurotransmitters are involved in these three sub types. Therefore, the choice of pharmacological interventions differ.

We aim to classify the craving typology and predict the risk of relapse in patients with AUD.

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MATERIALS AND METHODS

A cross-sectional single interview study was conducted in a Tertiary Care Hospital's de-addiction center for 4 months after approval from the Institute's Ethics Committee. Male patients between the age group of 18–60 years seeking treatment for AUD were enrolled in the study after written consent. Patients having comorbid substance use disorders

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except tobacco, comorbid psychiatric disorders, acute alcohol intoxication or those patients already taking anti-craving agents, and aversive or psychotherapy were excluded from the study. The sample size was calculated to be as 40 patients by convenience sampling. Sociodemographic profile and history pertaining to alcohol use and related complications was noted.

Participants were evaluated using the following tools:

Craving Typologies Questionnaire (CTQ)[9]

Individuals receive scores under reward, relief, and obsessive craving type. An individual may have a high score in more than one domain.

Advance Warning of Relapse Questionnaire (AWARE)[10]

The probability of heavy drinking in the next 2 months is estimated, based on the score. Patients attain a score between 28 and 196. Higher score is associated with increased risk of relapse.

Both the above scales were validated in Hindi and Marathi.

Statistics

Data was analyzed using descriptive statistics with SPSS21 software. Correlation was done among intervariables by Pearson's correlation coefficient.

RESULTS

Subjects were classified as early and late onset AUD with 25 year as cut off mark [Table 1].

There was no correlation between the craving type and onset of AUD [Table 2].

The AWARE score predicted a high relapse rate in most enrolled patients [Table 3].

The onset and duration of AUD and AWARE score did not show any correlation.

There was a close correlation between physical complications and AWARE score ($P < 0.0009$)****.

Table 1: Craving types with Early: Late onset AUD (number of patients: Early=32 and Late=8)

Craving type	Mean CTQ score (Early: Late)
Reward	15.67±4.68:11.62±4.24
Relief	14.56±3.84:17.75±5.11
Obsessive	16.18±5.61:16.5±3.96

AUD: Alcohol use disorder

Table 2: Estimation of risk of relapse using AWARE Score (*n* = 40)

AWARE score (probability of heavy drinking in next 2 months)	Number of patients
28–55 (37%)	5
56–69 (62%)	6
70–83 (72%)	10
84–97 (82%)	5
98–111 (86%)	5
112–125 (77%)	6
126–168 (90%)	3

AWARE: Advance warning of relapse

Table 3: Correlation of onset of AUD, total duration of illness and physical complications with AWARE score (*n* = 40)

Onset, duration and physical complications due to AUD	No. of patients	Mean AWARE score
Onset of AUD		
Early	32	88.93±27.21
Late	8	84.5±27.98
Duration of AUD (years)		
<5	17	80.94±24.67
5–10	12	91.08±25.90
10–15	7	88.14±19.28
>15	4	109±45.97
Physical complications		
Present	16	107.93±24.73
Absent	24	74.79±19.61

AWARE: Advance Warning of Relapse, AUD: Alcohol use disorder

DISCUSSION

Alcohol craving is a core symptom of AUD and a strong predictor of relapse.[7,11-13] As per the CTQ, it is classified as reward, relief, and obsessive.

Reward craving is the desire to achieve a pleasurable state of mind. It is more common in early-onset male alcoholics and is associated with novelty or sensation seeking behavior, impulsivity, anger, and traits observed in Cluster B Personality Disorders. It results from dopaminergic and/or opioidergic dysregulation. "Reward drinking" is generally associated with positive reinforcement. This pathway has an important genetic load.[14]

Relief craving is desire to terminate an aversive stimulus or suppress stress. It results from either γ-aminobutyric acid-ergic or glutamatergic dysregulation. It is associated with negative reinforcement. This pathway is usually observed in late-onset alcoholics, has bias toward females, and is associated with traits observed in Cluster C personality disorders. The influence of external factors is stronger than genetic influence.

Obsessive craving is lack of control over intrusive thoughts about drinking alcohol. This type of craving results

either from a serotonin deficiency or a personality style characterized by low constraint or disinhibition or their combination.

These three craving types usually overlap with one dominating. This becomes relevant in pharmacological treatment, for example, naltrexone is efficacious for reward craving, acamprosate for relief craving, and serotonin reuptake inhibitors for obsessive craving.

In the present study, the patients had overlap of craving typology. The craving type could not be correlated with the onset of AUD or predictors of relapse. There was no correlation between AWARE score and the onset of alcohol dependence and duration of illness. The presence of physical complications closely correlated with AWARE score.

We could not correlate the craving typology and risk of relapse with various parameters in AUD, probably due to our small sample size. Understanding craving may guide us toward better pharmacotherapy and effective anti-craving measures.

CONCLUSION

Reward, relief, and obsessive craving overlap in most patients of AUD. The risk of relapse is similar in all craving typologies. The presence of physical complications due to alcohol use is associated with higher risk of relapse.

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Original Article

Prevalence of Work-Related Musculoskeletal Disorders of Upper Extremities among Dentists in Punjab: A Questionnaire Study

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Abstract

Background: The prevalence of musculoskeletal disorders (MSDs) in the upper locomotive organs was investigated, along with the risk factors in association with MSDs were evaluated among dentists in Punjab.

Methods: This cross-sectional study was carried out among dentists using self-administered and nordic musculoskeletal questionnaire. Descriptive statistics and Chi-square test were used for the data analysis. Statistical analysis was done using Statistical Package for the Social Sciences version 20.

Results: A total of 160 dentists were included in the study. Majority of dentists had experienced symptoms in the shoulder (55%) as compared to wrist/hand (36.25%) and elbow (16.875%). The prevalence of MSDs increased when there were a lesser number of dental assistants in the clinics. Risk factors ($P < 0.05$) were observed to be different as per the site of MSD in question across the sample as associated stresses and contributing factors varied.

Conclusion: The prevalence of MSDs among Indian dentists is high. Specifically, long working hours and high job demand are the most significant risk factors. There is a dire need to address and to change the way dentistry that is practiced to the lower the risks of MSDs to dental practitioners. Dental professionals should be cautious and well trained to stop certain behaviors that can put their health at risk.

Key words: Dentist, Musculoskeletal disorder, Ergonomics, Nordic questionnaire, Pain, Dentistry

INTRODUCTION

Dentistry is a rapidly growing occupation in India, with numbers increasing from 40,000 dentists in 2000[1] to more than 2.7 Lakh in 2018.[2] However, little attention has been paid to occupational health hazards in the dental profession in India. While work-related musculoskeletal disorders (WRMSDs) have been frequently reported in the dental profession across different countries,[3-7] knowledge of the phenomenon among Indian dentists is lacking.

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The World Health Organization recognizes conditions that result in pain and functional impairment that affect the neck, shoulders, elbows, forearms, wrists, and hands as work related when the work activities and work conditions significantly contribute to the development of work-related disorders [Figure 1]. WRMSDs are described as wide range of degenerative and inflammatory conditions that affect the supporting blood vessels, peripheral nerves, joints, ligaments, tendons, and muscles. Such conditions could result in functional impairment and pain which are widely experienced at the upper extremities and the neck.[8]

At the workplace, the causes of MSDs are diverse but poorly understood. Aptel *et al.*[9] stated that biomechanical factors such as repetitive motion, strenuous efforts, extreme joint postures, and/or psychosocial factors establish the key role in WRMSDs. In Mekhora *et al.*,[10] it is provided that certain psychological factors are associated with

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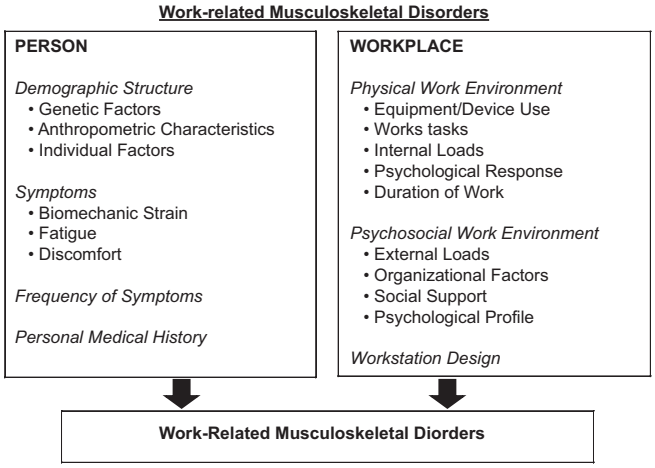

Figure 1: Factors scheme

musculoskeletal discomfort and may eventually provide one way to intervene to reduce MSDs.

In Western countries, attention to and awareness of WRMSDs in the dental profession has increased substantially due to the elevated number of musculoskeletal symptoms significantly affecting the health of dentists.[7,11,12] However, in India, even though the population amounts to 1.38 billion people, there is still a lack of research about the prevalence of WRMSDs in this rapidly growing occupational sector or the possible work-related risk factors for Indian dentists. Therefore, investigating the prevalence of work-related symptoms among dentists in India is of crucial importance.

Despite the evidence of MSDs in dentistry, research conducted among the dentists in Punjab region specifically aimed at upper extremities and their joints is very scanty. Hence, the present study is aimed to describe the prevalence of MSDs in the upper limbs and joints experienced by dentists during their clinical work in Punjab. The study also aimed to find the association between MSDs and selected sociodemographic, professional, and working characteristics variables.

MATERIALS AND METHODS

In this cross-sectional study, participants included a convenience sample of 160 dentist of Punjab region. Written informed consent was obtained from all participants before the start of the study.

A self-administered standardized nordic musculoskeletal questionnaire[13] was conducted on dentists in state of Punjab, over a period of 2 months. Before the study, a pilot study was undertaken to test the questionnaire for comprehensibility and relevance among ten dentists. The purpose of the questionnaire and how they should be answered was explained and whenever required, necessary further information was provided. They were not included in the study.

A 1-year recall of MSDs was used in this study, as this was shown to be an appropriate time scale in Taiwan,[14] Japan,[15] Korea,[16] Saudi Arabia,[17] Australia,[18] and Denmark.[19] In addition, the questionnaire contained general items such as gender, age, body mass index (BMI), education level, experience, and working conditions, including the work place, frequencies and duration of work tasks, number of dental assistants, and durations of being in a bent position and using handpieces. Similar method was used in the study focused on MSDs in neck and back among dentists in Punjab.[20]

The collected data were thoroughly screened and entered into MS-Excel spread sheets and analysis was carried out using Statistical Package for the Social Sciences version 20. Descriptive statistics and Chi-square test were used to assess statistical significance of differences observed. $P \leq 0.05$ was considered statistically significant.

RESULTS

During the survey, effective responses from 160 dentists were received, among them, 104 (65%) were female [Figure 2]. Majority of respondents (71.9%) belonged to the age group of 21–30 [Figure 3]. Nearly half of the dentists (45%) were 161–170 cm tall [Figure 2]. Values of the BMI of nearly half of the respondents (43.125%) were in over weight range (43.125%), about one-third (29.375%) were within normal range and 19.375% were obese.

Among the study sample, about three-fourths (74.375%) had completed graduation in the year 2011–20 [Figure 2]. Among the 160 dentists, 54 (33.75%) had a master's degree and the remaining 106 (66.25%) were dental graduates. About one-half (56.875%) worked with no dental assistant, and also nearly another one-half (41.875%) had one to six dental assistants.

Majority of them (85.625%) worked 6 days in a week while Nineteen dentists (11.875%) worked 7 days a week. Majority of dentists (85%) treated no more than 10 patients per day while about one-tenth (11.875%) treated about 11–30 patients per day. About half of dentists (53.125%) spent around half an hour per patient daily while around one-fourth (26.875%) spent more than 50 min per patient daily. During treatment, around 60% (60.625%) of dentists worked in a forward bent position for an average time of 1–10 min/patient.

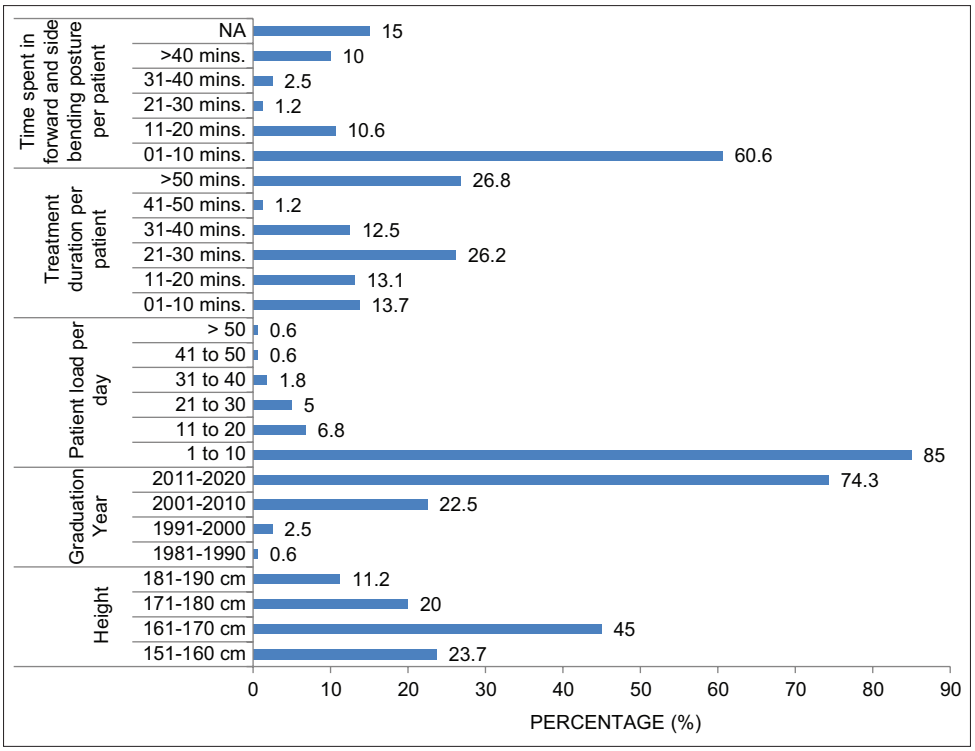

Figure 2: Distribution of study subjects according to different variables

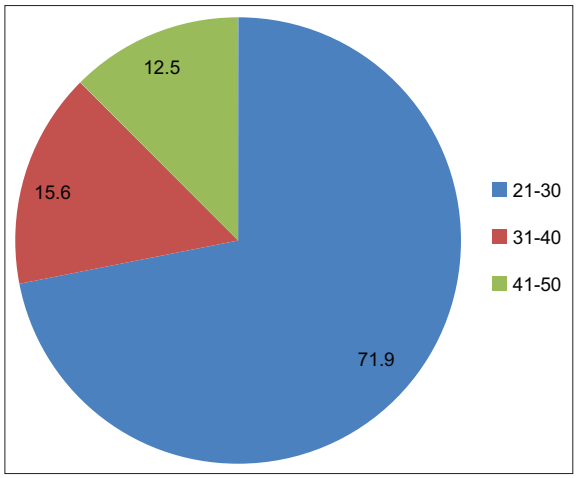

Figure 3: Distribution of study subjects according to age groups

Among the sample, 61.25% (98 dentists) reported pain in one of the regions, 10.625% (17 dentists) had pain in all the three regions whereas 38.75% (62 dentists) reported no pain in these three regions.

Out of 160 dentists, female dentists showed higher prominence of trouble in shoulder accounting to be 59.615% (62 dentists) among female as compared to 46.428% (26 dentists) among male which was clinically significant. Moreover, women with shoulder problems mostly had trouble in both shoulders 90.32% (56 dentists) as compared to an individual shoulder. Thirteen dentists had BMI <18.5, among these 12 (92.31%) had shoulder trouble which was statistically significant. 17 dentists (65.38%) amongst the 27 dentists having BMI in the range of 27.1–35 had pain in shoulder which was statistically significant. Seventy-six dentists (55.88%) reported problem in shoulder among the dentists who have been practicing for 1–10 years which was statistically significant. One hundred and six dentists had education level as BDS, among them 62 had pain in shoulder which was statistically significant. About 61.11% (55 dentists) among the 90 dentists who had no dental assistants complained of trouble in shoulder which was statistically significant [Table 1].

Forty-three dentists (41.346%) among total of 104 female dentists complained of trouble in wrist/hand which was clinically significant. Fourteen dentists among the 26 dentists having BMI ranging between 27.1 and 35 confirmed about pain in wrist/hand which was clinically significant [Table 2].

Among the 47 dentists with BMI ranging between 18.5 and 24, 13 dentists approved of trouble in elbow which was statistically significant. Thirteen practitioners among the 54 postgraduate dentists confirmed of pain in elbow which was statistically significant. Six dentists who worked 7 days a week complained of problem in elbow which was clinically significant [Table 3].

Table 1: Distribution and association of independent variables with shoulder

S. No.	Factors	Trouble with locomotive organs (shoulder)				Significance (*P* value)
		None	Right shoulder	Left shoulder	Both shoulders	
1.	Gender					0.000
	Male	30	12	7	7	
	Female	42	5	1	56	
2.	BMI					0.007
	<18.5	1	0	1	11	
	18.5–24	25	3	2	17	
	24.1–27	33	12	5	19	
	27.1–35	9	2	0	15	
	>35	4	0	0	1	
3.	Physical activity					0.152
	Yes	52	14	7	38	
	No	20	3	1	25	
4.	Years of practice					0.000
	1–10	60	8	7	61	
	11–20	10	9	1	2	
	21–30	2	0	0	0	
5.	Education level					0.000
	BDS	44	4	3	55	
	MDS	28	13	5	8	
6.	Number of dental assistants					0.000
	1	21	5	3	6	
	2–6	14	11	5	2	
	6–10	1	0	0	0	
	>10	1	0	0	0	
	NA	35	1	0	55	
7.	Work days in a week					0.616
	≤4	2	0	0	0	
	5	2	0	0	0	
	6	60	14	6	57	
	7	8	3	2	6	

*$P<0.05$ - Statistically significant

Among the total respondents, 55% (88 dentists) presented with trouble in shoulder; 36.25% (58 dentists) presented with trouble in wrist/hand while 16.875% (27 dentists) presented with pain in elbow.

DISCUSSION

The Nordic standardized questionnaire has been used for analyzing musculoskeletal symptoms since 1987[21,22] and is an internationally respected instrument for evaluating musculoskeletal complaints.[22] It is a self-reported survey method and disorders include aches, pains, and discomfort in the musculoskeletal system,[18] which might not be diagnosed as a disease by physicians.

The numbers of patients with musculoskeletal pain of the upper limb in dentists are growing, so that the prevalence of it from 58% in 2001[23] has reached to 81% in 2006.[24] Due to the increasing prevalence of musculoskeletal pain in dentists, the present research studies the prevalence and risk factors of the upper limb MSDs among a cross-section of Punjab dentists' population.

The results of this research showed that 61.25% of the subjects reported symptoms of MSDs over the past year, and this prevalence of such disorders is consistent with many studies (e.g., 64% of the subjects in study of Marshall *et al*., 64.8%,[25] in Motamayel *et al*.

In the present study, female dentists showed significantly higher prevalence of pain and discomfort for 59.615% (62 dentists) as compared to male dentists for 46.428% (26 dentists). This shows consistency with the findings of Rundcrantz,[26] Rickert *et al*.[27] Moreover, the effect on both shoulders in female dental professionals is observed to be of higher frequency as compared to other regions.

Furthermore, shoulders are the most commonly affected body regions followed by wrists and elbows as observed in the present study population. Similar results were found by Rickert *et al*.[27] This can be correlated with the higher use of upper body regions while working by the dental professionals which bears strains of vibrating instruments and longer chair time with no intermittent break.

Table 2: Distribution and association of independent variables with wrist/hand

S. No.	Factors	Trouble with locomotive organs (wrist/hand)				Significance (*P* value)
		None	Right wrist/hand	Left wrist/hand	Both wrists/hands	
1.	Age (years)					0.343
	21–30	70	32	1	12	
	31–40	21	4	0	0	
	41–50	11	6	0	3	
2.	Gender					0.047
	Male	41	8	1	6	
	Female	61	34	0	9	
3.	BMI					0.006
	<18.5	10	3	0	0	
	18.5–24	31	5	1	10	
	24.1–27	45	19	0	5	
	27.1–35	12	14	0	0	
	>35	4	1	0	0	
4.	Physical activity					0.083
	Yes	68	29	0	14	
	No	34	13	1	1	
5.	Years of practice					0.963
	1–10	88	35	1	12	
	11–20	13	6	0	3	
	21–30	1	1	0	0	
6.	Education level					0.857
	BDS	66	29	1	10	
	MDS	36	13	0	5	
7.	Number of dental assistants					0.851
	1	22	9	1	3	
	2–6	20	9	0	3	
	6–10	0	1	0	0	
	>10	1	0	0	0	
	NA	59	23	0	9	
8.	Work days in a week					0.836
	≤4	2	0	0	0	
	5	2	0	0	0	
	6	89	35	1	12	
	7	9	7	0	3	

*$P<0.05$ - Statistically significant

The prevalence of MSD decreases with the increase in number of years of practice. Higher proportion of discomfort in the locomotive organs is found to be present in dentists with 1–10 years of practice which tends to decline as the dental professionals gain experience with age. It can possibly be explained by the development of effective strategies to work for longer hours and adjust patient positioning along with equipment utilization, work efficiency, and maintaining general health. Similar findings were observed by Thornton *et al*,[7] as the senior batch students (3rd year) reported the highest level of musculoskeletal symptoms who have just started attending clinical practice in the dental school. However, some investigations documented that dentists under the age of 50 years showed lower percentage of MSD than older professionals as observed by Rickert *et al*.[27]

Number of dental assistants employed in clinic also appears to be associated with the risk of MSD and pain. No involvement of assistants in dental practice showed higher prevalence of MSD in dental professionals (55 dentists experienced pain in both shoulders, whereas no pain in shoulders/elbows was experienced with a dental setup of 6–10 dental assistants). Similar findings were observed by Samotoi *et al*.[6] with fewer symptoms reported in the presence of dental assistants. More number of dental assistants reduce the work load on dentists thus reducing the exposure to vibratory instruments as well as to-and-fro movements of joint while mixing of cements and other similar activities.

Educational qualification showed significant correlation on the prevalence of musculoskeletal diseases and pain. BDS graduates showed higher proportion of pain in both shoulders (55 respondents) as compared to postgraduates (MDS). Similar results were observed by Singh, *et al*.[20] which can be attributed to knowledge of ergonomics and utilizing appropriate illuminating techniques to reduce the strain on body while working.

Table 3: Distribution and association of independent variables with elbow

S. No.	Factors	Trouble with locomotive organs (elbow)				Significance (*P* value)
		None	Right elbow	Left elbow	Both elbows	
1.	Age (years)					0.381
	21–30	96	8	2	9	
	31–40	22	3	0	0	
	41–50	15	4	0	1	
2.	Gender					0.188
	Male	48	7	0	1	
	Female	85	8	2	9	
3.	BMI					0.000
	<18.5	10	1	2	0	
	18.5–24	34	4	0	9	
	24.1–27	60	8	0	1	
	27.1–35	24	2	0	0	
	>35	5	0	0	0	
4.	Physical activity					0.069
	Yes	87	12	2	10	
	No	46	3	0	0	
5.	Years of practice					0.425
	1–10	115	10	2	9	
	11–20	16	5	0	1	
	21–30	2	0	0	0	
6.	Education level					0.031
	BDS	92	5	2	7	
	MDS	41	10	0	3	
7.	Number of dental assistants					0.135
	1	28	5	2	0	
	2–6	24	6	0	2	
	6–10	1	0	0	0	
	>10	1	0	0	0	
	NA	79	4	0	8	
8.	Work days in a week					0.015
	≤4	2	0	0	0	
	5	2	0	0	0	
	6	116	11	0	10	
	7	13	4	2	0	

*P<0.05 – Statistically significant

CONCLUSION

This study investigates the prevalence rates for MSDs in upper extremities among dental professionals of Punjab, India. Gender, years of practice, education level, and number of dental assistants have been identified as possible factors affecting musculoskeletal system. Hence, there is a need for well suited interventions for preventing MSD and pain among professional dentists. Using psychosomatic approach and individual ergonomic instructions along with physiotherapy will provide relief from pain and discomfort and enhanced mental well-being. Upper body parts especially shoulders are more prone MSD because of the prolonged uncomfortable positions, the dentist has to stay in during the procedures. To overcome this prevalent disorder, it is highly recommended that the clinicians are regularly updated about the advancements in dental equipments, for example, ergonomic dental loops, dental chairs with lumbar, and arm support. Furthermore, taking brief breaks and stretching in between the scheduled patients greatly help to reduce the strain on shoulders and arms. To conclude, maintaining a healthy lifestyle is the real key to a successful dental practice.

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Original Article

Early Detection of Cardiovascular Changes in Type 2 Diabetes Mellitus Patients using Electrocardiogram as a Diagnostic Tool: A Cross-Sectional Study in a Tertiary Care Hospital in North East India

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Abstract

Background: Diabetes mellitus (DM) is a group of metabolic disorders that occur due to defects in insulin secretion, insulin action, or both. In comparison to the general population, type 2 DM (T2DM) patient have two-fold higher risks for developing cardiovascular diseases (CVD). Abnormalities detected during resting electrocardiogram (ECG) is associated with increased risk of diabetes induced CVD mortality and morbidity.

Aims and Objectives: The study aims to observe the ECG parameters in patients with T2DM for early detection of cardiovascular changes, asymptomatic for CVD, and the effect of duration of disease and glycemic control on the ECG parameters of these patients.

Materials and Methods: A cross-sectional study was carried out in a Tertiary Care Hospital Affiliated to a Agartala Government Medical College situated in the North-East India. One hundred known diabetic patients were enrolled for the study. Details history of the patient was taken as per the case study format. Blood samples were analyzed for glucose (fasting and postprandial), glycosylated hemoglobin. Resting 12 leads ECG was recorded at the outpatient department for all patients.

Results: Statistical analysis was carried out using SPSS software and results were statistically analyzed and correlated. PR intervals were significantly higher ($P = 0.01$) in type 2 diabetics. There was a significant ($P = 0.03$) positive correlation between the hemoglobin A1C (HbA1C) level and corrected QT interval (QTc) interval. Disease duration had significant positive correlation with RR interval ($P = 0.03$).

Conclusion: Resting ECG abnormalities in patients with T2DM indicate the onset of cardiovascular changes. Our study showed an early onset of ECG changes indicative of cardiovascular morbidity in T2DM patients that deteriorate with increasing HbA1C level and duration of disease. Regular monitoring of T2DM patients with ECG can help in the early detection of cardiovascular disease.

Key words: Cardiovascular complications, Diabetes mellitus, Electrocardiogram changes, Glycemic control, Corrected QT interval

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia, hyperlipidemia resulting from variable interactions of hereditary and environmental factors due to defects in insulin secretion, insulin action, or both. Type 2 DM (T2DM) is the most common type of diabetes, contributing more than 90% of DM worldwide which affects the other metabolic pathways and consequently causes end-organ damage in multiple organ-systems of the human body.[1] It is associated with many long-term complications in the form of microangiopathy such as neuropathy, retinopathy, and nephropathy as well as macrovascular complications such as coronary artery disease (CAD), stroke, and peripheral

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vascular disease. According to the estimates of the American Diabetes Association (ADA), 65–80% of diabetic patients die from cardiovascular disease, 75% of which is attributed to CAD.[2] Silent ischemia or angina, where ischemic chest pain is blunted or absent, remains one of the unique complications of diabetes.[3] In addition, studies have shown that the fatality rate of CAD is significantly higher in diabetic patients. Cardiac autonomic neuropathy is another common complication of T2DM which can cause postural hypotension, exercise intolerance, and silent myocardial infarction.[4] Early detection of cardiovascular changes in T2DM patients can reduce the burden of morbidity and mortality in these patients. Electrocardiogram (ECG) is a non-invasive technique for assessing the activity of the heart which can be used as a tool for screening for cardiovascular complications in T2DM patients. Usefulness of ECG as a prognostic tool in cases of hypertension, cardiac failure has been shown in multiple studies.[5] Various studies have shown the ECG abnormalities like prolonged corrected QT interval (QTc) interval in patients with T2DM. Although ECG abnormalities are found in diabetic patients in different studies, very few studies are done in Northeastern part of India. The aim of our study is to assess the ECG parameters in T2DM patients who are symptomatic for cardiac disease and to find out the correlation between ECG changes and duration of disease and hemoglobin A1C (HbA1C) level.

MATERIALS AND METHODS

Objectives

The objectives of this study were as follows:

1. To study the ECG parameters in patients with T2DM for the early detection of cardiovascular changes, asymptomatic for cardiovascular diseases (CVD).
2. To study the effect of duration of disease and glycemic control on the ECG parameters.

A hospital-based cross-sectional study was done in adults with T2DM attending diabetes and nutritional clinic outpatient department (OPD) of Agartala Government Medical College (AGMC) and Govind Ballabh Pant Hospital (GBPH), Agartala who had no complaints of CVD. Ethical clearance was obtained from the Ethical committee of AGMC and GBPH. The study included 100 T2DM patients attending diabetic clinic in AGMC and GBPH. The study subjects were evaluated by general history, clinical examination, and blood HbA1C level. The study was conducted between the periods from August 2020 to April 2022.

Inclusion Criteria for the Cases

The following criteria were included in the study:

1. Patients aged between 30 and 60 years

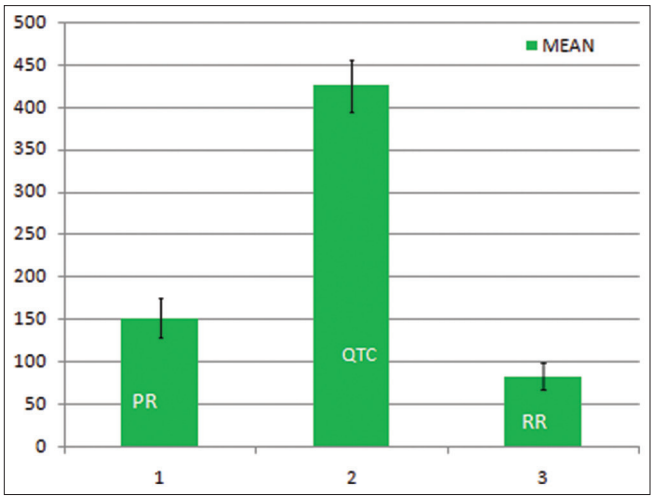

Figure 1: Bar diagram representation of the mean values of the electrocardiogram. **PR Intervals were found to be significantly higher ($P < 0.01$) among type 2 diabetes mellitus patients

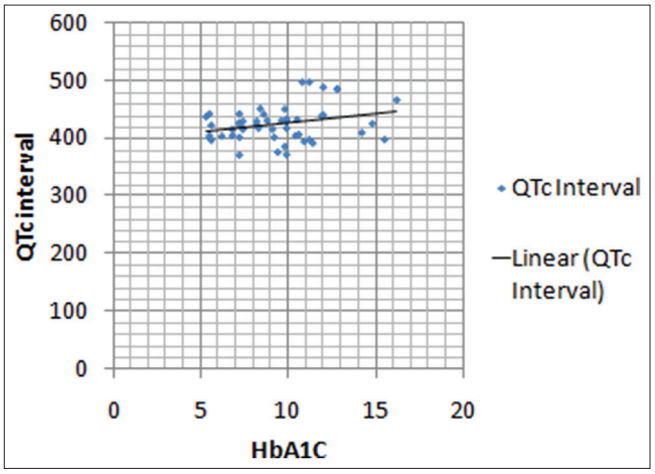

Figure 2: Correlation graph of hemoglobin A1C with corrected QT interval ($P < 0.03$)

2. Diagnosed cases of T2DM as given by the ADA. Patients who fulfill the following criteria for the diagnosis of DM:
    a. Symptoms of diabetes plus random blood glucose concentration ≥11.1 mmol/L (200 mg/dL) or
    b. Fasting blood sugar ≥7.0 mmol/L (126 mg/dL) or
    c. HbA1C ≥6.5% or
    d. Postprandial blood sugar ≥11.1 mmol/L (200 mg/dL) during an oral glucose tolerance test.
3. Patients having no cardiovascular complaints
4. Co-operative and willing to participate in the study.

Exclusion Criteria for the Cases

The following criteria were excluded from the study:

1. Already existing microvascular complications of diabetes such as retinopathy, neuropathy, and nephropathy
2. Known cases of cardiovascular disorders such as hypertension, CAD, and congestive cardiac failure.

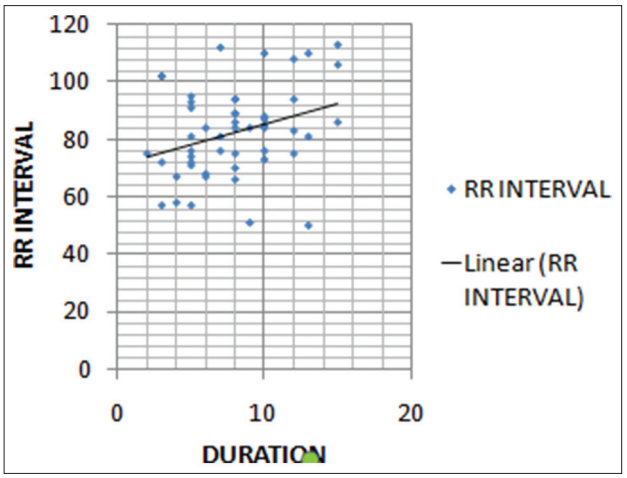

Figure 3: Correlation graph of duration of disease with RR interval ($P < 0.03$)

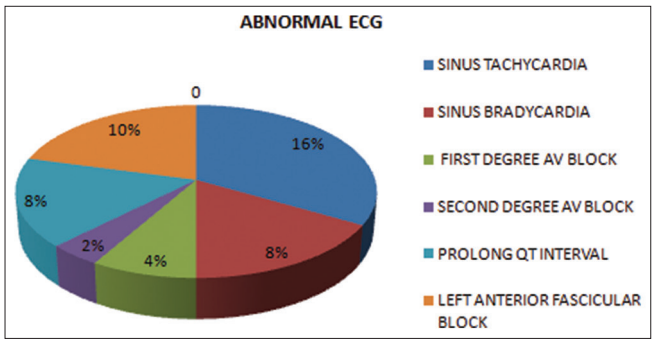

Figure 4: Pie chart representation of percentage of abnormal electrocardiogram in type 2 diabetes mellitus patients

Table 1: ECG parameters in type 2 diabetes mellitus patients

ECG parameter	Sample size (n=100)		
	RR interval (mean±SD)	OTc interval (mean±SD)	RR interval (mean±SD)
Values	151.24±23.38	424.92±30.41	82.44±15.69

ECG: Electrocardiogram

3. Presence of any other concomitant diseases disrupting cardiovascular homeostasis such as thyroid disorders, pheochromocytoma, chronic renal failure due to any cause, respiratory disorders, and dyselectrolytemia.
4. History of smoking, alcoholism or intake of any drugs such as vasodilators, diuretics, anti-arrhythmic, beta-blockers, alpha-agonist, or alpha-blockers.
5. Those who are not willing to participate in the study.

Study Tools

- Electrocardiograph – Model No. CARDIART 6108T
- Sphygmomanometer
- Stethoscope
- HbA1C kit
- Case Study Format.

Recording of ECG

Patients were made to relax comfortably in the ECG recording room. Resting ECG parameters of the patients were recorded (selected as elaborated in the sub-heading sampling procedure) only after obtaining their informed consent as per the inclusion criteria. All the variables such as name, age, and sex were noted as per the case study format. The following routine ECG parameters were assessed using Standardization (Calibration): 10 mm = 1 mV

- PR interval – 0.12–0.2 s/120–200 ms
- QTc interval – 0.39 ± 0.04 s/390 ± 40 ms
- RR interval – 60–100/min.

Data were analyzed using SPSS 15.0. *P* value was calculated to assess the significance of difference of ECG parameters. $P < 0.05$ was considered significant.

RESULTS

A total of 100 T2DM patients had participated in this study. Mean HbA1C level was 9.51 ± 2.65%. ECG parameters are summarized in Table 1 and Figure 1. PR interval was significantly higher ($P = 0.01$) in type 2 diabetics. There was a positive correlation between the HbA1C level and PR, QTc, and RR interval. However, the positive correlation between HbA1C level and QTc interval was statistically significant ($P = 0.03$) as shown in Figure 2. Disease duration also had positive correlation with RR and QTc interval. However, the correlation between duration of disease with RR interval was statistically significant ($P = 0.03$) as mentioned in Figure 3. Pie chart representation of percentage of abnormal ECG in T2DM patients has been shown in Figure 4.

DISCUSSION

The present study included 100 known diabetic subjects who are asymptomatic for cardiovascular disease. Their blood glucose parameters were estimated and resting ECG was recorded in these patients to observe whether any changes were present. PR intervals were significantly higher ($P = 0.02$) in type 2 diabetics. There was a positive correlation between the HbA1C level and PR, QTc, and RR interval. Positive correlation between HbA1C with QTc interval was significantly higher ($P = 0.02$). Disease duration had positive correlation with RR and QTc interval. Positive correlation between duration of disease with RR interval was statistically significant ($P = 0.03$). The presence of ECG abnormality indicated onset of cardiovascular complications which deteriorated with increasing HbA1C as well as with duration of disease.

Gupta *et al*. conducted a study in a tertiary care hospital of Bareilly, North India. One hundred diabetics presenting

to medicine OPD/In-patient department were evaluated for ECG abnormalities.[6] The research revealed that 26% asymptomatic diabetics had ECG abnormalities and most of them had a 5–10 year of duration of the disease. They also showed that 70% patients with ECG changes had poor glycemic control. In a study comprising 200 patients in two referral centers in Nigeria, the prevalence of ECG abnormalities detected in diabetics was as follows: prolonged QTc (25.5%), T-wave changes (22%), left ventricular hypertrophy (LVH) (18.5%), sinus tachycardia (15.5%), ischemic. heart disease (9%), conduction defects (7%), and ectopic beats (4%). The mean duration of disease in this study was 20 years.[7] Dzudie *et al*. carried out a study among 420 diabetics receiving chronic care at two hospitals in the Sub-Saharan region; ECG abnormalities were investigated and identified.[8] The main electrocardiographic aberrations were: T-wave abnormalities (20.9%), LVH (16.4%), arrhythmia (16.2%), ischemic heart disease (13.6%), conduction defects (11.9%), QTc prolongation (10.2%), and ectopic beats (4.8%). The authors also found that blood pressure variables were consistently associated with all electrocardiographic abnormalities.

Fatima Bello Sani concluded in their study that the prevalence of IHD by ECG criteria in persons with type 2 diabetes was 20%.[9] None of the patients with suggestive ECG findings of IHD presented with typical angina pain. Ewing *et al*. 1991, Rossing *et al*. 2001, and Maser *et al*. observed in their studies that typical impairment of ECG parameters in diabetic people was in QT region of the ECG.[10-12] Khoharo and Halepoto, in their study, concluded that in patients with DM, QT_C prolongation and autonomic dysfunction are closely correlated and QT_C prolongation is considered to be a specific sign of autonomic cardiac dysfunction and high mortality risk.[13] Ana De Santiago in her PHD concluded that ECG findings can be predictors of more serious events which could be aggressively prevented.[14] Prolongation of QT_C was studied by Chugh *et al*. Nelson *et al*. individually and concluded that prolonged QT_C is indeed a sign of CAN and a predictor of cardiovascular mortality in type 2 diabetes.[15,16] Chugh *et al*., in a longitudinal study on 221 patients, showed that ECG abnormalities were found in 24.9% at the beginning of the study.[15] It increased to 44.3% at the end of the study with average duration of follow-up of 5.9 years.

Finding of all these studies supports the finding of our study. Increased blood glucose level in diabetics leads to the activation of protein kinase C, which can cause atherosclerotic changes in the blood vessels, retarding the blood flow to the myocardium. Altered blood flow can lead to ischemic damage to the myocardial cells. Microvascular and macrovascular complications are well known in DM. Hyperglycemia is also proposed to cause end-organ damage by increasing the generation of reactive oxygen species. In T2DM, hyperglycemia also leads to the formation of the advanced glycation end product, which can cause degeneration of autonomic neurons leading to cardiac autonomic neuropathy. The combined effect of all these factors is neuronal damage in the brain.

The findings of our study, that is, the presence of ECG changes even when the patients are asymptomatic for cardiovascular disease, emphasize on regular ECG monitoring of diabetic patients. Prompt management of diabetes and controlling HbA1c level can prevent further cardiac complications. All type 2 diabetic patients should be screened for cardiovascular changes at the time of diagnosis and regularly there after using simple 12 lead ECG recording to reduce the burden of cardiovascular morbidity and mortality.

CONCLUSION

Resting ECG abnormalities are common among T2DM patients even in absence of any symptoms. Regular ECG monitoring can help in screening for cardiovascular complications among those T2DM patients who are asymptomatic for CVD and can prevent the cardiovascular mortality and morbidity. Regular assessment of ECG parameters and maintaining strict glycemic control can delay the cardiovascular complications in asymptomatic diabetic patients.

Limitations of the Present Study

The sample size in the present study is relatively small. Furthermore, unknown and subclinical complications, which are unaccounted for, may contribute to ECG changes.

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