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Original Article

Comparison between Z-Plasty versus Limberg Flap Technique in the Management of Sacrococcygeal Pilonidal Sinus

Ramana Prakash Baraju[1], N. Vinay Babu[2], Goparaju Shanti Kumar[3], Ranjith Kumar Gatika[2], Divvela Mohan Das[4]

[1]Assistant Professor, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal, Telangana, India, [2]Associate Professor, Department of General Surgery, Government Medical College, Suryapet, Telangana, India, [3]Postgraduate, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal, Telangana, India, [4]Professor, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medial College, Warangal, Telangana, India

Abstract

Background: There are controversies about the etiology and management of primary and recurrent pilonidal sinus (PNS), and also there are number of techniques of treatment in treating PNS among which no single procedure is superior in all aspects.

Aim of the Study: The aim of this study was to compare two operative procedures (modified Limberg flap [MLF] vs. Z-plasty flap [ZPF]) in the management of sacrococcygeal PNS, regarding their complications including recurrence of the disease, hospital stay, day off work, post-operative complications, and morbidity.

Materials and Methods: This is comparative prospective study between MLF and ZPF in treatment of sacrococcygeal PNS. Thirty patients were divided into two groups: Group (1) treated with MLF and Group (2) treated with Z-plasty, and we follow up of the patients in both groups for post-operative complications, hospital stay, day off work, recurrences, and patients satisfactions.

Results: Operative time, hospital stay duration, and complete wound healing were longer in Group (2) Z-plasty group. Mobilization was early in MLF group than Z-plasty group (1 day vs. 2 days). Time to return to work, it was 14 (12–16) days in the MLF groups and 18 (15–22) in the Z-plasty group. Infection occurred only in one in the MLF Group (1) and two patients in the Z-plasty group (2). The mean time for complete healing of the wound after MLF Group (1) was 16 ± 4.2 days while in Z-plasty Group (2), it was 22 ± 6.8 days. Satisfaction score was better in MLF Group (1). Recurrence had not occurred in any of the patients included in this study during the follow-up period.

Conclusion: Both MLF and Z-plasty techniques are used to cause flattening of the natal cleft, thus reducing local recurrence rates. Hence, we recommend the use of flap technique for PNS patients. However, modified Limberg transposition flap is better than ZPF, because of the less hospital stay, early return to work, and cosmetically more accepted since it has less post-operative complications. Furthermore, ZPF has a major limitation as it is difficult to apply if there is a wide defect in the horizontal axis.

Key words: Modified limberg flap, Sacrococcygeal pilonidal sinus, Z-plasty

INTRODUCTION

Pilonidal sinus (PNS) literally means a cavity or sinus containing hairs (Pilus = hair, Nidus = nest) presentation range from asymptomatic pits to painful draining lesions in the intergluteal region. PNS has a male preponderance[1] and usually affects patients from mid-teens to early thirties.

Congenital and acquired theories have been proposed.[2-4] Initially, the entity was referred as jeep riders disease. Over 80,000 US army soldiers were hospitalized during World War II contributed much information about the disease, what we have today.

The pathology of PNS is an established one. There are one or more pits in the midline of the natal cleft. These pits lead to a cavity lined by granulation tissue and contain hairs.

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Corresponding Author: Dr. N. Vinay Babu, Department of General Surgery, Government Medical College, Suryapet, Telangana, India.

Usually, from this cavity, one or more track run caudally and open either on the right or left of the midline. The secondary sinus is always laterally placed while the primary sinus is in the midline.

Numerous surgical techniques are employed for postnatal sacrococcygeal PNS. The exact procedure is determined by nature of disease presentation and the surgeons choice.

In our study, we wanted to compare two operative procedures (modified Limberg flap [MLF] vs. Z-plasty flap [ZPF]) in the management of PNS, regarding their

1. Complications
2. Duration of hospital stay
3. Time taken for wound healing
4. Time taken for return to work
5. Recurrence.

MATERIALS AND METHODS

This prospective randomized study was conducted at general surgery department at MGM Hospital, Warangal, during the period from June 2017 to August 2019. Thirty patients who were suffering from pilonidal disease were included in this study. Thirty patients were divided into two groups: Group (1) treated with MLF and Group (2) with ZPF.

Inclusion Criteria

The presence of sacrococcygeal PNS, patients willing to give written informed consent, adult (over 18 years of age) with PNS disease, patients fit for surgery with normal coagulation profile, and patients with no infection at time of surgery were included in the study.

Exclusion Criteria

Patients not willing to give informed consent, patients were unfit for surgery, age <18 year, patients presented with *de novo* PNS (presented for the 1st time), and patients with chronic medical conditions, such as diabetes mellitus, renal failure, immune suppression, or patients with defect in coagulation profile.

Informed consent was obtained from all patients and this study was approved by local ethics committee.

All patients were subjected to careful history taking: Duration of symptoms, previous operations, previous post-operative complications, recurrence time after previous operations, presence or absence of discharge, and pre-operative routine laboratory investigations.

All patients were prospectively evaluated in terms of age, sex, body mass index (BMI), duration of pre-operative symptoms, location of sinus pits (midline or paramedian), numbers of pits (single or multiple) and followed up in post-operative time regarding hospital stay, return to work, post-operative complications (wound dehiscence, infections, hematoma, seroma, and cosmetics scars), satisfaction score, and recurrence.

All the patients followed up in outpatient's clinic after operation till complete wound healing and removal of suction drain and stitches then every 3 months for the 1st post-operative year then yearly afterward unless if there were any complaint. If the patient is from distant area, we contact him by telephone. Follow-up period ranges from 12 months to 30 months.

Procedure

Pre-operative preparation included shaving on the day of surgery and broad-spectrum antibiotic on the night before and at start of surgery.

MLF Method

The operation was performed as described by Mentes *et al.* Most of patients in this study were operated under spinal anesthesia in the operating room (only two patients requested general anesthesia). After anesthesia, the patients were placed in the prone, jack-knife position, with the buttocks strapped apart using wide adhesive tape, then marking of skin with marker pen to draw MLF to pass to other side to center the flap 1 cm from midline. The excision was carried down to the fascia overlying the sacrum and laterally to the fascia of the gluteus maximus muscle. Dissection was performed with electrocautery. Elliptical inverted triangular and rhomboid were used to include all sinuses. After excision, a Limberg flap (LF) was prepared from the right or left gluteal region, the subcutaneous tissues were closed with 3/0 polyglactin (Vicryl), and skin with 3/0 Prolene interrupted suture and compression dressing was applied. Suction was placed through a separate incision that was located 2 cm lateral from the initial incision and kept in place until the drainage decreased to <10 ml/day.

Limberg Rhomboid Flap Advantages

- Used to cover large defects
- Least likely to necrose as it is a well vascularized flap
- Flattens the gluteal cleft
- Closure can be achieved without tension
- Mean hospital stay is 6 days
- Recurrence rate is 4% following a follow-up period of 74 months.

Procedure

- Rhomboid incision made around the PNS and excision of all the existing sinuses down up to the presacral fascia carried out

- Incision enclosed rhombic area of skin, subcutaneous fat, and sinuses excised along with lateral extensions
- Long axis of the rhomboid is in midline and the short axis is transversely placed [Figure 1].

Measurements

- Rhomboid
- Line A–C drawn
- Point C adjacent to the perineal skin
- Point A placed so that all diseased tissue can be included in the excision
- Line B-D transects the mid-point of A-C at the right angles and is 60% of its length
- D-E is a direct continuation of line B-D and is of equal length to the incision B-A, to which it will be sutured after rotation
- E-F is parallel to D-C and of equal length. After rotation, it will be sutured to A-D
- Flap consists of skin and fat and is constructed by extending the incision to the gluteal muscle fascia. The skin is approximated after insertion of a vacuum drain.

ZPF

Steps as modified Limberg except skin flaps were raised and transposed. Each limb of Z was equal in length. Angle of the flaps was roughly equal to 60°. Excision including all pits between marks and closed in Z-shaped flap which was mobilized easily and not under tension [Figure 2].

Post-operative management

Post operatively antibiotics, analgesics were given, aseptic dressings were done daily and suction drain was removed when drain was <10 ml/day amount. Clinical assessment was performed at the end of the 5th post-operative day and 1, 3, 6 months, and 12 months following surgery.

Satisfaction score

For performing a patient's satisfaction score we asked, a standard question to every patient: Are you satisfied with outcome of your surgical treatment? The answers were scored in a discrete ordinal scale from 1 to 4 with 4 for excellent, 3 good, 2 fair, and 1 poor.

Statistical analysis

For all statistical analyses, $P < 0.05$ was considered statistically significant.

Z-Plasty

Principle

Obliterating the natal cleft and increasing the transverse length by recruiting the lateral tissue.

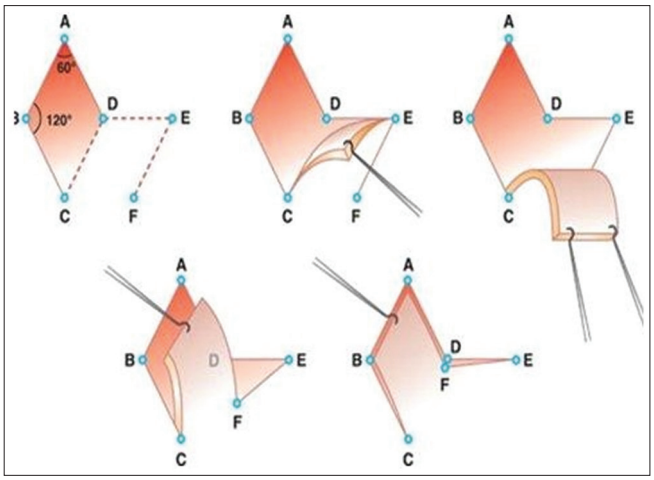

Figure 1: Diagrammatic representation of the Limberg flap

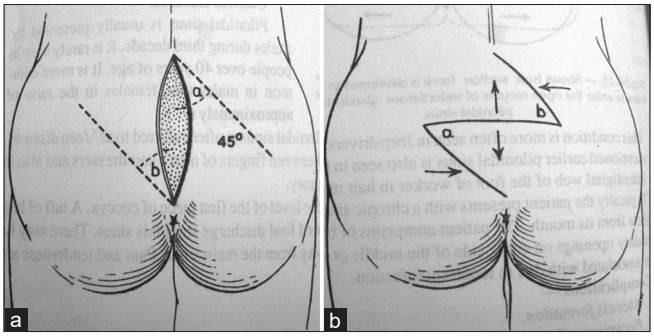

Figure 2: Z-plasty. (a) Marking of Z limbs a and b, (b) flaps created and transposition done and skin closed

Procedure

- Excision of the midline sinus
- From the ends of the midline wound, the limbs of the "Z" are cut
- Subcutaneous flaps are raised up to the level of fascia
- Transposition of the flaps carried out
- Skin is closed.

Mansoory and Dickson used this technique on 120 patients and reported a complication rate of 4% and a recurrence rate of 1.65% after a follow-up for 9 years. The patients were discharged on post-operative day 1 and they returned to work 2 weeks later.

RESULTS AND ANALYSIS

Thirty patients were included in this study from June 2017 to August 2019, of whom 15 patients were treated using the MLF procedure and 15 patients were treated using the ZPF.

Ages of both groups range from 18 to 40 years with mean age in the MLF Group (1) about 23 years and 24 years in the Z-plasty Group (2). Most patients of both groups were males only four females in Group (1) and one female in Group (2).

Sex Distribution in both Groups

There was no significant difference between the two groups in age, BMI, sinus pits location, or presence of multiple or single pits but most pits were multiple and in midline in both groups.

Relation to Obesity in both Groups

About 27% of patients with sacrococcygeal pilonidal disease in our study were overweight (BMI: 25–29). Pre-operative durations of symptoms were nearly equal in both groups with ranges from 9 to 12 months with average 11 months.

Patient Complaints

The main complaints in both groups were pain then discharges and there was no significant difference between both groups regarding pre-operative complaints.

In the present study, majority complained of pain, discharge, and sinus, one presented with swelling.

Complaints	No. of cases	Percentage
Pain	30	100
Discharge	30	100
Sinus	30	100
Swelling	1	3.33

PNS in Relation to the Operative Time and Early Mobilization

Regarding operative time, there was a significant difference between both groups as it was longer in Z-plasty Group (2) than modified Limberg Group (1) also hospitalization was longer in Z-plasty Group (2) than MLF Group (1). Mobilization was early in the MLF group than the Z-plasty group as mean time to first mobilization was earlier in MLF Group (1) than Z-plasty Group (2) (1 day vs. 2 days) with mean (1–1) day versus 2 (1–3) days, respectively.

In Relation to Regarding Return to Work

As regarding suction drain usage, removal of suction drain was early in MLF Group (1) than Z-plasty Group (2) but without significant statistical difference. As regarding return to work, it was 14 (12–16) days in MLF Group (1) and 18 (15–22) days in Z-plasty Group (2). Satisfaction score was good to excellent in MLF Group (1) better than in Group (2) (Z-plasty) which was poor to good.

Post-operative Complications Results in MLF Versus Z-Plasty

As regarding post-operative complications: Only one patient had infections in MLF Group (1) and two patients in Z-plasty Group (2).

Seroma not occurred in any patient in MLF Group (1) and occurred in two patients in Z-plasty Group (2) which treated conservatively without intervention. Wound dehiscence had occurred only in one patient in Z-plasty Group (2) and treated successfully with daily dressing. As regarding flaps: Partial flap ischemia was occurred in one patient in MLF Group (1) and three patients in Z-plasty Group (2) and treated conservatively but total flap necrosis did not occur in any patient in both groups and flap edema had occurred in one patient in the MLF Group (1) and two patients in Group (2) so regarding flaps, there was no statistical difference in flap complications; just complications were lower in Group (1) than Group (2).

In Relation to Complete Wound Healing

The mean time for complete healing of the wound after MLF Group (1) were 16 ± 4.2 days while in Z-plasty Group (2) were 22 ± 6.8 days and irregular scar formation occurred only in one patient in Group (1) and four patients in Group (2).

When patient's satisfaction for post-operative cosmetic appearances was compared, there was a good acceptance from patients for modified Limberg scars than Z-plasty scars. Recurrence had not occurred in any of the patients included in this study during the follow-up period.

RESULTS AND ANALYSIS

Clinical comparison between two groups

Parameter	MLF Group (1)	ZPF Group (2)
No. of patients in each group	15	15
Sex (M/F)	11/4	14/1
Age (years)	23	24
Site	0	
Midline single	12	11
Midline multiples	3	4
Para-midline	0	0
Duration of pre-operative complaints (months)	10.45±3.2	11.3.4±9.45
Main complaint		
Pain	15	15
Discharge sinus	15	15
Obesity		
Average BMI<25	12	11
Overweight (BMI 25–29.9)	2	3
Obese (BMI 30–39.9)	1	1
Morbidly obese (BMI≥40)	0	0

BMI: Body mass index

Operative and post-operative out comes in both groups

Parameter	MLF Group (1)	ZPF Group (2)
Duration of operation (minutes)	52 (45–70)	75 (60–90)
First mobilization (day)	1 (1–1)	2 (1–3)
Painless toilet seating (days)	1 (1–2)	2 (1–3)
Drain usage	5.71±2.5	7.68±1.9
Length of hospital stay (days)	1.6 (1–4)	3.4 (3–7)
Time return to work	10 (8–15)	18 (14–22)
Pain VAS score	2 (1–3)	5 (2–6)
Complete healing time (day)	16 (14–24)	22 (18–28)
Patient satisfaction score	3.2±0.66	1.9±0.7
Follow-up (months)	14±8.6	15±7.8

Complications		
Wound infection	1	1
Seroma	0	2
Flap edema	1	2
Partial flap ischemia	1	3
Flap necrosis	0	0
Partial wound dehiscence	1	3
Total wound dehiscence	0	0
Irregular scar formation	1	4
Recurrence rate	0	0

DISCUSSION

PNS was described by Anderson in 1847 and by Hodges in 1880. Pilonidal as a word means "a nest of hair." PNS disease PSD is a benign chronic condition start with localized inflammation with abscess formation causing fistulae, sinuses, chronic inflammation, and discharge.

It may occur in many sites as axilla, umbilicus, and interdigital space but it is usually seen in the sacrococcygeal region (natal cleft), although it is chronic but often present with acute exacerbations. In the past, it was thought to be a congenital disease but recently, it is more accepted to be an acquired condition.

It is mainly occurs in young age and more common in males than in females (male/female = 4–5/1). According to Gurer *et al.*, he reported a mean patient age of 25.5 and a gender balance of 95% males in a series about PNS disease.

In our study, mean age in both groups was 23 and 24 years, respectively, with range from 16 to 45 years and M:F was 6:1 with percentage 84%, although our study in recurrent group only, also many studies confirm that the disease is predominant in males. Although it is benign chronic disease, as it occurs in young adults in their main productive age so it has a negative impact on the socioeconomic condition, general economy, and financial state because it causes loss of work time, especially during acute exacerbations.

There are many risk factors implicated in occurrence of PSD including family history, local trauma, obesity, sedentary occupation, and poor body hygiene. There are many factors contributing in recurrences such as post-operative complications, obesity, smoking, size of sinus, and previous procedure used.

In the literature, there are two options which have been used for in the treatment of PSD, either conservative medical methods or surgical treatment. Medical treatment options include alcohol, phenol, and silver nitrate injection into the cavity. Surgical treatment methods[5-8] include curettage after sinusotomy, excision, and leaving an open for secondary intention or marsupialized wound after excision, excision and primary closure, Bascom procedure, Karydakis flap procedure (KF), or sinus excision and skin flap methods, such as LF, ZPF, and MLF. Surgical treatment is the most preferred methods.

The use of complex plastic flaps for cleft obliteration is preferable in recurrent PNS. There is a disadvantage in surgical treatment of PSD in general as it is operator dependent. There is controversy about the ideal procedure for the treatment. The ideal treatment methods should result in rapid wound healing, short hospital stay, short period of work off days as most of patient are young working adult and working, less wound complications as seroma, dehiscence, infection, low recurrence rate, good patient satisfactions, and good cosmetic results. Hence, the main goal in the management of PNS should aim to complete excision of the sinuses and all pits with their ramifications, prevent wound complications that can result in recurrence, create an eccentric suture line, obliteration of the natal cleft using various flap techniques, improve local hygiene, and prevent hair regrowth in the site of the repair by always shaving hair in this area or any methods of hair ablation.

Recurrence is the main problem in the treatment of PNS and may occur due to inadequate excision, presence of dead space, deep midline gluteal clefts, poor personal hygiene, midline scar, early post-operative wound complications, excessive tension, and obesity. The lowest recurrence rates have been reported for procedures using local flap rotation. There are many flaps used in the treatment of recurrent PNS such as Z-plasty, W-plasty, KF, LF, MLF, rotation flap, gluteus maximus musculocutaneous flap, sacral adipofascial turn-over flap, cleft lift procedure, and V-Y fasciocutaneous advancement flap. In the literature, recurrence rates with flap procedures were ranging between 0 and 6%–8%.

In this present study prospectively compared between two flap procedures in treatment of PNS disease (MLF vs. ZPF). Both flaps had lowest recurrence rates reported in literature and this is important in the procedure used but in our study, we focused on other important factors i.e. hospital stay, time off work and patients satisfactions.

This study was conducted on 30 patients in general surgery department at MGM Hospitals, Kaloji Narayana Rao University of Health Sciences, Warangal, during the period from June 2017 to August 2019 with pilonidal disease which were included in this study and divided into two groups: Group (1) treated with MLF and Group (2) with ZPF.

We found that most of the patients were young adults, and most of them were male, as present in literature, in MLF, female patients were four more than Z-plasty because after their counseling they preferred LF than ZPF as they

had thought that it is cosmetically better than Z-plasty. As regarding operative time, hospital stay, time off work, post-operative complications, satisfaction score, and MLF were better than Z-plasty.

Regarding recurrences, we did not observe any recurrences in both groups this may be attributed to small number of patients in our study, or due to effectiveness of the both procedures, or follow-up time was shorter.

Although recurrence is the most important factor in the treatment of PNS disease, also there are many other important factors in the treatment of PNS with surgical procedures as post-operative pain, hospital stay, return to daily activities, time off work, and patient cosmetic satisfaction, especially in recurrence with large defects, as flap procedures can reduce aesthetic satisfaction because it may result in an irregular scar. Regarding duration of hospital stay in our study, we found that hospital stay time were 1.6 (1–4) days in MLF Group (1) lower than 3.4 (3–7) days in Z-plasty Group (2).

In our study, the MLF group had a better post-operative pain score, higher patient satisfactions, earlier first mobilization (1 vs. 2 days), and more painless toilet sitting (1 vs. 2 days). These patients also had shorter complete healing time (22/24 day) than the Z-plasty group.

A Cochrane overview has been performed to provide evidence-based guidance for surgical treatment. The review concluded that off-midline closure (including MLF, Karydakis and Bascom flaps natal cleft, and Z-plasty) is the best choice for primary and recurrent PNS.

CONCLUSION

From results of this present study, we found that LF procedure is a safe choice for the surgical treatment of primary and recurrent sacrococcygeal PNS disease due to its low complication rate, short length of hospital stay and early return to work, better post-operative pain score, high patient satisfaction, and shorter complete healing duration. Therefore, we recommend MLF procedure as a good option for the treatment of primary and recurrent PNS disease. Furthermore, ZPF has a major limitation as it is difficult to apply if there is a wide defect in the horizontal axis.

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