

Sciatic Nerve Bifurcation and Its Implication in Posterior Approach of Total Hip Replacement: A Rare Case Report

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Abstract

Introduction: The Sciatic nerve is the widest nerve of the body. It consists of two components, the tibial and the common peroneal. This components are derived from the ventral rami of L4 to S3 spinal nerves of the lumbosacral plexus. Sciatic nerve exits pelvis through the greater sciatic foramen below the piriformis muscle and descends down between the greater trochanter of the femur and ischial tuberosity of the pelvis toward the knee. The purpose of this study is to identify the course and variations in branching pattern of the sciatic nerve which may lead to various clinical manifestations, complication, and care that should be taken during total hip replacement.

Case Report: A 60-year-old male came with pain in right hip since 6 months. X-ray PBH was done and showed Grade 4 arthritis. Patient was planned for total hip replacement. Patient was kept in floppy lateral position. Incision was taken from shaft of femur directing towards posterior side through greater trochanter. We observed Variation in sciatic nerve at this level and carefully pulled it away from the surgical site. Postoperatively, neurology was evaluated and showed no neurovascular deficit.

Conclusion: It is important to be aware of anatomical variation in sciatic nerve during a surgical intervention in the gluteal region so as to reduce the risk of injuring these nerves which are more susceptible to be injured.

Key words: Bifurcation of the sciatic nerve, Posterior approach, Sciatic nerve, Tibial and common peroneal nerves, Total hip replacement

INTRODUCTION

Sciatica is a Greek word derived from “Ischiadichus” and hence it is called as ischiadic nerve. The sciatic nerve is the widest nerve of the body, having two components, tibial and the common peroneal, both of which initially form a common trunk from the lumbosacral plexus. The tibial part is formed from the ventral branch of ventral rami

of L4 to S3 spinal nerves. The common peroneal part is formed from the dorsal branches of ventral rami of L4 to S2 spinal nerves.^[1] It usually exits from the pelvis through the greater sciatic foramen below the piriformis muscle and goes down between the greater trochanter of the femur and ischial tuberosity of the pelvis, at the posterior aspect of the thigh, it divides into the tibial nerve and common peroneal (fibular) nerves at a varying level proximal to the knee. At proximity it lies deep to the gluteus maximus muscle, resting first on the posterior ischial surface with the nerve to the quadratus femoris lying between them. It descends posterior to the obturator internus, the Gemelli, and quadratus femoris muscle, separated by the quadratus femoris from obturator externus muscle and the hip joint. On medial aspect, it is accompanied by the posterior femoral cutaneous nerve and the inferior gluteal artery. On

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descending course, it lies posterior to adductor magnus and anterior to the long head of biceps femoris. It represents to a line drawn from just medial to the midpoint between the ischial tuberosity and greater trochanter to the apex of the popliteal fossa. As the sciatic nerve has significant anatomical variation in its course, topography and level of division, the unpredictability of this can lead to inadvertent damage intraoperatively, and special care must be taken to prevent sciatic nerve palsy. High level division is a relatively common finding, dividing into its terminal branches in the pelvis and thigh.^[2] Neurological and vascular complications following hip arthroplasty are uncommon, and their impact ranges from transient and trivial such as numbness tingling to permanent and devastating, namely, foot drop. The proximity of neural and vascular structures makes any operation in the hip region potentially hazardous. Direct or indirect injuries of sciatica nerve and branches may occur during operative exposure and placement of the implant. Thermal effects of cementing also have hazardous effect on sciatic nerve leading to temporary to permanent damage. Complete awareness of the anatomy of the pelvis and proximal femur is essential before undertaking any procedure. Peripheral nerve injuries may be either at distant sites or within the immediate vicinity of the hip joint. Sciatic nerve injury is the most common nerve and most dangerous injury following total hip arthroplasty.

CASE REPORT

A 60-year-old male came with chief complaints of pain in right hip joint since 6 months. Plain radiograph was taken, suggestive of grade four osteoarthritis of right hip joint. The patient was explained the need for total hip replacement. Routine preoperative investigation was done. Blood profile was within normal limit. Posterior approach was planned for the patient. Patient was kept in lateral position with affected side above. Greater trochanter was by palpating it from lateral condyle of femur. Incision was taken 10 above and 5 cm below the greater trochanter. Soft tissue was dissected in layers. We noticed that sciatic nerve was crossing posteriorly with bifurcation and needed further attention for the same. It was observed that it is type 2 variations which is quite rare and must be documented for future references. We retracted the nerve posteriorly with gentle care, but one of the branches was crossing the surgical site. Another retractor was placed to retract the branch and procedure was continued. Procedure was uneventful and patient had no neurodeficit postoperatively.

DISCUSSION

The sciatic nerve was first described in detail by Ambroise Paré in the 16th century, and in the 19th century, Cruveilhier

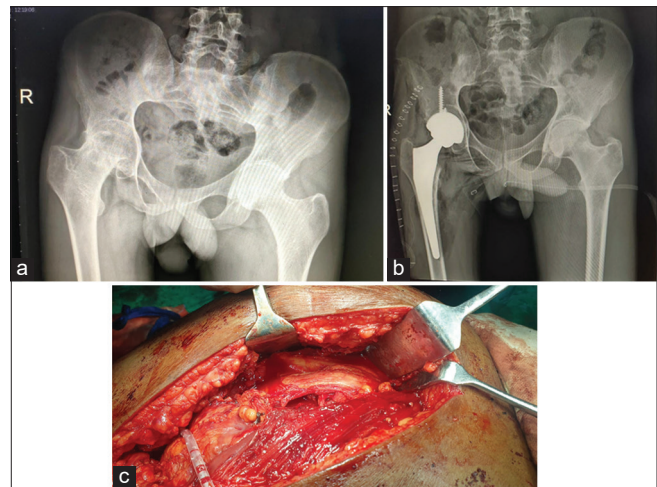


Figure 1: (a) Grade 4 right hip arthritis, (b) Postoperative radiograph of total hip replacement, (c) sciatic nerve variation

observed variation in the bifurcation level.¹⁴ Variant types include the sciatic nerve passing through the belly of the PM, or the high bifurcation of the sciatic nerve into the tibial nerve and common peroneal nerve in the gluteal region, with one of these branches possibly coursing through the PM.^[2,3]

Sciatic nerve anatomy and its bifurcation levels are important in clinical and treatment aspects. Under normal circumstances undivided SN courses through greater sciatic foramen below piriformis and divides at the apex of the popliteal fossa topographic variations and relationship of the sciatic nerve and piriformis muscle was studied by Pokorný *et al.*^[2] The level of the sciatic nerve division and its relation to the piriformis muscle was also studied by Ugrenovic *et al.*^[3] According to both of them, sciatic nerve descends from pelvis through the infrapiriform is foramen in 192 lower limbs (96% cases), while in eight lower limbs (4%) the variable relations between SN and piriformis muscle were detected. Common peroneal nerve traversed through the piriformis and left the pelvis in 5 limbs (2.5%) and Tibial Nerve left the pelvis through the infrapiriform is foramen. In three limbs (1.5%), common peroneal nerve was present above the piriformis and tibial nerve was below the piriformis. Variations in the course of the SN have also been associated with iatrogenic nerve injury during certain procedures, such as total hip arthroplasty, and arthroscopy.^[4,5] Authors have given different classifications for the level of division and course of sciatic nerve in relation to piriformis muscle. The degree and prevalence of variation have remained constant in cadaveric and magnetic resonance imaging studies with around 90–93% of cases showing type 1 pattern with anatomic variation in up to 10%. Rare unclassified variations may still be encountered during surgical intervention in this region. Beaton and Anson

classified the relationship of the sciatic nerve to the piriformis and its subdivisions to the muscle.^[6] Four main types were observed with Type 5 and 6 were considered hypothetical variations.

- Type 1: Undivided nerve below undivided muscle - 90%
- Type 2: Division of nerve between and below undivided muscle - 7.1%
- Type 3: Division above and below undivided muscle - 2.1%
- Type 4: Undivided nerve between heads - 0.8%
- Type 5: Division between and above heads.
- Type 6: Undivided nerve above undivided muscle.

The prevalence rate of neurologic injury after primary hip arthroplasty is around 0.7–3.5%,^[5-8] increasing up to 7.6% after revision hip arthroplasty.^[5,6,9,10] Direct causes of sciatic nerve injury during hip arthroplasty include direct external injury, lengthening of the pelvic limbs, thermal injury from bone cement, pressure damage secondary to hematoma, and traction damage due to dislocation of the femoral region. Approximately 40% of the cases the cause of injury remains unknown.^[11] The major causes of neurologic injury are stretching, compression, contusion, laceration, thermal injury from bone cement, and vascular compromise occurred during operations. Amongst these causes, stretching is the most common one and is due to either traction or excessive extension of the limb. Secondary risk factors are acetabular hip dysplasia, female gender especially with below-average height and muscle mass, posttraumatic arthritis, minimal invasive procedures, and revision hip arthroplasty; however, neurologic injury can occur in the absence of these risk factors. Therefore, it is better to perform traction operations with caution or to protect the sciatic nerves of high-risk patients in advance to prevent nerve injury. Furthermore, if needed, it is also recommended to prevent bone cement leakage, while understanding the variability of sciatic nerve during posterior approach in total hip replacement. It is also necessary to maintain an optimal level of anticoagulant agents to avoid pressure damage due to hematomas. The sciatic nerve branches are most susceptible to injury due to the low mobility of the fibular head of the knee joint and the point projected through the sciatic notch from the pelvis. Damage of the fibular parts is more common than that of the tibial parts; in particular, the outer part of the fibular area is known to be damaged more often. Sciatic nerve injury is the most common peripheral nerve damage following hip arthroplasty.^[5-7,12]

CONCLUSION

It is important to be aware of anatomical variation in sciatic nerve during a surgical intervention in the gluteal region especially posterior approach in total hip replacement, so as to reduce the risk of injuring these nerves which are most susceptible to be injured. A detailed anatomical study of such variations will be helpful for evaluating the pain in various test positions. Our case report provides awareness of additional sciatic nerve entrapments that are possible within the gluteal regions. To prevent and minimize neurovascular injuries, one of the complications of posterior approach of hip arthroplasty, it is obligatory to have accurate knowledge of the anatomical structures and to understand clinically anatomical variation. It is very important to be cautious during the posterior approach regarding excessive stretching, damage by the instruments, bone cement leakage, and hematoma formation. Fixation of acetabulum screws should be performed in the posterosuperior quadrant to minimize neurovascular injuries. Finally, movement of acetabulum implants should also be carefully monitored.

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