



VARIATION OF HIGH DIVISION OF SCIATIC NERVE IN NORTH INDIAN POPULATION AND ITS RELATION WITH PIRIFORMIS MUSCLE

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ABSTRACT Sciatic nerve is a branch of sacral plexus which divides in the posterior compartment of thigh into tibial nerve and common peroneal nerve. Sometimes the sciatic nerve can show a variation i.e the nerve can divide at higher level. The higher division of sciatic nerve can be caused by anatomical abnormality in piriformis muscle. The aim of the study was to note the relation of sciatic nerve with piriformis muscle. This relation is important for surgeons as this area is for deep intramuscular injections and sciatic nerve can be injured. Or Sciatic nerve block can be failed during anesthesia. Even the nerve can be injured during posterior hip operation.

KEYWORDS : Sciatic Nerve, Piriformis Muscle, Tibial Nerve, Common Peroneal Nerve

INTRODUCTION

Sciatic is a Greek word derived from the '*ischiadicus*'. Sciatic nerve, also known as ischiadic nerve or ischiatic nerve, is the largest nerve in the humans and other animals. The sciatic nerve is the workhorse of the lower extremity, supplying the vast majority of the motor and the sensory function to the lower limb. It supplies motor function to the posterior thigh, and all the muscles below the knee (15). Arising from the lumbosacral plexus, this nerve is typically 2cm wide at its origin and is the thickest nerve in the human body with a root value of L4, L5, S1-3. Sciatic nerve further divide into the tibial nerve and the common peroneal (fibular) nerves at a varying level proximal to the knee joint. The point of bifurcation of the sciatic nerve is very much variable (16). Both motor and sensory fibers are seen in it. The motor branches of the nerve supply the posterior group of muscles of the thigh as well as two joints of the lower limb i.e the femoral and the knee joint whereas its sensory branches supply the whole tibial and foot areas with the exception to the anteromedial tibial side and the medial margin of the foot (11). There is a close relationship between the sciatic nerve and the intrapelvic muscles (especially piriformis) along its course. One of the intra pelvic muscle, piriformis may compress the sciatic nerve and cause a syndrome named piriformis syndrome (20). According to this syndrome, there is irritation of the sciatic nerve during its passage from greater sciatic foramen in gluteal region which is caused by anatomic abnormalities of piriformis muscle. Various studies have documented the relationship of sciatic nerve with piriformis which help us to understand this syndrome better. It is just because of the close relation of the muscle to the sciatic nerve which makes it possible to trauma and inflammation (4). The present study was conducted to have the knowledge of sciatic nerve entrapment while its passage through the greater sciatic notch so that it can be correlated well with the piriformis syndrome in the study population.

MATERIAL AND METHOD

Material for the present study comprised of 60 lower limbs (25 males cadavers and 5 females cadavers) of embalmed adult human cadavers obtained from the department of Anatomy, of our Institute. The gluteus maximus muscle was elevated during dissection to explore the piriformis, the superior gemellus, the obturator internus, the inferior gemellus and the quadratus femoris. And further limb was dissected to expose to study the sciatic nerve from its exit from the greater sciatic foramen in gluteal region and its relation with the piriformis muscle. The relationship of the sciatic nerve with the piriformis at its exit from the greater sciatic foramen was studied according to the classification given by Patel (2011) and Beaton and Anson (1937). Patel (2011) classified the relationship into 3 types (11). While Beaton and Anson (1937) classified the relationship into 6 types (2). According to Patel, type I- Sciatic nerve as a single trunk comes out below piriformis; type II- Sciatic nerve already divided in pelvis and its two divisions comes out below piriformis and type III- Sciatic nerve already divided in pelvis and its two divisions comes out differently from pelvis, one (Common peroneal nerve) comes out after piercing the piriformis & other (Tibial nerve) comes out below the piriformis. According to Beaton and Anson (1937), the relationship of the sciatic nerve at its exit from the greater sciatic foramen into 6 types, type 1- undivided nerve below undivided muscle, type 2- division of nerve between and below undivided muscle, type 3- division above and below undivided

muscle, type 4- undivided nerve between heads, type 5- division between and above two heads and type 6- undivided nerve above the undivided muscle.

RESULTS

In present study relation of the sciatic nerve with the piriformis at the exit from greater sciatic foramen was noted. Two types of course of the sciatic nerve were noted as it comes out of the pelvic to the gluteal region. These were, undivided sciatic nerve passing below the piriformis muscle and divided sciatic nerve passes by piercing the piriformis muscle. The nerve was seen emerging undivided below the piriformis as a single trunk in 29 cases (96.67%) on left side (Figure 1) and in 28 cases (93.33%) on the right side. In one case (3.33%) on left side (Figure 2A) and two cases (6.66%) on the right side (Figure 2B), the common peroneal nerve was seen piercing the piriformis muscle and the tibial nerve was emerging below the piriformis. Among the male cadavers, 24 cadavers showed undivided nerve passing below the piriformis muscle bilaterally, whereas in one cadaver the common peroneal nerve pierces the piriformis muscle and the tibial nerve passes below the piriformis muscle bilaterally.

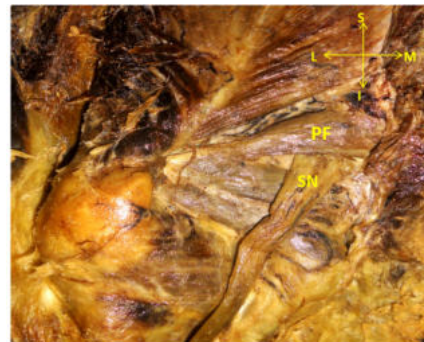


Figure 1: Male cadaver showing left side limb showing undivided sciatic nerve (SN) passing below the undivided piriformis muscle (PF); (S- Superior, I- Inferior, M- Medial, L- Lateral)

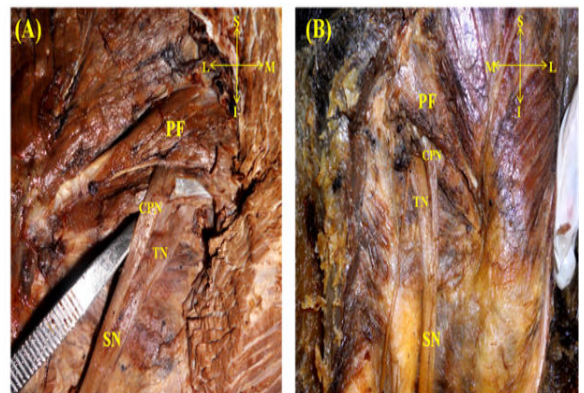


Figure 2: Male limb showing sciatic nerve (SN) with common peroneal nerve (CPN) and tibial nerve (TN).

peroneal nerve (CPN) piercing piriformis (PF) and tibial nerve (TN) emerging below it (A) left side; (B) right side; (S- Superior, I- Inferior, M- Medial, L- Lateral)

Among the 4 female cadavers, the undivided sciatic nerve passes below the piriformis muscle bilaterally, whereas in one limb the common peroneal nerve pierces the piriformis muscle and the tibial nerve passes below the piriformis muscle unilaterally on the right side. According to Beaton and Anson classification, in present study 57 cases fall under type I category i.e undivided nerve passes below undivided muscle. Whereas in 3 cases, type 2 variation (divided nerve passes between and below the undivided muscle) was noted. But according to Patel's classification, variations were noted as according Figure 3.

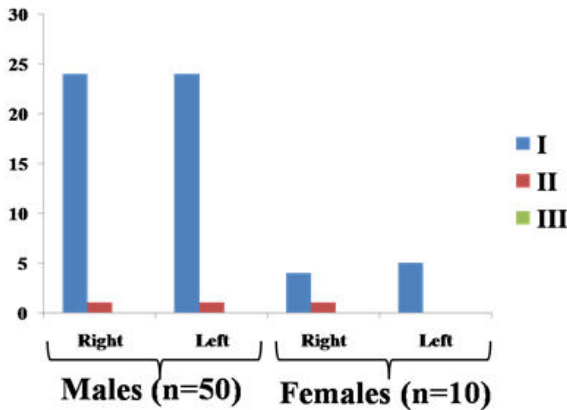


Figure 3: Bar diagram showing variations recorded according to Patel's classification

DISCUSSION

In present study, in 95% extremities the sciatic nerve passes undivided below the piriformis muscle. This result agrees with 96%, 92%, 91.8% and 90% observations reported by Ugrenovic et al (22), Desalegn and Tesfy (6), Patel et al (11) and Beaton (3) respectively. These were the highest percentages reported in the literature. However, lower percentage 52% was reported by Saritha et al (17).

In current study, 5% extremities showed type II variation according to Beaton and Anson classification (2) which is the most accepted classification. According to which the sciatic nerve divided in the pelvis and the two divisions comes out differently. The tibial nerve passes below the piriformis muscle whereas the common peroneal nerve pierces the piriformis muscles. This result correlates with Pecina (12) and Ogengo (10) who also reported 6.15% and 7.9% observations respectively. In contrast higher observation (28%) was reported by Parkash et al (14) and lower percentage (2.5%) was reported by Ugrenovic et al (22).

Incidence of high division of sciatic nerve and its relations with the piriformis at its exit from the greater sciatic foramen has been reported in literature and listed in Table 1.

Table 1 Comparison Of Incidence Of High Division Of Sciatic Nerve And Its Relations With Piriformis At Its Exit From Greater Sciatic Foramen

Sr No.	Name of Investigators (year)	Type1 (%)	Type2 (%)	Type3 (%)	Type4 (%)	Type5 (%)	Type6 (%)
1.	Beaton & Anson (1937) ⁽²⁾	84.2	11.7	3.3	0.8		
2.	Beaton (1938) ⁽³⁾	90	7.1	2.1	0.8		
3.	Pecina (1979) ⁽¹²⁾		6.15				
4.	Chiba (1992) ⁽⁵⁾		34				
5.	Sayson et al (1994) ⁽¹⁸⁾						Single case
6.	Uluutku & Kurtoğlu (1999) ⁽²³⁾	74	16	10			
7.	Moore & Dalley (1999) ⁽⁸⁾		12.2	0.5			
8.	Ugrenovic et al (2005) ⁽²²⁾	96	2.5	1.5			
9.	Pokorny et al (2006) ⁽¹³⁾	79.1	14.3	4.4	2.2		

10.	Prakash (2010) ⁽¹⁴⁾	70	28				
11.	Ogengo (2011) ⁽¹⁰⁾		7.9				
12.	Patel (2011) ⁽¹¹⁾	91.8					
13.	Saritha (2012) ⁽¹⁷⁾	52		24			
14.	Shewale (2013) ⁽²¹⁾	73.3 3	11.1 1	2.23			
15.	Desalegn (2014) ⁽⁶⁾	92		5.5			
16.	Present study	95	5				

CONCLUSION

Piriformis syndrome which is one of the uncommon and often undiagnosed cause of buttock and leg pain may be caused by anatomic abnormalities of the piriformis muscle resulting in irritation of the sciatic nerve by the piriformis muscle (9). The abnormal passage of the sciatic nerve has been resulted in entrapment of sciatic nerve as it comes out of greater sciatic notch in the gluteal region. Knowledge of such differences is important for surgeons who are dealing with Piriformis syndrome which affects 5-6% of patients referred for the treatment of back and leg pain (19). If the regional anatomy is not known by the physician then there would be difficulty in identification and accurate diagnosis (4). These studies will mostly focus on the routes of exits of the sciatic nerve through greater sciatic foramen which is important for surgeons as this is the area of frequent surgical intervention and deep intramuscular injections is provided in this region (1). Compared to the lower division of the sciatic nerve, higher division of sciatic nerve (tibial and common peroneal nerves) can result in the escape of either nerves from one of the aforementioned causes, resulting in a decrease in neurological deficits. One important consequence of the high division of the sciatic nerve is that it may lead to the failure of popliteal block anaesthesia (14).

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