VIA MEDICA

ORIGINAL ARTICLE

Folia Morphol.
Vol. 70, No. 3, pp. 175–179

ISSN 0015–5659
www.fm.viamedica.pl

# Variant anatomy of sciatic nerve in a black Kenyan population

J.A. Ogeng'o, H. El-Busaidy, P.M. Mwika, M.M. Khanbhai, J. Munguti

*Department of Human Anatomy, University of Nairobi, Nairobi*

[Received 5 February 2011; Accepted 8 May 2011]

*Knowledge of variant anatomy of the sciatic nerve is important in avoiding inadvertent injury during operations in the gluteal region and interpreting non-discogenic sciatica. This variant anatomy may cause piriformis syndrome and failure of sciatic nerve block. The variations differ between populations but data from Africans is scarce. This study, therefore, investigated variations of sciatic nerve in a black Kenyan population.*

*One hundred and sixty-four sciatic nerves from 82 cadavers of black Kenyans were exposed by dissection at the Department of Human Anatomy, University of Nairobi, Kenya. The level of bifurcation, relationship to piriformis, and topographic relations between the branches were studied. The results were analysed by SPSS version 16.0 and are presented by macrographs.*

*In 33 (20.1%) cases division occurred in the pelvis, while in 131 (79.9%) it occurred outside the pelvis. A single trunk sciatic nerve exited below the piriformis muscle in 131 (79.9%) cases. In cases of pelvic division, the tibial nerve was always infrapiriformic, while the common peroneal nerve passed below piriformis in 16 (9.8%) cases, pierced the piriformis in 13 (7.9%), and passed above it in 4 (2.4%). For those in which division was extrapelvic, 110 (67.1%) were in the popliteal fossa, 17 (10.4%) in the middle third of the thigh, and 4 (2.4%) in the gluteal region. Where the division was pelvic, in 19 (11.6%) cases they continued separately, in 8 (4.9%) the two nerves reunited, and in 6 (3.7%) they were connected by a communicating nerve.*

*The sciatic nerve in the Kenyan population varies from the classical description in over 30% of cases, with many high divisions, low incidence of piriformic course of common peroneal nerve, reunion, and unusual connection between common peroneal and tibial nerves. These variations may complicate surgery and interpretation of sciatic neuropathy. Preoperative nerve imaging and extra operative diligence in the gluteal region and the back of the thigh are recommended.* (Folia Morphol 2011; 70, 3: 175–179)

**Key words: sciatic nerve, variations, piriformis syndrome, sciatica**

## INTRODUCTION

Variant anatomy of sciatic nerve may lead to inadvertent injury during operations in the gluteal region, piriformis syndrome, non-discogenic sciatica, coccygodynia, muscle atrophy, and failure of sciatic nerve block [4, 16]. Variations in the relationship with piriformis and level of division have been described [2, 15, 16, 17]. The frequency of these variations differs between populations [3, 16, 17]. Data from African populations are, however, scarce and

Address for correspondence: J.A. Ogeng'o, BSc, MBChB, PhD, Department of Human Anatomy, University of Nairobi, P.O. Box 00100–30197, Nairobi, tel: 254720837592, e-mail: jogengo@uonbi.ac.ke

have addressed only a few variables [4, 9]. This study, therefore, investigated the variant anatomy of the sciatic nerve in a black Kenyan population.

## MATERIAL AND METHODS

This was a descriptive dissection study on formalin fixed cadaveric limbs of adult black Kenyans at the Department of Human Anatomy, University of Nairobi, Kenya. The study was done during medical students' dissection classes. The gluteal region, back of the thigh, and popliteal fossa were exposed by dissection. The gluteus maximus muscles were cut in the middle and the halves freed and pulled away to expose the sciatic nerve and piriformis muscle. The biceps femoris muscle was also retracted to expose the nerve in the back of the thigh. The nerve was then exposed in the popliteal fossa. In the three regions, the nerve was exposed by removal of fat and connective tissue. The level of bifurcation, relationship of the nerve and/or its divisions with the piriformis as well as the topographic relationship between the branches were examined and representative images of the variations taken using a digital camera. The data were analysed by Statistical Package for Social Sciences (SPSS) software version 16.0 for Windows and are presented by macrographs.

## RESULTS

One hundred and sixty-four (164) sciatic nerves of eighty-two (82) lower limbs were examined. The sciatic nerve, present in all cases, comprised two components: the tibial (TN) and common peroneal (CPN) nerves. It exited through the greater sciatic foramen, and ran anterior to the gluteus maximus, between the ischial tuberosity and greater trochanter. It lay posterior to the gamelli, the tendon of obturator externus, quadratus femoris, and between the biceps femoris and adductor magnus. There were variations in level of division, relationship with the piriformis muscle, and communication between the branches.

### Level of division

In 131 (79.9%) cases, the nerve divided distal to the lower border of the piriformis muscle, while in 33 (20.1%) it divided proximal to the muscle, that is in the pelvis. Among those dividing distal to the muscle, 110 (67.1%) divided in the popliteal fossa (Fig. 1A), 17 (10.4%) in the middle third of the thigh (Fig. 1B), and 4 (2.4%) in the gluteal region (Fig. 1C).

### Relationship with the piriformis

In 131 (79.9%) cases, the sciatic nerve exited from the infrapiriformic compartment as a single trunk. In those which divided proximal to the piriformis, the TN passed below the piriformis in all cases while the CPN passed below the piriformis in 16 cases (9.8%) (Fig. 1D); pierced the piriformis in 13 (7.9%) cases (Fig. 1E), and above it in 4 (2.4%) cases (Fig. 1F). There were no cases of the common trunk piercing the piriformis.

### Communication between the CPN and TN

In the instances of pelvic and gluteal division, the CPN and TN reunited in 8 cases (4.9%) (Fig. 1G). There was communication between the two nerves in 6 cases (3.7%) (Fig. 1H).

## DISCUSSION

Sciatic nerve usually divides in the popliteal fossa to give common peroneal and tibial nerves. In the current study, only 67.1% of the sciatic nerves conformed to this standard textbook description. This is comparable to the figure of 69% reported in a Polish population [13], but is lower than 96.2% reported among Nigerians [4] and 77.5% among Ugandans [9]. Over 20% divided in the pelvis, and 12.8% proximal to popliteal fossa. This suggests that the frequency of variant anatomy of sciatic nerve displays wide variations. Each of the anatomical variations may reflect a different and case-specific clinical presentation of sciatic neuropathy.

### Level of division

Division of sciatic nerve occurred in the pelvis in 20.1% of cases. This is within the range of 4.0–48% reported in literature (Table 1). Notably, it is close to the figure of 22.5% reported for a Ugandan population [9] but far less than the 48% reported for a Turkish population [8]. The probable basis for this pelvic division is the separate existence of the nerves during embryonic development [1, 12]. The level of division of the sciatic nerve influences the extent of neurological deficit in sciatic neuropathy. For instance, division in the gluteal region or proximal to the popliteal fossa may result in involvement of only one of the two divisions during popliteal fossa injuries. Furthermore, it may account for failure of sciatic nerve block when performing popliteal block anaesthesia [4, 16].

In 12.8% of cases the division was proximal to the popliteal fossa. This is lower than the prevailing 27.7–40.7% in literature [16, 17]. In addition, the

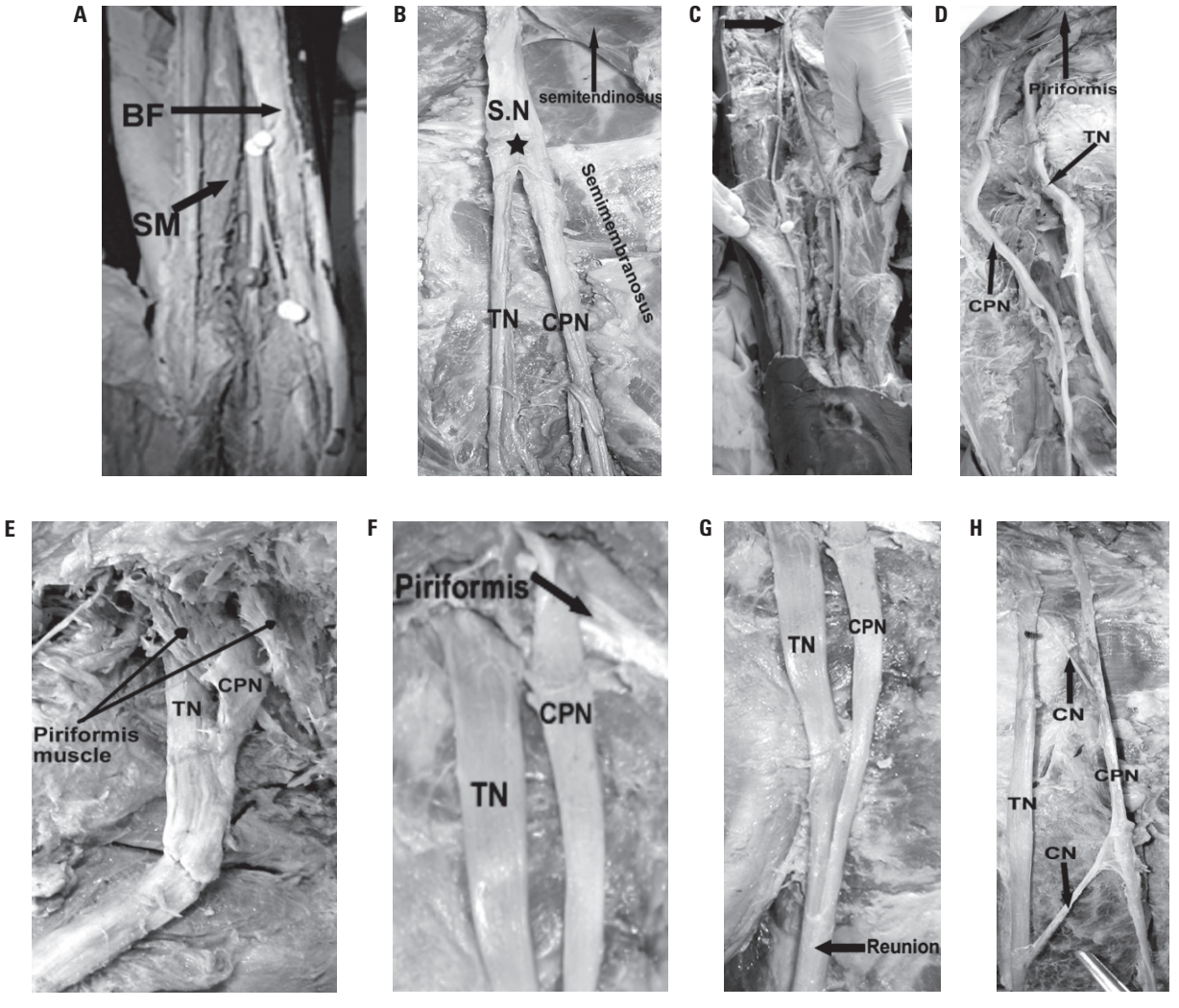


**Figure 1.** Variations in the level of division of sciatic nerve (SN); into tibial nerve (TN) and common peroneal nerve (CPN); **A.** Division of SN (proximal white pin) in the popliteal fossa. Note the CPN (distal white pin) skirting laterally medial to the tendon of the biceps femoris as the TN nerve (dark pin) continues distally; **B.** Division (star) of SN in the middle third of the thigh into TN and CPN. Note relationship with semimembranosus and semitendinosus; **C.** Gluteal division of SN (arrow) into TN (dark pin) and CPN (white pin); **D.** Pelvic division with both TN and CPN exiting below piriformis muscle; **E.** Pelvic division with CPN piercing the piriformis. The TN exits below the piriformis and the two re-unite to continue as a single SN; **F.** Pelvic division with CPN, running superior to the piriformis, while the TN runs below; **G.** Pelvic division of the SN with reunion of the TN and CPN in the thigh, compared to reunion in the gluteal region in C; **H.** Gluteal division of SN into TN and CPN. Note the communicating nerves (CN) joining TN to CPN in the proximal and middle thirds of the thigh; BF — biceps femoris; SM — semimembranosus.

67.1% of popliteal divisions in the current study is lower than the figure of 72.5% found in Turkish [17] and 72.2% found in Polish populations [13] but higher than the 34.9% found in Indians [16]. These findings suggest that the level of division also displays population variations which anaesthetists and surgeons should be aware of during operations in the gluteal region or interpretation of sciatic neuropathy. Imaging to determine the level of division may be useful before block anaesthesia in the popliteal fossa.

**Relationship with the piriformis muscle**

The relationship of the sciatic nerve and its branches with the piriformis has been implicated in piriformis syndrome and is important in clarifying clinical aetiology of non-discogenic sciatica. In 7.9% of cases, CPN pierced the piriformis muscle. This is among the lowest reported in literature (Table 2), and implies that the incidence of piriformis syndrome is low in the study population.

In the present series, in 2.4% of cases CPN exited the pelvis above the piriformis muscle. This is con-

**Table 1.** Proportions of pelvic division of sciatic nerve

| Author | Level of division (%) | | |
|---|---|---|---|
| | N | Before exit | After exit |
| Pokorny et al., 2006 [15] | 91 | 20.9 | 79.1 |
| Ugrenovic et al., 2005 [17] | 100 | 4.0 | 96.0 |
| Gabrielli et al., 1997 [7] | 40 | 13.7 | 86.3 |
| Kakuriza et al., 2010 [9] | 40 | 22.5 | 77.5 |
| Guvencer et al., 2010 [8] | 25 | 48 | 52 |
| Prakash et al., 2010 [16] | 43 | 16.3 | 83.7 |
| Current study | 164 | 20.1 | 79.9 |

**Table 2.** Reported proportions of common peroneal nerve (CPN) piercing piriformis muscle

| Author | Proportion of CPN in piercing piriformis |
|---|---|
| Chiba, 1992 [3] | 34% |
| Pokorny et al., 2006 [15] | 14.3% |
| Guvencer et al., 2009 [8] | 16% |
| Lee and Tsai, 1974 [11] | 34.6% |
| Ugrenovic et al., 2010 [17] | 2.5% |
| Current study | 7.9% |

cordant with the low incidence reported [2, 4, 11, 17]. These variations reveal wide disparities in the relationship between the sciatic nerve and the muscle piriformis, and underscore population differences in the incidence of piriformis syndrome.

### Communication between the CPN and TN

The TN and CPN nerves reunited in 4.9% of cases, similar to the figure of 5% in the Brazilian and Ugandan studies [9, 18]. Such reunions are probably important in explaining the presentation of piriformis syndrome and failed sciatic nerve block in the popliteal fossa. In 3.7% of cases, the CPN and TN were connected by a definite communicating nerve, similar to what has been described between the median and musculocutaneous [10, 14] and between the ulnar and median nerves [6]. In such cases isolated nerve lesions may cause an unusual pattern of sensory motor deficit causing confusion in the assessment of nerve injuries [6]. Accordingly, the communication observed in the present study may cause confusion in the evaluation and interpretation of sciatic, common peroneal, tibial neuropathy, and nerve block. Furthermore, it may be important in explaining the reduced severity of the presentation of sciatic neuropathy. It may also provide the anatomical basis for spontaneous reinnervation of muscles following nerve injury [5]. Pertinent to this suggestion are reports that anastomosis between two nerves may be done to reinnervate structures the nerves of which have been damaged [19].

## CONCLUSIONS

The sciatic nerve in the Kenyan population varies from the classical description in over 30% of cases, with many high divisions, low incidence of piriformic course of the CPN, reunion, and unusual connection between the common peroneal and tibial nerves. These variations may complicate surgery and interpretation of sciatic neuropathy. Preoperative nerve imaging and extra operative diligence in the gluteal region and the back of the thigh are recommended.

## ACKNOWLEDGEMENTS

We are grateful to the staff of the Gross Anatomy Laboratory for their technical assistance, and Catherine Chinga for typing the manuscript.

## REFERENCES

1. Bardeen CR, Elting AW (1901) A statistical study of the variations in the formation and position of lumbosacral flexus in man. Anat Anz, 19: 209–239.
2. Beaton IE, Anson JB (1937) The relation of the sciatic nerve and its subdivisions to the piriformis muscle. Anat Rec, 70: 1–5.
3. Chiba S (1992) Multiple positional relationships of nerves arising from the sacral plexus to piriformis muscle in humans. Kaibogaku Zasshi; 67: 691–724.
4. Chukwuanukwu TOG, Ukoha UU, Chukwujekwu IE, Asomugha AL, Oanusi A, Anyabolu AE, Ashaolu JO (2007) Bilateral thigh division of sciatic nerve: incidence and clinical implication in Nigeria. Trop J Med Res, 11: 12–13.
5. Conlay B, Baker DC (1979) Hypoglossal-Facial Nerve Anastomosis for Reinnervation of the paralysed face. Plast Recons Surg, 63: 63–72.
6. Dogan NU, Uysal II, Seker M (2009) The communications between the ulnar and median nerves in upper limb. Neuroanatomy, 8: 15–19.
7. Gabrielli C, Olave E, Mandiola E (1997) Inferior gluteal nerve course associated to the high division of sciatic nerve. Rev Clin Anat, 15: 79–83.
8. Guvencer M, Iyem C, Akyer P, Tetik S, Naderi S (2009) Variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the piriformis. Turkish Neurosurg, 19: 139–144.

9. Kakuriza J, Kiryowa H, Turyabahika J, Ochieng J, Ibingira CBR (2010) Levels of bifurcation of the sciatic nerve among Ugandans at School of Biomedical Sciences, Makerere and Mulago Hospital, Uganda. East Central Afr J Surg, 15: 69–72.
10. Le Minor JM (1990) A rare variation of the median and musculotaneous nerves in man. Arch Anat Histol Embryol, 73: 33–42.
11. Lee CS, Tsai TL (1974) The relation of the sciatic nerve to piriformis muscle. J Formos Med Assoc, 73: 75–80.
12. Mandiola El, Hernandez PH, Hofer UP, Crovetto E, Ortega E (1986) Variaciones anatomicas del origin del nervio isquiatico (en fetos humanos termino) An Anat Norm, 4: 40–43.
13. Okraszewska E, Migdalski L, Jedrzejewski KS, Bolanowski W (2002) Sciatic nerve variations in some studies on the polish population and its statistical significance. Folia Morphol, 61: 277–282.
14. Oluyemi KA, Adesanya OA, Saalu CL, Okwuonu UC, Ofusori DA, Odun EI (2007) Communication between median and musculocutaneous nerve and accessory head of biceps brachii: a case report. Internet J Surg, 12: 1.
15. Pokorny D, Jahoda D, Veigl D, Pinskerova V, Sosna A (2006) Topographic variations of the relationship of the sciatic nerve and the piriformis muscle and its prevalence to palsy after total hip arthroplasty. Surg Rad Anat, 28: 88–91.
16. Prakash BAK, Devi MN, Sridevi NS, Rao PK, Singh G (2010) Sciatic nerve division: a cadaver study in the Indian population and review of literature. Singapore Med J, 51: 721–723.
17. Ugrenovic S, Jovanovic I, Krstic V (2005) The level of sciatic nerve division and its relations to the piriformis muscle. Vojnosanit Pregl, 62: 45–49.
18. Vicente EJD, Viotto MJS, Barboso CAA, Vicente PC (2007) Study on anatomical variations between sciatic nerve and piriformis muscle. Rev Bras Fisioter, 11: 227––232.
19. Woodson GE (2007) Spontaneous laryngeal reinnervation after recurrent laryngeal or vagus nerve injury. Ann Otorhinol-Laryngol, 116: 57–65.