นิพนธ์ต้นฉบับ • Original Article

เส้นประสาท Sciatic : จุดแยกตัวเป็นเส้นประสาท Tibial กับเส้นประสาท Common Peroneal และความสำคัญทางคลินิก

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Sciatic Nerve : Site of Division into Tibial and Common Peroneal Nerve and Clinical Implications.

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หลักการและเหตุผล: เนื่องจากได้พบการแบ่งแยกแขนงของเส้นประสาท Sciatic เป็นเส้นประสาท Tibial และเส้นประสาท Common Peroneal ที่แตกต่างไปจากตำราทั่วๆ ไปอยู่เนืองๆ ประกอบกับมิอาจค้นพบการศึกษาดังกล่าวในตำราภาษาไทยใดๆ กอปร์กับความรู้ดังกล่าวมีความสำคัญต่อการรักษาทางศัลยกรรม

วัตถุประสงค์: เพื่อศึกษาตำแหน่งที่แน่นอนของเส้นประสาท Sciatic แยกแขนงออกเป็นเส้นประสาท Tibial และ Common Peroneal ในคนไทย

รูปแบบการศึกษา: การศึกษาเชิงพรรณนา

สถานที่ทำการศึกษา: ภาควิชากายวิภาคศาสตร์ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

กลุ่มตัวอย่าง: ศพคนไทย (ครูใหญ่) 65 คน, วัย 14-92 ปี ชาย 39 คน หญิง 26 คน

การวัดผล: วัดความยาวของเส้นประสาท Sciatic จากจุดที่ลอดใต้กล้ามเนื้อ Piriformis ไปจรดที่จุดแยกแขนงออกเป็นเส้นประสาท Tibial และ Common Peroneal เป็นเซนติเมตร และวัดจากจุดเดียวกันไปยัง lateral condyle ของ femur

ผลการวิจัย: การแยกหลักๆ มีสี่แบบ ดังนี้ ร้อยละ 40.7 (ของเส้นประสาท 130 เส้น) แบ่งแยกที่ปลายกระดูกต้นขา (ชนิดที่ 1), ร้อยละ 25.3 แบ่งแยกที่บริเวณสะโพก (ชนิดที่ 2), ร้อยละ 24.6 แบ่งแยกที่บริเวณเข่า (ชนิดที่ 3) และร้อยละ 8.4 แบ่งแยกที่กลางต้นขา (ชนิดที่ 4) และมีเพียงเส้นเดียวแบ่งแยกที่เศษหนึ่งส่วนสามล่างของต้นขา ทั้งนี้มักมีความผิดแผกแตกต่างในศพเดียวกันด้วย ชนิดที่หนึ่งไม่เคยมีรายงานมาก่อนหน้านี้

สรุป: เส้นประสาท Sciatic ในคนไทยแบ่งแยกเป็นแขนง Tibial และแขนง Common Peroneal ที่เข่าร้อยละ 65 ที่สะโพกร้อยละ 25 และที่เหลือแบ่งในต้นขา ผลการศึกษาครั้งนี้น่าจะมีประโยชน์ทางคลินิกในการรักษาทั้งทางศัลยกรรม วิสัญญีวิทยา และเวชศาสตร์ฟื้นฟู

Background: A description of the location of division of the sciatic nerve into tibial and common peroneal nerve in Thai subjects is not available. A precise knowledge is desirable for execution of surgically orientated intervention and the like. Various textbooks and reports description are diversified and most without exact percentage for each site.

Objective: To determine the exact location of sciatic nerve into it's major branches of tibial and peroneal nerve in Thais subject.

Design: Descriptive study.

Setting: Department of Anatomy, Faculty of Medicine ChiangMai University, ChiangMai, Thailand.

Subjects: The study was carried out on sixty-five cadavers (130 specimens), age ranged from fourteen to ninety-two years of both sexes

Measurement: The length from the point of the sciatic nerve emergence underneath the belly of the piriformis to the point of it's branching and also to the lateral condyle of the femur in centimeters.

Results: The division pattern was classified into four types. In 40.7% (of 130 specimens) division was at the level of the femoral condyle (Type I), in 25.3% it was at the gluteal region (Type II), in 24.6% at about the popliteal space (Type III), in 8.4% at the mid-thigh level (Type IV) and only one specimen at the lower third of the thigh. Intra cadveric variation was noted quite commonly. Type I has not been described vefore.

Conclusions: Briefly stated, sciatic nerves in Thais divide 65% in the knee, 25% in the gluteal region and the rest in the thigh. These findings would have strong clinical implications in surgical, anaesthetic and rehabilitative interventions.

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Introduction

Injury to the sciatic nerve causes a devastating catastrophe ; entailing muscular weakness, joint contracture, limb deformities, trophic ulcerations and abnormal gait. Knowledge of its exact anatomy is thus a key to successful surgical, anaesthetic and rehabilitative interventions.

The sciatic nerve is the largest branch contributed by the lumbosacral plexus. It really consists of two nerves, the tibial and the common peroneal, bound together in the same sheath to form the largest nerve in the body with a width of about two centimeters, leaving the pelvis through the greater sciatic foramen, underneath the belly of the piriformis muscle, covered by the gluteus maximus muscle. It then branches into two major components, namely the common peroneal nerve and the tibial nerve. The precise point of banching of the nerve is described differently in various text books; in the pelvis[1-3], gluteal region[1,3-6], upper high[1,3-6] mid thigh[2,7], distal thigh or lower third of thigh[1-3,6,8-11] and upper part or apex of popliteal fossa[5,12-14]. However, the specimens that were self-donated to use for teaching our medical students were found to have a much different pattern of division. Searching of records could not provide any prior study of the sciatic nerve branching in any Thai literature. We thus endeavored to study the location of the main branching of the sciatic nerve in Thai subjects.

Material and Methods.

A study was carried out on sixty-five cadavers of both sexes (thiry-nine male, twenty-six female), aged between fourteen and ninety-two years. All were Thai who had donated their bodies for teaching medical and paramedical as well as post-graduate students at the department of Anatomy, Faculty of Medicine, ChiangMai university.

Dissection was carried out by removing the skin down to muscular level from the gluteal region to the back of the knee. The gluteus maximus muscle was detached from its medial attachment, starting from its lower border, reflecting it completely laterally. The gluteus medius muscle would now come into view, deta ching it from its insertion and lifting it up to expose the gluteus minimus and the pirifomis. The sciatic nerve could now be located at the distal border of the piriformis muscle. The nerve could be followed to the point of its branching into the two major components of tibial and common peroneal nerves. Measurement was the made of the length from the point of its emergence underneath the belly of the piriformis to the point of its branching and also to the lateral condyle of the femur.

The dissection was carried out on each cadaver by two post-graduate students simultaneously on each side under the supervision of the authors and the measurements were made by one of the authors (P.M.)

Results

There were 130 specimens in sixty-five cadavers from thirty-nine males and twenty-six females, age fourteen to ninety-two years, as shwon in **Table I**. All sciatic nerves passed beneath the piriformis muscle. Of these, the point of branching into the two major components of tibial and common peroneal nerves of each could be grouped into four types, namely:

Table I : Showing the age, specimens and the length of each nerve from its point of emergence to its branching agianst the length to the lateral femoral condyle.

Age	Legth from piriformis muscle to sciatic nerve branching agianst length to femoral condyle (cm.)	Specimens	
		Right	Left
38-86	0/0*	13	20
14-83	32/32-40/40	27	26
56-77	19/37-20/40	6	5
38-92	30.5/32-33/40	19	13
77	33/45	0	1
Summation	-	65	65

0/0 = Division at the point of emergence from under the piriformis

Figure I : Sciatic Nerve : Site of Division

Figure II : Sciatic Nerve : Site of Division

Diagram I : Site of division :
At the level of the femoral condyle (arrow)

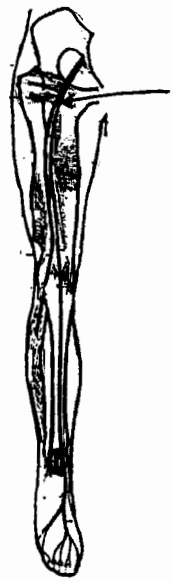

Diagram II : Site of division :
At the gluteal region (arrow)

Type I : At the level of the femoral condyle (Figure I and Diagram I).

There were thirty-four cadavers with twenty-one males (32.3%) and thirteen females (20.0%) making up a total of fifty-three specimens (40.7%) in this group. The detail is shown in **Table II**. No report or description of this pattern was described before.

Type II : At the gluteal region (Figure II and Diagram II).

This group comprised of twenty-one cadavers, ten males (15.0%) and eleven females (17.0%), thirty-three specimens (25.3%) in all as shown in **Table III.**

Type III : About the popliteal space : Not to exceed eight centimeters above the femoral condyle **(Figure III and Diagram III).**

There were twenty-two cadavers with twelve males (18%) and ten females (15%) making up a total of thirty-two specimens (24.6%) in this group. The detail is shown in **Table IV.**

Type IV : At midthigh level : between eleven to twenty-five centimeters from piriformis **(Figure IV and Diagram IV).**

Table II : Number, side and sex of cadavers and specimens branching at the femoral condylar region.

number / type	male (%)	female(%)	total specimen (%)
symmetrical bilateral	15	4	38
left side only	2	5	7
right side only	4	4	8
summation	21 (32.3)	13 (20)	53 (40.7)

Figure III : Sciatic Nerve : Site of Division

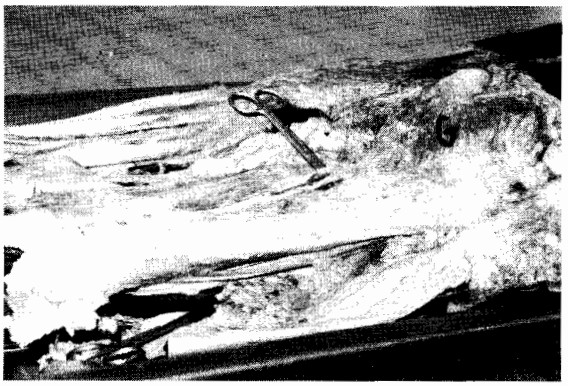

Figure IV : Sciatic Nerve : Site of Division

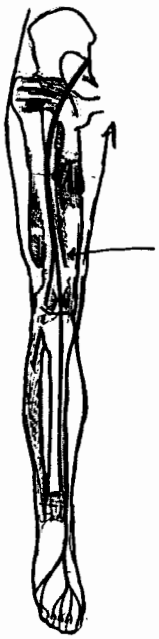

Diagram III : Site of division :
About the popliteal space (arrow)

Diagram IV : Site of division :
At midthigh level (arrow)

Table III : Number, side and sex of cadavers and specimens branching at the gluteal region.

number / type	male (%)	female (%)	total specimen (%)
symmetrical bilateral	5	7	24
left side only	4	4	8
right side only	1	-	1
summation	10 (15)	11 (17)	33 (25.3)

Table IV : Number, side and sex of cadavers and specimens branching at about the popliteal space. (not to exceed 8 cm. above the femoral condyle)

number / type	male (%)	female (%)	total specimen (%)
symmetrical bilateral	6	4	20
left side only	3	0	3
right side only	3	6	9
summation	12 (18)	10 (15)	32 (24.6)

Table V : Number, side and sex of cadavers and pecimens branching at the mid-thigh level. (between 11-25 cm. from the piriformis)

number / type	male (%)	female (%)	total specimen (%)
bilateral	3	2	10
unilateral	1*	0	1
summation	4* (6)	2 (3)	11 (8.4)

*Actually only 5 cadavers plus one specimen.

There were 5.5 cadavers with four males and two females making up a total of eleven specimens (8.4%) in this group. The detail is shown in **Table V**

Only one specimen from a male, seventy-seven, on the left side, divided at the level of the lower third of the thigh, while his right side at the midthigh level.

Further perusal revealed six cadavers with division of the nerve in the gluteal region on one side and at the femoral condyle on the other side. Of these three were male and the other three were female. All but one had the division on left buttock and right knee. The other had this vice versa **(Figure V.)**

Discussion

The relationship of the sciatic nerve to piriformis muscle as quoted from a standard textbook is as followed. Of 640 limbs studied, 87.3 percent had both tibial and common peroneal divisions passing below piriformis muscle, 12.2 percent had the peroneal division passing through piriformis muscle, 0.5 percent had the peroneal division passing above. All sciatic nerves in our study passed below the piriformis muscle, al-

Figure V : Sciatic Nerve : Site of Division

though the number of our specimens (130) are much less.

Gosling et al.[1], Moore[2] and Snell[3] described the division of the sciatic nerve in the pelvis although no percentage of the division is given. We found no specimen in our study dividing at this level.

Chiba. S[16] reported a study of 514 sciatic nerves, 179 (30.5 percent) divided into tibial and common peroneal nerves about the piriformis muscle, i.e. in the gluteal region. We found 25.3 percent of our specimens dividing in this region. Craggs[4], Gosling et al.[1], Last[5], Moore, Agur[6] and Snell[3] also described division of the sciatic nerve in this region but no exact percentage were given.

Moore[2] and Snell[7] described the division of the sciatic in mid thigh. We found only 8.4 percent of our specimen branching at this level.

Many authors[5,12-14] described the division of the sciatic nerve into the tibial and common peroneal nerves at the superior end of the popliteal fossa., and many others[1-3,6,8-11] described it at the lower third of the thigh. Although they are at different levels, they are in quite a close proximity. And if we were to group them together, we can liken them to our Type III. Twenty-two cadavers could then be allocated to this group with 32 specimens (24.6%).

However, one of our specimens did divide at the lower third of the thigh. (While the opposite side divided in the mid-thigh.)

From the result of our study, Type I and Type III in combination make the largest group (of close proximity) of division about the knee: fifty-six cadavers or eighty-five specimens (65.4%). Thus more than half of the sciatic nerves in Thai individual divide into tibial and common peroneal nerves at the knee region. Of these thirty-three are males and twenty-three are females. While those divided in the mid-thigh account for only 8.4 percent in our series with no significant difference between male and female.

The most interesting finding in this study is that 40.7 percent of our specimens division took place at the level of the femoral condyle. This has not been described before. More than half of the cadavers divided at this level although only fifty-three individual nerves (40.7%) did so, male did so more than female.

Thus from all these, 65.4% of the nerves divide in the knee region, 25.3% in the gluteal region and the rest in the thigh.

Equipped with these facts, a surgeon (a general surgeon, a neurosurgeon or an orthopaedist) will be better prepared for his task of carrying out a successful surgical intervention for the patients[17]. In another aspect, a rehabilitation physician will be better facilitated in carrying out nerve conduction study[18-20] or nerve stimulation[21] or elctrical stimulation to keep the bulk of the muscle in rehabilitation of the patient[18-20]. An anesthesiologist will likewise be better armed to carry out nerve blocking on the sciatic, common peroneal, or tibial nerves[22,23]

Although this study was encountered with quite a lot of variations to what had been described previously. We do think that it would contribute to enhance the successful execution of these interventions in general or at least in the Thai population in the North.

Conclusion

Sciatic nerve divides into two major components of tibial and common peroneal nerves at 4 locations ; the gluteal region (25.3%), the mid thigh region (8.4%), the popliteal space (24.6%) and the femoral condylar region (40.7%).

Thus the division around the knee accounts for more than half. Division at the femoral condylar region is described here for the first time. Intracadaveric variations are noted quite commonly.

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