

## CADAVERIC STUDY OF SCIATIC NERVE W.S.R TO GRUDHRASI (SCIATICA) – A PRELIMINARY STUDY

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### Abstract

The most common disorder which affects the movements of leg particularly in the most productive period of life i.e. 30-50 years is back ache problem. One third of these cases turns into Grudhrasi (sciatica), which is a painful condition chiefly, affecting the lower-back area which radiates downwards to one leg or both legs along the grudhrasi nadi (sciatic nerve). For an exact management a complete knowledge about the pathway and level of division of grudhrasi nadi (sciatic nerve) is very important. The division of sciatic nerve normally occurs at the junction of the upper two thirds and lower one third of the thigh. However, this division shows variations which may be inside the pelvis or outside the pelvis. The abnormal divisions of the nerve may be the reason for various pathologies related to the nerve. The study was done in 20 cadavers used in routine dissection for under graduate students. The cadavers were fixed in 10% formalin. Out of the 20 cadavers dissected, 2 of cadavers showed a higher division of sciatic nerve. The division occurred at the inferior border of piriformis and the divided nerve emerges from the lower border of piriformis. The variation was seen bilaterally. A thorough knowledge of the division of the sciatic nerve helps in the differential diagnosis of sciatica of various origins and its management by different management methods or surgical methods. This study also gives a hint for the surgeons to be very careful while doing surgery as some patients may have a difference in the division of sciatic nerve by birth itself.

**Key words:** Grudhrasi; Sciatic nerve; Piriformis; Ayurveda; Grudhrasi.

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## INTRODUCTION

One third of back ache cases turns into Grudhrasi (sciatica), which is a painful condition chiefly, affecting the lower-back area which radiates downwards to one leg or both legs along the grudhrasi nadi (sciatic nerve). It is a major cause for the loss of millions of workdays annually resulting in huge loss of nation's economy. According to Ayurveda, Grudhrasi is of two types i.e. Vatikam and vatakaphajam.<sup>[1]</sup> It is a condition where dysfunction of vata affects sciatic nerve (Grudhrasi nadi) characterised by stabdhata (stiffness), ruk (pain), toda (pinning sensation), stambhana starting from sphik (buttock), kati (low back), prushta, radiating down the posterior border of the thigh, janu (knee) and outer border of jangha, pada and angulees, with stiffness and impairment of lifting the thigh while lying in supine position. Hence knowledge about the sciatic nerve, its level of bifurcation into tibial (medial popliteal), common peroneal (lateral popliteal) and the pathway are very important from the management and surgical point of view. Sciatic nerve is the largest nerve in the human body. It arises inside the pelvis from the lumbar plexus seen on either sides of the lower part of the spinal cord. The nerve has two components-tibial (medial popliteal) and common peroneal (lateral popliteal). The ventral divisions of the anterior primary rami of lumbar and sacral segments L<sub>4</sub>, L<sub>5</sub>, S<sub>1</sub>, S<sub>2</sub>, and S<sub>3</sub> contribute to the tibial component. The common peroneal gets its contribution from dorsal divisions of spinal segments L<sub>4</sub>, L<sub>5</sub>, S<sub>1</sub> and S<sub>2</sub>. The nerve enters the gluteal region from the pelvis passing below the lower border of piriformis. Then it runs down through the posterior compartment of thigh. Reaching the junction between the upper two thirds and lower one third of the thigh the nerve divides into the tibial and common peroneal nerves. Rarely this division may occur at a higher level – anywhere along the back of thigh or inside the pelvis.<sup>[2]</sup> When the division is intrapelvic both the tibial and

common peroneal nerves run separately and they may enter the posterior compartment of thigh passing inferior to piriformis, in some cases one nerve may be seen above piriformis and one below the muscle; rarely one of the nerves may pierce the piriformis and reaches the back of thigh. Thus knowledge in the bifurcation of the sciatic nerve and the structures which may compress the nerve helps the surgeon or physician to arrive at a clear diagnosis for a better management especially during surgeries.

As described by Acharya Charaka Grudhrasi is a Vatavyadhi characterised by Stambha (stiffness), Ruk (pain), Toda (pricking pain) and Spandana (frequent switching). These symptoms initially affect Sphik (buttock) as well as posterior aspect of Kati (waist) and then gradually radiates to posterior aspects of Ooru (thigh), Janu (knee), Jangha (calf) and Pada (foot).<sup>[3]</sup>

Acharya Sushruta opines that there are two Kandara in the leg that gets afflicted. The two Kandara include the one extending distally from the Parshni to the toes, and other extending above from the Parshni to the Vitapa. These two Kandara when gets afflicted with the Vata Dosha limits the extension of the leg. This disease is known as Grudhrasi.<sup>[4][5][6]</sup>

The appropriate diagnosis of many back pain conditions is very difficult in spite of progress in medicine and surgery in the fields of allied science. The exact aetiology is also not sure. Hence no rational curative measures are known. It is recently reported that the methods of treatment are numerous and varied from exercise to rest, manipulation to immobilisation of muscles, joints and discs, surgery etc., but all these are possible only after a clear knowledge about the pathway and bifurcation of the sciatic nerve. Hence as a routine way, anatomical study was conducted in cadavers to know the pathway of sciatic nerve and its bifurcation which helps the

physicians to diagnose the condition in a better way for its easy management.

## MATERIALS AND METHODS

Routine dissections of human cadavers were conducted in the departments of Anatomy, Kanyakumari Government Medical College, Asaripallam, Nagercoil, Tamil Nadu revealing the variations in the division of the sciatic nerve. Totally twenty cadavers were studied. The cadavers were pre fixed in 10% formalin to be used for study purpose.

### Study on the pathway of sciatic nerve

Twenty cadavers were dissected during the course of two years, of which two cadavers showed a higher level of division of the sciatic nerve. The gluteus maximus muscle was reflected to expose the underlying structures. Piriformis, Gemelli, obturator internus tendon and the sciatic nerve were identified. The divided nerves were found to run over the tendon of obturator internus after emerging from the lower border of piriformis. The nerves were not bound by the common epineurium. Neither of the components pierced the piriformis. (Figure 1) These are the difference found, which may be an inborn condition.

## DISCUSSION

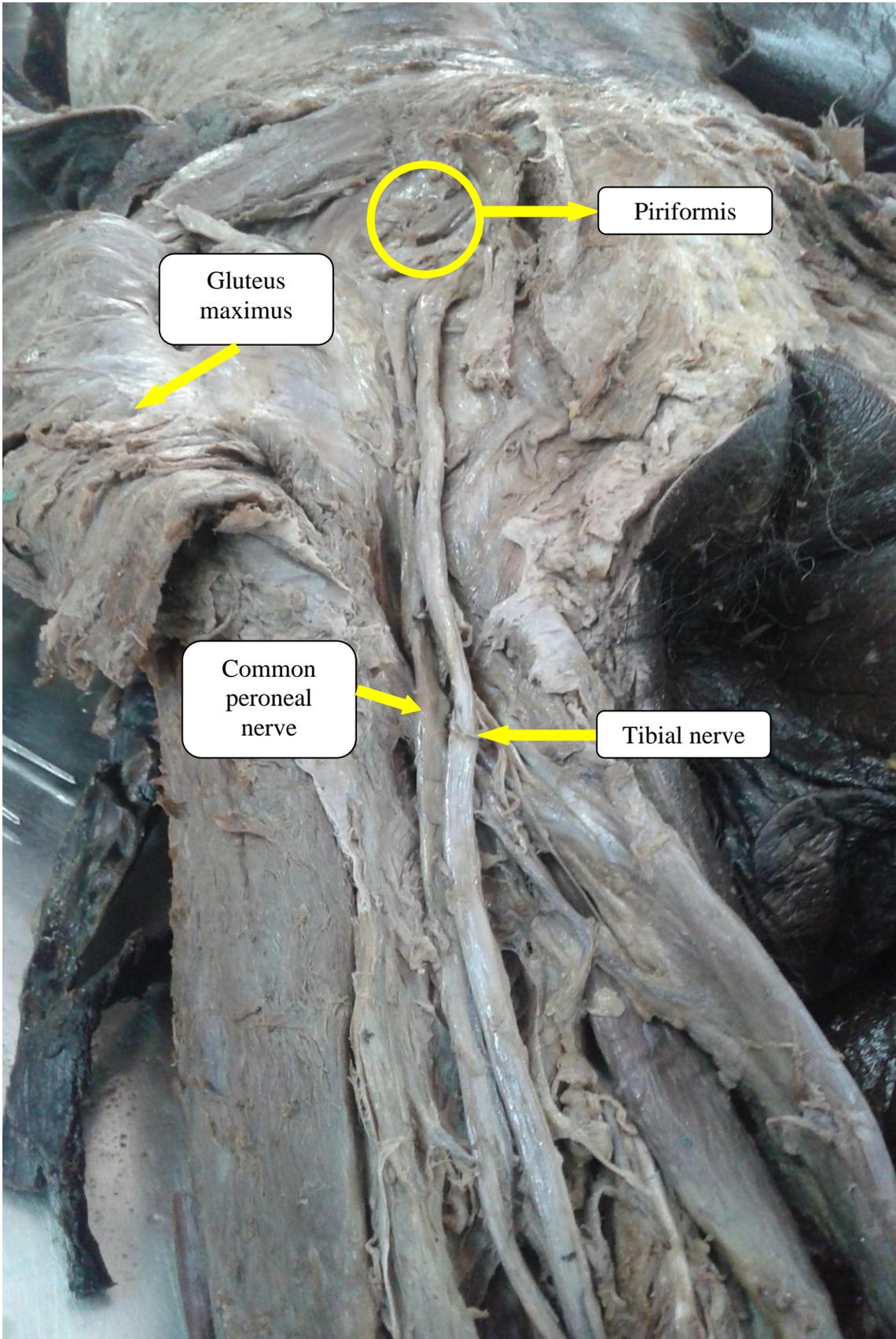
According to modern medicine the general treatment for sciatica comprises analgesic drugs and rest in bed. Hence the repeated use of analgesic becomes necessary. Unfortunately all the analgesic is liable to give rise to many side effects particularly by repeated and prolonged use.<sup>[7]</sup> Ayurveda the age old Indian System of Medicine, advocates a different way for the management of ghrudhrasi (sciatica) giving consideration to protect the normal health while treating the disease with highly efficacious methods with surprisingly safe and easily available drugs, but a scientifically proven methodology of this 21<sup>st</sup> century is not

found. Now the whole scientific world have high hopes in Ayurveda due to its efficiency to provide proper and safe methods of management in disorders, where the efforts of modern methods of science like the deep knowledge of anatomical structures, its pathway and its difference from normal way helps the Ayurvedic science to prove various hypothesis scientifically.

The sciatica symptoms include nerve pain, numbness, tingling, and weakness. It may include inability to walk depending upon the where the pressure of the sciatic nerve occurs. This clue of pressure on the sciatic nerve helps to calculate what type of poorvakarma or panchakarma should be done. Investigations are CT-scan, MRI, EMG (electrical activity of the muscle) and Nerve conduction test and Blood tests are routinely done to identify nerve pathology.

Going through the embryology of the sciatic nerve, it is mentioned the nerve is the thickest nerve in the body and is covered by a common sheath of epineurium. Although the nerve has a common epineurium the component nerves – tibial nerve and the common peroneal nerves remain separate. During the course of development the two nerves migrate towards each other and get enclosed in a common sheath.<sup>[8]</sup> Failure in the development of the epineurium or a thin layer of epineurium results in the separation of the nerve into its components at a higher level. In the present study it was found that in two cadavers, the division of sciatic nerve is at a higher level than usual. This high division may result in sciatica, nerve injury during deep intramuscular injections in gluteal region, piriformis syndrome, failed sciatic nerve block in anesthesia and injury during posterior hip operations. This also motivates radiologist to repeat MRI on other side, as there can be differences on two sides. This knowledge is also very important to prevent deep intramuscular injection hazards in gluteal region.

**Figure 1: Abnormal division of Sciatic nerve - at higher level**



The differences in the exit routes of these two nerves are important in clarifying the clinical etiology of nondiscogenic sciatica. This may be an inborn condition. The divided nerves were found to run over the tendon of obturator internus after emerging from the lower border of piriformis.

The nerves were not bound by the common epineurium. Neither of the components pierced the piriformis. Variation in the division of sciatic nerve at different levels above the superior angle of popliteal fossa has been reported by various authors. The division may be intra-pelvic and the component nerves – tibial and common peroneal may leave the pelvis below the lower border of piriformis, may pierce the piriformis or appear above the upper border of piriformis. The tibial and common peroneal nerves may divide outside the pelvis at any level between the lower border of piriformis and the superior angle of popliteal fossa.

This study shows the division of sciatic nerve below the lower border of piriformis into the tibial and common peroneal nerves. This may be a condition which is inborn and may not be a case of *grudhrasi* (sciatica). Here the stress is given to understand the pathway and the difference of division of sciatic nerve which may be helpful in the management of *grudhrasi* (sciatica).

The specific therapeutic measures to be adopted for *Grudhrasi* are oral medications, *purvakarma* of *panchakarma* like *abhyanga* (oil application) with *snehas* (oil), *swedana* (sudation) etc and *panchakarma*. The therapies described in *Bhagna Chikitsa* (management of fracture) are also useful in *Grudhrasi* (sciatica) cases caused by trauma.<sup>[9]</sup> According to the condition of the patient traction are done in cases of *Grudhrasi*. For all these therapies a complete knowledge about the pathway and the level of division of sciatic nerve is of much important. The present study is a preliminary

study regarding the sciatic nerve and its relevance in *Grudhrasi*.

Yet the study should be conducted in larger samples to derive at a conclusion. Reported previous studies have shown different degrees of variation in the division of sciatic nerve.<sup>[10]</sup>

Benson and Anson in 1937 have studied the relationship and variation of piriformis and sciatic nerve in 120 cadavers and classified the variations into different types. Type I is the undivided nerve below the undivided muscle; Type II, the divided nerve below the muscle.<sup>[11][12]</sup> In the present study the division of the nerve was found below the lower border of piriformis muscle.

Thus this study helps to throw light on the differential diagnosis of *Grudhrasi* (sciatica) by various etiology as well as piriformis syndrome which helps in the effective management of *Grudhrasi* (sciatica) clinically and surgically. The compression caused by structures other than Inter Vertebral Disc prolapse are of importance for physicians and surgeons in effectively relieving the cause behind sciatica of varying etiology and thus helping to reach the right management.<sup>[13]</sup>

## CONCLUSION

A thorough knowledge of the division of the sciatic nerve helps in the differential diagnosis of sciatica of various origins and its management by different treatment methods. During surgery, surgeons should be very careful that some patients may have a difference in the division of sciatic nerve by birth itself. This study shows the division of sciatic nerve below the inferior border of piriformis which is unusually at a higher level than the normal level of division. The level of division of sciatic nerve is intra-pelvic or extra-pelvic; when intra-pelvic the level of division inside the pelvis and how it leaves the pelvis and the extra-pelvic division of sciatic nerve are of great significance as this may

cause compression on the nerve by various structures.

Thus this study helps to throw light on Grudhrasi (sciatica) of various etiology as well as piriformis syndrome which helps in the effective management of Grudhrasi (sciatica) clinically and surgically.

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