

Safe Distance for Superior Gluteal Nerve and its Relation with Thigh Length: A Cadaveric Study

L Shukla, G Soni, N Gaur

Citation

L Shukla, G Soni, N Gaur. *Safe Distance for Superior Gluteal Nerve and its Relation with Thigh Length: A Cadaveric Study*. The Internet Journal of Human Anatomy. 2010 Volume 2 Number 1.

Abstract

Superior gluteal nerve emerges through the greater sciatic foramen above the piriformis muscle. The nerve curves upwards and forwards between the gluteus medius and minimus muscles, supplies both of them and ends by supplying the tensor fasciae latae muscle, from its deep surface. During hip surgeries, this nerve often gets injured resulting in complications. An exact knowledge of its course is helpful in avoiding such injuries. The aims of this study are to find the distance of the most inferior branch of superior gluteal nerve from the tip of the greater trochanter; to find the correlation of this distance with the length of thigh and also to find the safe zone where the chances of injury to superior gluteal nerve, during hip surgeries, would be minimal. 20 lower limbs of formalin fixed cadavers were subjected to dissection for their superior gluteal nerve. The distance of the most inferior branch of superior gluteal nerve from the tip of the greater trochanter was measured in the anterior third, middle third and posterior third of the gluteus medius muscle. The correlation between these distances and the thigh length was evaluated. The range of distance from tip of the greater trochanter to superior gluteal nerve was found to be 4.0-8.3 cm (mean 6.0 cm) in the anterior third, 5.0-7.6 cm (mean 5.9 cm) in the middle third and 5.0-7.8 cm (mean 6.2 cm) in the posterior third of gluteus medius muscle. From the tip of the greater trochanter a distance of 4.0 cm in the anterior third; and 5.0 cm in the middle third and posterior third of the gluteus medius muscle, can be considered safe for the superior gluteal nerve, in hip surgeries. The results of the present study also showed that there was no statistically significant correlation between distance of most inferior branch of superior gluteal nerve from the tip of the greater trochanter and thigh length.

INTRODUCTION

Superior gluteal nerve (SGN) leaves the pelvis through the greater sciatic foramen, above piriformis muscle, along with superior gluteal vessels; and divides into superior and inferior branches [1]. The superior branch of SGN supplies the gluteus medius muscle and occasionally the gluteus minimus muscle [1]. The most inferior branch (MIB) of SGN runs across gluteus minimus, supplying the gluteus medius and minimus muscles and ends in tensor fasciae latae muscle by supplying it from its deep surface [1]. The inferior branch of SGN is liable to get injured during hip surgeries. An exact knowledge of anatomy of SGN will be helpful in avoiding such injuries. The aims of the present study are to find the distance of MIB of SGN from the tip of the greater trochanter (GT); to find any correlation of this distance with the thigh length and also to find the safe zone where the chances of injury to SGN during hip surgeries would be minimal.

MATERIALS AND METHODS

20 lower limbs of formalin fixed cadavers were dissected to

expose SGN. Cadavers with apparent physical deformity were excluded from study. The distance of the MIB of SGN, from the tip of the GT, was measured at the anterior third, middle third and posterior third of the gluteus medius (GM), with the help of sliding calipers. The length of thigh was measured from the tip of the GT to the most projecting point on the lateral condyle of femur, with the help of a measuring tape. The correlation between these distances and length of thigh was determined using 'SYSTAT- 12 Pearson coefficient analysis' software.

OBSERVATIONS

Figure 1

Table I shows the mean and range of distance of the most inferior branch (MIB) of superior gluteal nerve (SGN) from the tip of greater trochanter (GT) in the three parts of gluteus medius (GM) muscl

Distance of MIB from GT in	Mean (cm)	Range (cm)
Anterior 1/3 of GM	6.06	4.0-8.3
Middle 1/3 of GM	5.98	5.0-7.6
Posterior 1/3 of GM	6.24	5.0-7.8
Thigh length	39.85	34.5-43.0

e

DISCUSSION

During hip surgeries taking care of the SGN is an important step; therefore the knowledge of the location of SGN from the surface serves as a guide while approaching this region. Basarir et al determined the mean distance between the MIB of SGN and apex of GT to be 5.1 cm [2]. Murat et al reported this distance between GT and SGN to be 4.4 cm [3]. The distance of MIB of SGN from GT in relation to the three parts (anterior, middle and posterior) of GM was reported by Ikeuchi et al in the patients with dysplastic hips, where this distance was influenced by the severity of dysplasia [4]. The mean distance reported by them was 3.7 cm (range 2.5-4.5 cm) in anterior third, 4.0 cm (range 3.0-5.0 cm) in middle third and 4.4cm (range 3.5-5.5 cm) in posterior third of GM [6]. Whereas, the present study was done in apparently normal cadavers and we observed the mean distance of MIB in anterior third to be 6.06 cm (range 4.0-8.3 cm) , in middle third 5.98 cm (range 5.0-7.6 cm) and in the posterior third of GM 6.24 cm (range 5.0-7.8 cm). Various workers have determined the so called 'safe zone' for MIB of SGN by determining the shortest distance of this nerve from GT to minimize the chances of injury to the SGN while approaching the gluteal region, in hip surgeries [2,3,5,6]. A safe distance proximal to the tip of the GT varying from 3.0-7.2 cm has been reported in different studies [5, 9-11]. The most commonly accepted value for this 'safe zone' is 5.0 cm adjacent to GT [5, 6]. In the present study the shortest distance of MIB in the middle 1/3 and the posterior 1/3 of GM was 5.0 cm, whereas in the anterior 1/3 of GM it was 4.0 cm. The findings of the present study, regarding the distance of MIB from GT, are similar to the most accepted values reported by Jacob and Buxton; and also by Ramesh et al, except in the anterior third where this distance was 4.0 cm, which is comparatively less [5, 6]. In previous studies the views on relationship between the 'safe zone' and body height have been found to be conflicting. Comstock et al and Eksioglu et al reported that the distance

between SGN and GT was dependent on body height [7, 8]. In the present study it was observed that the distance between GT and MIB had no statistically significant correlation with thigh length. This finding of the present study coincides with Basarir et al, who in their study on 15 cadavers concluded that this distance is independent from body height or femoral length [2]. Therefore, the reason for such a wide range (3.0-7.2 cm) of 'safe zone' is yet to be understood; genetic, racial or regional differences may be there, which can be considered in future studies.

CONCLUSION

From the tip of the greater trochanter a distance of 4.0 cm in the anterior third; and 5.0 cm in the middle third and posterior third of the gluteus medius muscle, can be considered safe for the superior gluteal nerve, in hip surgeries. The distance from the tip of the greater trochanter to the most inferior branch of superior gluteal nerve was found to be independent of thigh length. This study redefines the 'safe zone' and gives precise information by specifying the distances of the most inferior branch of superior gluteal nerve from greater trochanter in relation to three positions, anterior, middle and posterior of gluteus medius muscle. It opens the doors for future research for finding the reason for wide range of 'safe zone'; there may be genetic, regional or racial differences, as well.

References

1. Gray H, Carter HV. Pelvic Girdle and Lower Limb. In, Susan Standring(ed). Gray's Anatomy. The Anatomical Basis of Clinical Practice, 39th Edition. Churchill Livingstone, Elsevier, 2000; 1456.
2. Basarir K, Ozsoy MH, Erdemli B, Bayramoglu A, Tuccar E, Dincel VE. The safe distance for the superior gluteal nerve in direct lateral approach to the hip and its relation with the femoral length: a cadaver study. Arch Orthop Trauma Surg 2008 Jul; 128(7):645-50.
3. Murat B et al. How Reliable is the Safe Zone of Hardinge Approach for Superior Gluteal Nerve? Trakya Univ Tip Fak Derg 2009; 26(2):134-6.
4. Ikeuchi M, Kawakami T, Yamanaka N, Okanoue Y, Tani T. Safe zone for the superior gluteal nerve in the transgluteal approach to the dysplastic hip. Intraoperative evaluation using a nerve stimulator. Acta Orthopaedica 2006; 77(4):603-6.
5. Ramesh M, O'Byrne JM, McCarthy N, Jarvis A, Mahalingham K, Cashman WF. Damage to the superior gluteal nerve after the Hardinge approach to the hip. J Bone Joint Surg [Br] 1996; 78:903-6.
6. Jacobs LG, Buxton RA. The course of the superior gluteal nerve in the lateral approach to the hip. J Bone Joint Surg [Am] 1989; 71:1239-43.
7. Comstock C, Imrie S, Goodman SB. A clinical and radiographic study of the "safe area" using the direct lateral approach for total hip arthroplasty. J Arthroplasty 1994; 9:527-31.
8. Eksioglu F, Uslu M, Gudemez E, Atik OS, Tekdemir I.

Reliability of the safe area for the superior gluteal nerve.

Clin Orthop Relat Res 2003; 412:111-6.

9. Baker AS, Bitounis VC. Abductor function after total hip replacement. An electromyographic and clinical review. J Bone Joint Surg [Br] 1989; 71:47-50.

10. Bos JC, Stoeckart R, Klooswijk AI, van Linge B,

Bahadoer R. The surgical anatomy of the superior gluteal nerve and anatomical radiologic bases of the direct lateral approach to the hip. Surg Radiol Anat 1994; 16:253-8.

11. Foster DE, Hunter JR. The direct lateral approach to the hip for arthroplasty. Advantages and complications. Orthopedics 1987; 10:274-80.

Author Information

Lovesh Shukla

Department of Anatomy, Maharaja Agrasen Medical College

Gargi Soni

Department of Anatomy, Maharaja Agrasen Medical College

Neha Gaur

Department of Anatomy, Maharaja Agrasen Medical College