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Variations in the Gluteal Course of Sciatic Nerve in Nigerian Cadavers: Implications for Intramuscular Injections

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ABSTRACT

Injury to the Sciatic nerve as a result of intragluteal injections is quite common but avoidable. This study aimed to provide a safe alternative to the traditional dorsogluteal and ventrogluteal injection sites. Eighty four (84) gluteal regions from forty two (42) cadavers were dissected following guidelines described in Finley's Interactive cadaveric dissection guide and the 15th Edition of Cunningham's manual of practical anatomy. The course of the Sciatic nerve in the gluteal region as well as the distance between relevant surrounding structures were examined. The Sciatic nerve was observed to have a normal course through the Ischio-trochanteric path in all the cadaveric specimens dissected. An anatomical space approximately 6cm, and free from major neurovascular structures was observed to exist between the medial margin of Sciatic nerve at exit point and the gluteal cleft at the midline. We suggest that this space, 5.77cm; 6.09cm long in male and female cadavers can be used as a safe site for intragluteal injections especially when the usual injection sites for some reasons are not available. This study will also be helpful in the management of certain categories of surgical patients and other individuals with special needs

Keywords: Sciatic nerve; Cadavers; Intra gluteal; Dorsogluteal; Ventrogluteal

INTRODUCTION

The gluteal region as well as the shoulder are commonly the preferred sites for intramuscular injections. Accidental and iatrogenic nerve injuries from injections is a common occurrence in medical practice¹. There is evidence to suggest that accidental injuries to the sciatic, radial, axillary, ulnar, median, tibial and the common fibular nerves are frequently encountered in medical cases of traumatic nerve injuries¹. In the lower extremity, the Sciatic nerve probably due to variations in its course remains the most frequently injured nerve especially during intragluteal injections².

Disability from injuries to the Sciatic nerve can occur in any individual including infants and adults, with different patterns and levels of recovery³.

Sources of direct injury to the Sciatic nerve include a wide range of possibilities from an incorrectly placed needle damaging a normal nerve, to a correctly placed needle causing damage to the nerve at an anatomically variant location. The Common fibular division of Sciatic nerve is said to be more frequently involved in intragluteal injections, suggesting that in variations of Sciatic nerve involving the Common fibular division passing above Piriformis, the nerve could encroach into

the site of intra gluteal injection³.
A number of authors have suggested that adequate knowledge of anatomy should complement experience in needle placement³.

The muscle bulk in the gluteal region makes it a preferred site for intramuscular injections but the term 'upper outer quadrant' is difficult to define precisely^{4,5}. As observed by⁴, the Sciatic nerve may follow either one or both of two patterns; pass above or through the Piriformis muscle as a single trunk⁴, or as a divided nerve with one of the major divisions (Tibia and Common fibular nerve) lying on either side; above or below the piriformis.

It has been observed that Sciatic nerve is within the reach of standard needle even when injections are given in the upper outer quadrant of the buttocks⁶.

Sciatic nerve injury leading to permanent paralysis of the foot and following intramuscular injection in the gluteal region has been variously reported^{6,7,8,9,10}.

According to³ Post injection sciatic nerve injury is a common cause of Sciatic nerve mononeuropathy in medical practice. This occurs in the developing world largely due to inadequate health care facilities and

experienced personnel in the rural regions.

Beaton and Anson⁵ in 1937, grouped the possible anatomical relationships between the Sciatic nerve and the Piriformis muscle into six categories.

As concerns intragluteal injections several Authors^{6,7,8,9} have described the incidence, topographic anatomy and potential clinical significance of these six morphologic types.

Though a few authors¹¹⁻¹⁴ recommend the ventrogluteal region as a safe site, the dorsogluteal site is currently widely used for intramuscular injection of drugs and continues to be recommended in nursing texts and clinical practice^{5,12,15-17}.

The lateral aspect of the thigh at the junction of middle and lower third is recommended as an ideal site for intramuscular injection in children^{4,16,18-21}.

The debate as to which technique is the best for Intra gluteal injections is ongoing, with the first and most considered method being the dorsogluteal site, in a procedure that involves separating either the left or right buttock into four quadrants [Figure 1], and thereafter selecting a site in the middle of the upper outer quadrant, and consequently inserting the needle into the gluteus maximus. Some of the recognized complications of this procedure include inserting the needle too high up resulting in contact with bone or injecting too close to the central point of the cross potentially hitting the sciatic nerve. A common mistake

made by many practitioners is that of having the patient lay on their side rather than in a prone position. This alters the appropriate visualization of the cross, resulting in increased frequency of misplaced injections.

These unresolved issues prompted this study which aimed at suggesting an alternative, anatomical risk free injection site for the gluteal region.

MATERIALS

Fourty two (42) adult Nigerian cadavers (39males and 3 females) from three (3) Nigerian Universities viz: University of Port Harcourt, Enugu State University of Science and Technology and University of Calabar were used in the study. They were dissected using standard protocols culled from^{22,23}. After exposure of the gluteal part of the Sciatic nerve, the normal course and variations were noted and the distance between the Sciatic nerve at exit point at the inferior border of the Piriformis muscle and the midline or gluteal cleft was measured.

RESULTS

The course of eighty four (84) Sciatic nerve were examined in relation to its surrounding structures. The findings are as presented in tables and graphical illustrations. Table 1 represents the mean distance between the medial margin of Sciatic nerve at the inferior margin of the piriformis, to the midline, tip of coccyx or gluteal cleft. Table 2 presents analysis of variance (ANOVA)

Table 1a: The distribution of the distance between Sciatic nerve at exit and the midline measured in male

Sex	N	Min	Max	Mean	Std. Dev	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
Male	78	5.00	7.00	5.77	0.41	5.67	5.86
Female	6	5.61	6.55	6.09	0.34	5.74	6.45
Total	84	5.00	7.00	5.79	0.41	5.70	5.88

female cadavers (XY)

Female cadavers have the higher mean value compared to the males

Table 1b: The distribution of the distance between Sciatic nerve at exit and the midline measured on the

Side	Sex	N	Min	Max	Mean	Std. Dev	95% Confidence Interval for Mean	
							Lower Bound	Upper Bound
Right	M	39	5.00	6.80	5.76	0.39	5.64	5.89
	F	3	5.60	6.00	5.83	0.21	5.32	6.35
	Total	42	5.00	6.80	5.77	0.38	5.65	5.89
Left	M	39	5.00	7.00	5.79	0.46	5.64	5.94
	F	3	5.61	6.30	6.00	0.36	5.12	6.89
	Total	42	5.00	7.00	5.81	0.45	5.67	5.95

right gluteal regions (XY)

Female cadavers measured higher (5.83cm right and 6.00cm left) compared to males (5.76cm right and 5.79cm left).

Table 2a: T-test comparing the distance between the medial margin of Sciatic nerve and the gluteal cleft in male and female cadavers

Parameter	Mean diff	S.E.M diff	df	t-value	p-value	Inference
XY	-0.33	0.17	82	-1.89	0.06	Not significant

XY = Distance between the Medial margin of Sciatic nerve and the gluteal cleft

Differences were not significant at $p < 0.05$

Table 2b: T-test comparing the distance between the medial margin of Sciatic nerve and the gluteal cleft on the left as well as the right gluteal region

Side	df	Mean diff	S.E.M diff	t-value	p-value	Inference
Left	40	-0.21	0.27	-0.77	0.45	Not significant
Right	40	-0.07	0.23	-0.30	0.77	Not significant

Differences were not significant at $p < 0.05$

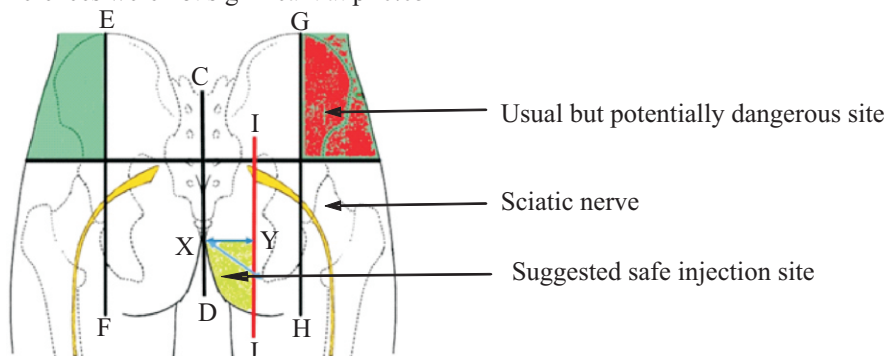


Figure 1: Diagram illustrating the suggested safe injection site XYDJ (painted green)

DISCUSSION

Anatomical sites currently used for intramuscular injections including the gluteals, anterolateral thigh and deltoid regions frequently present with complications.

The need for alternative sites has therefore become challenging .In the current study, the Sciatic nerve pathway in all the cadavers were similar; in all of the limbs studied they were observed to run down the ischio-trochanteric path through the thigh in an oblique and lateral fashion.

In cadavers where division occurred in the pelvis, the nerves were observed to reunite just below the Piriformis muscle and then continue their normal course down the posterior thigh.

On the average, the distance between the medial aspect of the Sciatic nerve and the gluteal cleft measured at the point of exit at the inferior border of the Piriformis was 5.79cm (Figure 1). The authors suggest that this site be

..... further explored as an alternative for intramuscular injections, especially where the traditionally employed upper outer quadrants are involved in trauma or other pathological conditions.

..... This seems to suggest that there may be situations where this region is less dangerous for minor procedures because accidental injuries to the Sciatic nerve is relatively less likely.

..... In addition, the following as summarized were considered before suggesting an alternative site;

- 1. Current injection sites are not always safe.
- 2. Sciatic nerve mostly run lateral and oblique after emerging into the gluteal region.
- 3. This region is mostly devoid of major nerves and vessels.
- 4. Abundance of muscle tissues.

CONCLUSION

The study focused on the distance between the medial margin of Sciatic nerve and the gluteal cleft. It seek to map out and suggest a safe injection site, considering that the current sites (dorsogluteal and ventrogluteal) in the gluteal region are associated with post injection problems, which stems from direct trauma to the Sciatic nerve and indirect trauma. The dorsogluteal distance between the medial margin of Sciatic nerve and the gluteal cleft was more in female cadavers (6.09cm) compared to the male cadavers (5.77cm). The mean distance between the medial margin of Sciatic nerve and the gluteal cleft was (5.79cm). Findings of this study will be helpful in better understanding of the anatomical basis of injection safety, nursing care and other areas of clinical practice.

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