ESTABLISHMENT OF SAFETY PARAMETERS FOR HIP POSTEROLATERAL ACCESS TO CADAVERS' ISCHIATIC NERVE: AN ANATOMICAL STUDY

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SUMMARY

Orthopaedic doctors' preference for the posterolateral access of the hip demands further attention and improvement of the surgical technique in order to reduce per- and postoperative complications rates, especially the iatrogenic ones. Although neurological deficit post hip arthroplasty is an uncommon complication (about 1% of the cases), almost 80% of these cases are correlated to the ischiatic nerve or to one of its divisions. The objective of this study was to establish safety parameters for the posterolateral access of the hip, aiming to reduce the incidence rate of iatrogenic injuries of the ischiatic, tibial or fibular nerves, since this subject has not been addressed by literature so far. Twenty human cadavers' hips were studied and the shortest distance between the lateral end of the ischiatic nerve and the insertion of the quadratus muscle of the thigh was 2 mm (measured over this muscle's proximal edge). The establishment of such parameters provides orthopaedic surgeons with more confidence to go posterior and distally through the posterolateral access, but does not minimizes the level of care required to dissection and the importance of using a fine surgical technique.

Keywords: *Anatomy, Hip (anatomy), Hip (surgery); Sciatic nerve.*

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INTRODUCTION

Since hip arthroplasty has become popular, in the late 1960's, palsies and paresthesia of ischiatic and fibular nerves are regarded as rare complications, historically reported on a frequency of 0.5% - 2.0%[1,2,3]. Although little prevalent and with a good postoperative prognosis, these neurological changes remain being targeted for studies, since the observation of simple measures by the surgical team, such as limiting the stretching of the operated limb to up to four centimeters or adopting peroperative methods of neural monitoring, may be related to a reduced incidence of these complications[4].

In a series of 3126 hip arthroplasties, only 53 cases were identified of neuropathy on the ipsilateral lower limb to the surgical procedure[5]. The etiology of the neuropathy remained unexplained in 57% of these cases; however, there is a trend towards correlating its cause with the surgical technique employed and to anatomical peculiarities of patients.

According to Schmalzried et al[6] the prevalence of neurological deficit after a hip arthroplasty is approximately 1% (0.08% - 7.6%), with almost 80% of these cases being correlated to ischiatic nerve or one of its divisions (ischiatic nerve: 27.2%, tibial nerve: 0.4%, fibular nerve: 51.9%). The risk factors identified were the following: female gender, review arthroplasties, and arthroplasties due to hip development dysplasia.

Among the patients presenting postoperative neurological deficit, approximately 15% evolve with strength reduction impairing ambulation, whether associated or not to permanent paresthesia[6].

The posterolateral access port to the hip is the most commonly used one by orthopaedic surgeons in hip arthroplasties[7], enabling us to infer that accesses through this port and the occurrence of ischiatic nerve damage are correlated. And, although studies conducted so far have addressed the frequency of nervous injuries in that population, there is no objective description of anatomical safety margins, i.e., distances that, when complied with, would reflect low or no incidence of iatrogenic nerve damage.

Addressing the correlation between nervous injury and access port, the objective of the present study was to assess anatomical parameters in cadavers and to determine a safety zone for posterolateral access to the hip so as to reduce the incidence and prevalence of ischiatic nerve injuries during a surgical procedure.

MATERIALS AND METHODS

At the Anatomy Laboratory, 20 human male and female cadavers' hips were dissected through an 'open book'* posterior access port (Figure 1), identifying and proximally isolating the ischiatic nerve and its divisions, as well as the femoral insertion of pyriform, superior gemellus, external obturator, inferior gemellus and quadrate of the thigh muscles.

The distance between the lateral limit of ischiatic nerve emergence under pyriform muscle and the femoral insertion of the same muscle was measured, which will be referred to as ischiatic-quadrate of the tight distance - (DIQ) (Figure 3).

The distances were measured by all the authors at different times, and the results presented refer to the simple arithmetic average among the four values. A Mitutoya Pachymeter was employed for taking measurements.

* 'Open book' posterior access port: The skin incision forms a"‡", where the proximal cross-sectional line is made between the sacral promontory and 1.2 cm proximal to the small trochanter; the longitudinal incision is made perpendicularly to the other two, on the posterior edge of the femoral proximal shaft (Figure 1). Skin and subcutaneous cell tissue are flapped medially and laterally; maximum and medium gluteal muscles are disconnected from the femur and medially flapped, reaching the plane where the structures of interest are found.

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Figure 1 – 'Open book' p*osterior access port to the hip. Legend: A: ischiatic nerve; B: pyriform muscle; C: superior gluteal artery and nerve; D: maximum gluteal muscle; E: skin and subcutaneous cell tissue.*

Figure 2 – *Ischiatic-pyriform distance. Legend: A: pyriform muscle; B: ischiatic nerve; DIP: ischiatic-pyriform distance.*

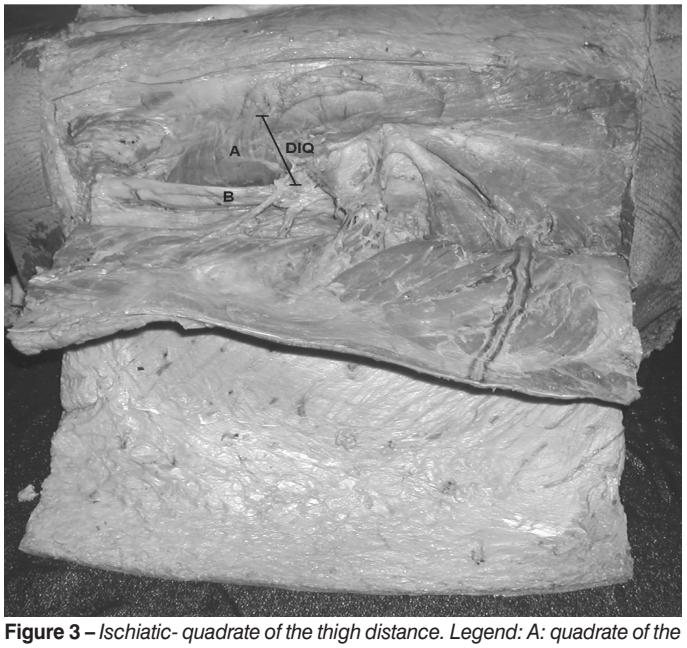

Figure 3 – *Ischiatic- quadrate of the thigh distance. Legend: A: quadrate of the thigh muscle; B: ischiatic nerve; DIQ: ischiatic-quadrate of the thigh distance.*

RESULTS

The ischiatic-pyriform distance was, in average, 39 mm (standard deviation = 6.74, median = 37, mode = 37), ranging from 27 to 54 mm, while the ischiatic-quadrate of the thigh distance was, in average, 29.35 mm (standard deviation = 4.66, median = 30, mode = 30), ranging from 20 to 38 mm. The measurements are reported on Table 1.

DISCUSSION

The selection of a safer access port, meaning one presenting lower risks of postoperative complications has been widely discussed[8], however, a study comparing the posterolateral port to the lateral access port didn't show significant difference for ischiatic nerve injury incidence[8]. Other parameters, such as postoperative Trendelenburg gait, were not significantly different as well.

In clinical practice, the posterolateral access port is preferred by hip surgeons, which is justified by the lack of need to disconnect the medium gluteal muscle and by a better access to the acetabulum, enabling an easy insertion of the acetabular component of prostheses or osteosynthesis material.

Femoral insertions of the pyriform and quadrate of the thigh muscles were chosen for being parameters of easy peroperative visualization, so that, when distances of 27 mm (from the pyriform muscle – on a straight line on its lower margin) and 20 mm (from the quadrate of the thigh muscle – on a straight line on its proximal margin) are respected, the risk of injuring the sciatic nerve would be minimized.

Piece	Ischiatic-pyriform distance*	Ischiatic-quadrate of the thigh distance*	Emergence kind **
1	38	34	simple
2	54	38	simple
3	54	36	simple
4	42	34	simple
5	37	31	simple
6	36	28	simple
7	30	24	simple
8	45	30	forked
9	35	20	forked
10	37	30	simple
11	34	24	simple
12	35	30	simple
13	36	29	forked
14	39	27	simple
15	37	24	simple
16	43	31	simple
17	37	30	simple
18	27	23	simple
19	39	34	simple
20	45	30	forked

*Legend: *distances in millimeters; **simple refers to the joint emergence of the fibular and tibial bundles of the ischiatic nerve under pyriform muscle; **forked refers to independent emergences of ischiatic nerve bundles under pyriform muscle.*

Table 1 – *Measurements of the ischiatic-pyriform and ischiatic-quadrate of the thigh distances.*

CONCLUSION

The awareness about the safety margins for posterolateral access to the hip in what concerns the ischiatic nerve makes an orthopaedic doctor willing to perform hip arthroplasties or surgeries such as acetabular fractures osteosynthesis (through this very access port) more confident to advance posterior and distally. Based on this study, conducted with formol-preserved cadavers, we can conclude that the minimum distance obtained as a safety parameter to avoid iatrogenic injuries of the ischiatc nerve would be 27 mm (average: 39 mm) from the insertion of the pyriform muscle, and 20 mm (average: 29.35 mm) from the insertion of the quadrate of the thigh muscle, emphasizing that these determinant factors (insertions of the pyriform and quadrate of the thigh muscles) have been chosen because of the peroperative ease to locate and identify them at the posterolateral hip access.

Nevertheless, an accurate surgical technique and a careful dissection remain critical to avoid iatrogenic nervous injuries, once individual variations exist.

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