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Original Research Article

PATTERNS OF ADDUCTOR HIATUS IN NIGERIANS: A CADAVERIC STUDY

Mbaka G.O.

Department of Anatomy, Lagos State University College of Medicine, Ikeja, Lagos State, Nigeria.

ABSTRACT

Introduction: Adductor hiatus (AH), an osseo- muscular or osseo- fibrous space between adductor magnus muscle or aponeurosis and the shaft of femur has been classified into four different types. The interest in the hiatus is due to the large vascular structures that traverses the hiatus which is of concern to the surgeons.

Materials and Methods: A total of 61 embalmed cadavers (102 limbs), 35 female lower limbs and 67 male lower limbs were dissected to show AH.

Results: The bridging fibrous which shows the highest frequency was observed in 44 limbs. It exhibited incidence of 43.1% prevalence of AH shape on both sexes. The incidence in male was 27.5% while in female it was 15.7%. The bridging muscular type, the least occurrence shows incidence of 17.6% in both sexes; in males, 13.7% and in females, 3.9%. Oval fibrous type shows a prevalence of 20.5% in both sexes, 12.7% in males and 7.8% in females. Oval muscular type shows 18.6% incidence in both sexes. In males, 11.8% and in females, 6.9%. The distance from the apex of AH to the adductor tubercle was measured and shows a range of 5.0cm-17.0cm with a mean distance of 10.3cm.

Conclusion: The result of this study showed that bridging fibrous AH type exhibited the highest prevalence depicting variation from another racial study. Therefore to adopt an appropriate surgical intervention in a situation of adductor canal outlet syndrome, the surgeon has to be aware of the population variations.

KEY WORDS: Adductor hiatus, Adductor magnus, femoropopliteal compression, Nigerians.

Corresponding Author: Mbaka, G.O. (Ph.D.), Department of Anatomy, Lagos State University College of Medicine, PMB, 21266, 1-5 Oba Akinjobi Street, Ikeja, Nigeria.
E-Mail: mbaaka2gm@gmail.com

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INTRODUCTION

Adductor hiatus (AH) is an osseo- muscular or osseo- fibrous space between adductor magnus muscle or its aponeurosis and the shaft of femur through which femoral vessels pass from the anterior compartment of the thigh through femoral canal to the posterior compartment in the popliteal region. AH is the termination of adductor canal and also a point of transition of femoral vessels to popliteal vessels [1]. The interest in the hiatus is due to large vascular structure that traverses the space which is of potential concern to surgeons. Olson and Holt [2] conducted a study that indicated the approximate location of AH using adductor tubercle as landmark to the apex of the hiatus. They showed a range from 8.0 to 13.5 cm (mean 10.0). Thereafter, other studies were conducted that showed structural variations. The classification of AH according to its varied shapes and surrounding structures was reported by Kale et al, [3]. According to the study, the hiatus was basically classified as bridging and oval shaped based on the shape of the upper boundary or margin. The

two classified shapes were regarded as either muscular or fibrous depending if the surrounding structure is muscular or tendinous (aponeurotic) part of adductor magnus [3]. Kale et al, [3] established from the study which was conducted on Caucasians that oval fibrous showed most predominant type.

The clinical importance of AH is due to the likelihood of fermoropopliteal occlusions. The actual cause of the occlusions has not been properly classified [3]. However, local anatomic factors are reported to play major role [4,5].

The femoral artery initially disposed lateral to its venous counterpart in the femoral triangle crosses the vein anteriorly at the apex of the triangle to continue medial to the vein in the femoral canal. The artery maintains that relationship with the vein until the two vessels exit the adductor canal hiatus. At the point of exit from AH the vein lies posterior lateral to its arterial counterpart [1]. The femoral vein thus shows spiral appearance in relation to the artery from the apex of the femoral triangle to their exit through AH [6].

The artery at its exit point into the popliteal fossa makes intimate contact with the aponeurotic part of adductor magnus [7] which is capable of causing direct mechanical damage to its wall during traction [8]. There is also the likelihood that the vascular wall might be stressed because of the transiting of the vessels from a fixed position in the adductor canal to a freely mobile fatty area of popliteal region during leg movement [8].

It has been established that four different types of AH shapes exist; oval muscular, oval fibrous, bridging muscular and bridging fibrous [3]. Amongst the different types, the bridging and oval fibrous types show the potentials of exposing people to thrombosis of femoral artery. In the study on Caucasians oval fibrous exhibited the highest frequency of occurrence.

To the best of knowledge no study of this nature has been conducted on blacks, Nigerians in particular as ethnic or racial variations might not be unlikely. This investigation therefore would offer an opportunity to examine if the patterns on Nigerians would show consistency with the Caucasians report.

MATERIALS AND METHODS

A total of 61 embalmed cadavers (102 limbs), 35 female lower limbs and 67 male lower limbs were dissected to show AH. Before commencing with the dissection, each cadaver was turned facing down, then a vertical incision was made along the midline of the thigh from the lower border of gluteal maximus downward to lower part of popliteal fossa. The skin and the fascia were reflected laterally and medially and then detached exposing the semimembranosus and semitendinosus on the medial and biceps femoris muscles on the lateral. To gain assess into the deeper plain, the biceps long head crossing from medial to lateral part of the thigh was released from the underlining structures and detached close to the point of its union with the short head and reflected laterally. Following the detachment of long head of biceps femoris, the sciatic nerve which was partially covered by the muscle was fully exposed and displaced laterally to remove fat deposit deep in the fossa surrounding the popliteal vessels. Afterward, AH was exposed, cleaned to note its shape. Also the structure of fibres which formed the borders of the hiatus were equally noted to determine if the shape was oval muscular, oval fibrous, bridging muscular or bridging fibrous.

The distance of the hiatus from the knee region was determined. The landmark point for the measurement was adductor tubercle, a small ridge slightly above the medial epicondyle of femur. The tubercle was located which marked the point of measurement to the apex of the hiatus to determine the extent.

RESULTS

The number of lower limbs investigated was 102 from 61 cadavers. The bridging fibrous (fig. 1) exhibited highest frequency, observed in 44 limbs and constituting 43.1% prevalence of AH type on both sexes. Of the total number of bridging fibrous shape, the incidence in male was 27.5% (28) while in female it was 15.7% (16). The bridging muscular type (fig. 2) which had the least occurrence shows incidence of 17.6% (18) in both sexes; in males, 13.7% and in females, 3.9%. Oval fibrous type (fig. 3)

shows a prevalence of 20.5% (21) in both sexes, 12.7% in males and 7.8% in females. Oval muscular type (fig. 4) shows 18.6% (19) incidence in both sexes. In males, 11.8% and in females, 6.9%. Fig. 5 shows the summery of different AH shapes with four variations. In most of the cadavers, the same pattern of AH shape was observed on both limbs of each cadaver except for few incidences where they varied. The variations however shows more occurrences in females than in males.

The distance from the upper angle of AH to the adductor tubercle was measured and shows a range of 5.0cm-17.0cm. The mean distance was 10.3cm. The oval muscular had the longest range while bridging fibrous shows the shortest range.

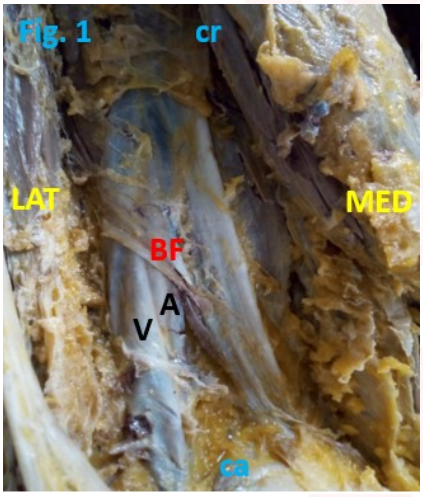

Fig. 1: BF: Bridging fibrous adductor hiatus. LAT: lateral, MED: medial, cr: cranial, ca: caudal, A: popliteal artery, V: popliteal vein.

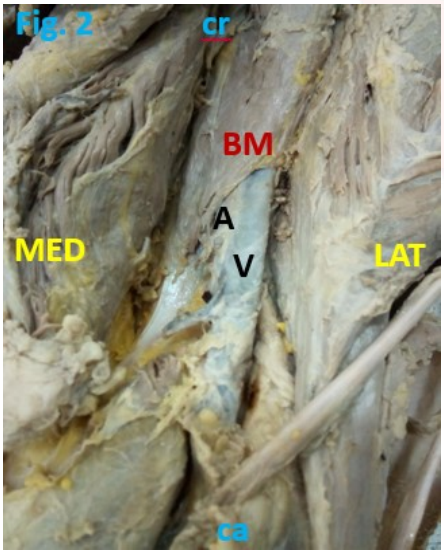

Fig. 2: BM: Bridging muscular adductor hiatus. LAT: lateral, MED: medial, cr: cranial, ca: caudal, A: popliteal artery, V: popliteal vein.

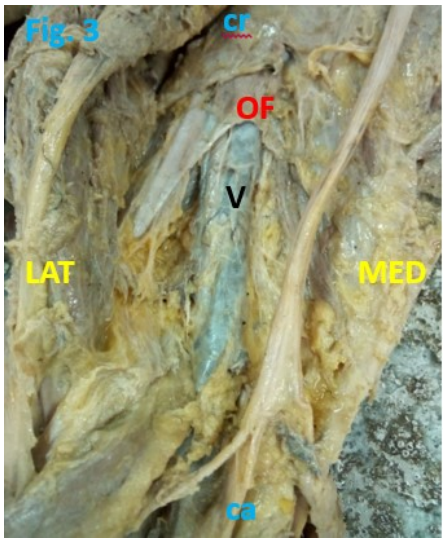

Fig. 3: OF: Oval fibrous adductor hiatus. LAT: lateral, MED: medial, cr: cranial, ca: caudal, V: popliteal vein.

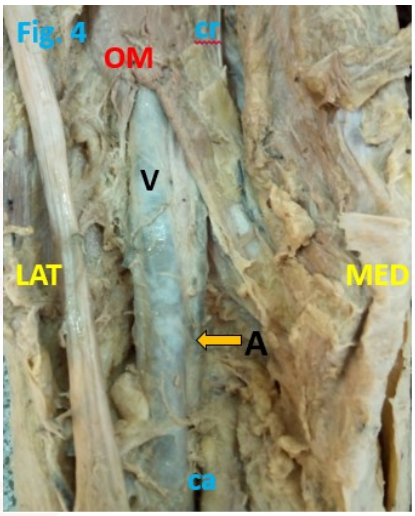

Fig. 4: OM: Oval fibrous adductor hiatus. LAT: lateral, MED: medial, cr: cranial, ca: caudal, A: popliteal artery V: popliteal vein.

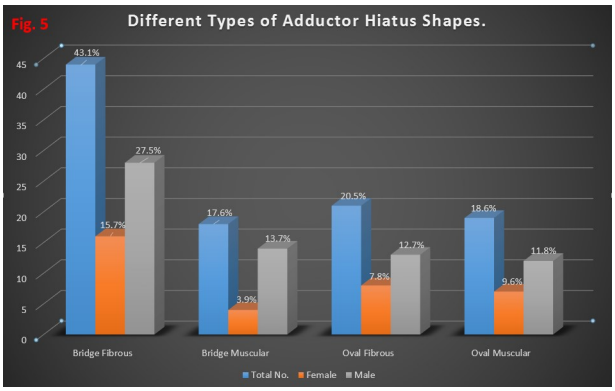

Fig. 5: Comparative result of Bridging fibrous, Bridging muscular, Oval fibrous, Oval muscular of both males and females

DISCUSSION

Majority of Nigerians are manual labourers actively engaging in foot exertion. The predominant AH type that relates to femoral artery would determine those at higher risk

of damage to the vessel wall due to compression or traction. The unfortunate scenario is that majority of the populace more often seek alternative medical care as such issues like femoro-popliteal compression are usually not reported to hospitals for orthodox medical attention. Besides it is not certain if the available health specialists are even aware of the varied types of AH which is pivotal for the understanding why only a particular people are exposed to femoral artery thrombosis at the level of the AH. A report shows that 72% of occlusions of femoro-popliteal region were localized at the adductor canal hiatus [8]. Most of the incidences are said to be associated with local anatomic factors that may involve direct mechanical damage or compression of the femoral artery often referred to adductor canal outlet syndrome [8].

The pulsatile nature of femoral artery is envisaged to implicitly expose it to mechanical damage or occlusion at the hiatus. More insight to this was on the account of some reports where mechanical damage was believed to occur due to repeated trauma created by the pulsatile movement of the arterial wall where it lays in intimate contact with the aponeurosis of the adductor magnus muscle [7,9]. In this context, AH with bridging fibrous and oval fibrous margins (aponeurotic margins) were perceived to be more liable cause of mechanical damage or compression to femoral artery wall. It could be worrisome considering fibrous margin predominance in the two racial population investigations. The study on Nigerian cadavers shows that bridging fibrous type of AH has the highest frequency whereas in Caucasian study oval fibrous margins was reported to be the most predominant type [3].

This study findings apparently shows population variation. There was also wider range of distance from the adductor tubercle to the apex of AH in the examined Nigerian cases compared to the reported range in the Caucasians [2]. The population variations of AH pattern can enable for prediction those at higher risk of having adductor canal outlet syndrome. The varied types might also be symptoms specific in cases of adductor canal outlet syndrome *i.e.* occluding thrombosis of femoral artery, limping with pinging pain caused by muscular ischemia of the affected calf, coolness and numbness of the foot and absence of popliteal pulse [3].

However it has become more revealing that the clinical condition that happens in adductor canal outlet syndrome is primarily caused by hypertrophied band of adductor magnus [3]. Nonetheless, the incidence of occlusions of femoro-popliteal region and damage to femoral arterial wall is not an exclusive event. The occurrence of hypertrophied band in the environment of fibrous margins (aponeurotic) either in bridging fibrous or oval fibrous would altogether culminate to the lethality of the condition. Therefore surgical intervention [10] with diligence is required to avoid losing the affected limb.

CONCLUSION

The study conducted shows bridging fibrous as the most common AH type indicating population variation in relation to a study on the Caucasians. The study also established wider range of distance from the adductor tubercle to the apex of AH compared to the report on Caucasians. Therefore to be able to adopt an appropriate surgical intervention in a situation of adductor canal outlet syndrome, surgeons have to be aware of the population variation of AH types.

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Conflicts of Interests: **None**

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