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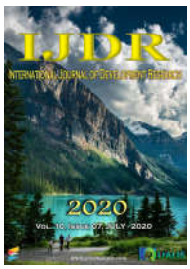

RESEARCH ARTICLE OPEN ACCESS

A STUDY OF THE LENGTH OF POPLITEAL ARTERY IN THIEL CADAVER AND CLINICAL APPLICATIONS

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ABSTRACT

The length of popliteal arteries might vary according to ethnicity and geographical locations. This study intends to examine the length of the popliteal artery and the associated clinical significances. 24 popliteal regions of 12 Thiel embalmed cadavers between the ages of 32 and 110 years were cut-up to expose the origin, termination and important landmarks and were then photographed and measured. Measurements of different lengths of the popliteal artery were taken as follow: from the adductor hiatus to the lower border of the popliteal muscle (L1); from the adductor hiatus to the femoral condyle (L2); and from the femoral condyle to the point of termination (L3). L1 and L3 were higher in the left limb while L2 was higher in the right. The mean of L1, L2 and L3 were 14.86 ± 3.64, 9.12 ± 2.92, and 5.91 ± 1.72 respectively. L1, L2 and L3 of the left and right limbs and of both limbs of were compared with those obtained from similar studies across other countries. The outcome of this study would provide radiologists, vascular surgeons and knee orthopaedic surgeons with crucial information and estimated data for their routine clinical practices.

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INTRODUCTION

The popliteal artery is the deepest of all neurovascular structures in the popliteal fossa throughout its whole course, having its normal length as 20cm (Khandewal *et al*., 2014; Sinnatamby, 2011). The artery which is usually fastened between the adductor hiatus (where it begins), and the fibrous arch in soleus, at the distal border of the popliteus (where it terminates) is prone to damage in knee dislocations (Standring, 2008; Sinnatamby, 2011; Khandewal *et al*., 2014).Clinical conditions which are usually associated with the artery are popliteal artery atherosclerosis, entrapment syndrome, aneurysms, trauma, cystic adventitial disease, embolus which require corrective surgical measures in the popliteal region (Wright *et al*., 2004). Popliteal artery can also be affected during surgical procedures in the popliteal region such as: knee joint arthroscopy, repair of knee joint menisci, excision of Baker's cyst, posterior cruciate ligament inlay reconstruction, repair of knee ligaments and knee bypass grafts (Telang *et al*., 2016). Adequate knowledge and understanding of anatomical variations of the popliteal artery and the possible range of its length within a geographical region is crucial, and could be of help to orthopaedic surgeons, vascular surgeons and radiologists in carrying out the aforementioned surgical interventions (Antonello *et al*., 2005; Telang *et al*., 2016).The fact that variations in length of popliteal artery could be affected by such factorsas ethnicity and geographical differences (Khandewal *et al*., 2014), has necessitated through this study, the need to measure and analyze the length of popliteal artery in the Scottish population using Thiel embalmed cadavers.

MATERIALS AND METHODS

Twenty-four popliteal fossae of Twelve Thiel embalmed cadavers in the Center for Anatomy and Human Identification (CAHID), University of Dundee Scotland were used for the study. The skin of each fossa was dissected and reflected sideways, after which the superficial fascia, adipose tissue, and other connective tissues were cut and removed. To reveal the commencement of the popliteal artery, the hamstring muscles were reflected; while to expose the point where the artery terminated, the soleus muscle was cut in its middle portion in a supero-inferior direction.

The photographs of the left and right popliteal fossae were taken respectively using a digital camera and stored in the JPEG format in a computer. The images were measured using the Imagej software (NATIONAL INSTITUTES OF HEALTH, USA, VERSION 1.52A) and were recorded in the centimeters (cm) unit of measurement. Three different lengths of popliteal arteries were taken as follows: L1, L2 and L3 with cautions taken to avoid intra-observation error (Figure 1). The data were analyzed using the SPSS statistical software, version 23 (IBM®, NEW YORK, USA), and recorded as mean (with their standard deviations) and range in the centimeter (cm) unit of measurement.

Ethics: This research work was carried out in the Centre for Anatomy and Human identification (CAHID) under guidelines of Human Tissue Act Scotland.

RESULTS

The mean value of L1 on the right limb was 16.06 ± 6.88 cm with values ranging from 14.71 to 15.03 cm; while on the left, the mean of L1 was 16.28 ± 6.82cm, with its values ranging from 15.40cm to 15.76cm.

The total mean value for L1 for both limbs was 14.86 ± 3.64 with its range as 7.50 to 21.52. The mean value of L2 on the right limbs was 9.17 ± 2.94 cm which ranges from 3.94cm to 15.20cm; while for the left limbs, the mean value of L2 was 9.08 ± 3.03 cm, which had its range from 4.13 to 15.83cm. The average value of L2 for both limbs was 9.12 ± 2.92cm which had its range from 3.94 and 15.83cm. L3 on the right limbs had a mean value of 7.51 ± 3.73 cm with value ranging from 6.09 – 6.29cm, while the mean value of L3 on the left limbs was 8.48 ± 4.61cm with values ranging from 5.74 – 5.86cm. For both limbs, L3 had a range from 2.38 to 9.78cm and a mean value of 5.9 ± 1.72cm.

DISCUSSION

It seems that only few literature studies have been documented on the assessment of popliteal artery length and its associated clinical significances. L1 and L3 were higher on the left limb while L2 was higher in the right limb as seen in the present study, which also corresponded with the findings in the South Indian and Turkish cadavers as reported by Telang *et al*. (2016) and Barut *et al*. (2009). L1 in this study (in Scotts cadavers) were found to be lesser than that in Turk cadavers as recorded by Ogzur *et al*. (2009) and

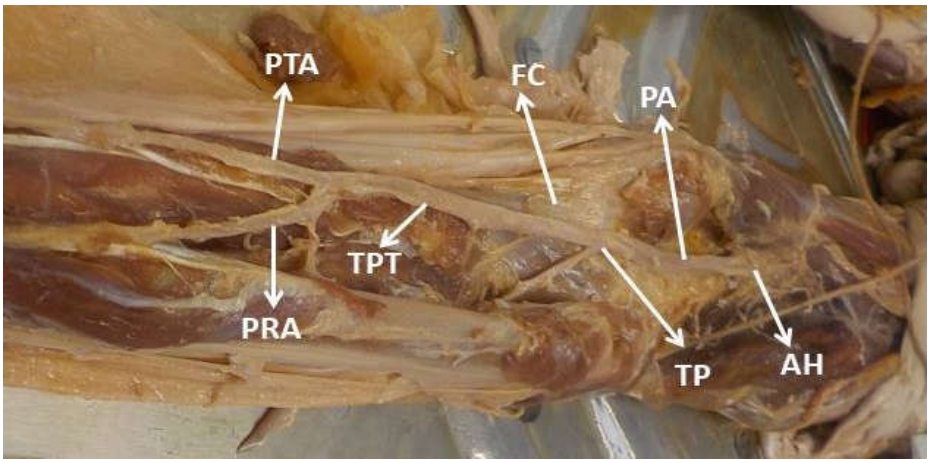

Figure 1. Landmarks used for the measurement of L1, L2 and L3: AH = Adductor Hiatus; PRA = Peroneal Artery; TPT = Tibioperoneal Trunk; TP = Point of Termination of popliteal artery; PTA = Posterior Tibial Artery; FC = Femoral condyle; PA = Popliteal Artery

Table 1: Comparison of various lengths of popliteal artery from adductor hiatus (AH) to the point of termination (TP) (L1) with the findings from other studies

Study	Methodology	Sample Size (Limbs)	Left (cm)	Right (cm))	All (cm)
Ogzur et al. (2009)	Dissection	40	Nil	Nil	19.11 ± 3.47
Telang et al. (2016)	Dissection	100	20.88±2.03	20.87 ± 1.94	Nil
Barut et al. (2009)	Dissection	28	16.78±2.85	16.46±3.18	16.65±2.95
Present study	Dissection	24	16.28±6.82	16.06 ± 6.88	16.17 ± 6.80

Table 2: Comparison of various length of popliteal artery: L2=from adductor hiatus (AH) to the femoral condyle (FC) with the findings from other studies

Study	Left (cm)	Right (cm)	All (cm)
Barut et al. (2009)	10.08 ± 2.12	9.26 ± 1.63	Nil
Telang et al. (2016)	14.92 ± 2.15	14.97 ± 1.89	Nil
Ogzur et al. (2009)	Nil	Nil	13.81 ± 2.38
Present study	8.48 ± 4.61	7.51 ± 3.73	8.10 ± 4.20

Table 3: Comparison of various length of popliteal artery: L3=from femoral condyle (FC) to the point of termination (TP) with the findings from other studies

Study	Left (cm)	Right (cm)	All (cm)
Ogzur et al. (2009)	Nil	Nil	Nil
Telang et al. (2016)	6.06 ± 1.53	5.92 ± 1.31	Nil
Barut et al. (2009)	6.69 ± 1.15	7.20 ±1.98	7.28 ± 3.62
Present study	8.48 ± 4.61	7.51 ± 3.73	7.28 ± 3.62

Barut *et al*. (2009) respectively, and in the Indian cadavers (15.15 cm) by Bose and Ramanathan, (2017). However, L1 in the present study was higher than those recorded in the South-Indian and Turkish cadavers by Bose and Ramanathan (2017) and Yildiz *et al*. (2009) respectively. Contrary to the observation of the present study, L2 was higher on the left limb while L3 was higher on the right limb in Turk cadavers as recorded by Barut *et al*. (2009). L2 was higher in the left limb in South Indian cadavers (Telang *et al*., 2016) which was in agreement with the findings of the present study. Furthermore, L2 in the present study was lesser than that in the Turkish cadavers (Ogzur *et al*., 2009), and South Indian cadavers (13.65cm) (Bose and Ramanathan, 2017). L3 in the present study was higher than that reported in the South Indian cadavers by Bose and Ramanathan (2017) and lesser than L3 as reported by Barut *et al*. (2009) in Turk cadavers. L3 in the present study was higher in the left limb which was supported by the findings in the Indian cadavers (Telang *et al*., 2016) and in the Turk cadavers (Barut *et al*., 2009). Observations from the present study suggest that even in individuals of the same body height or lower limb length, the length of popliteal artery which terminated at a higher level is likely to be shorter than the length of the popliteal artery that terminated at a normal level. The length of the popliteal artery can also be affected by the manner in which the artery terminated. These variations in length among different studies, including the findings of the present study suggest racial differences in the length of the popliteal artery and can provide useful information for radiological analysis, arterial grafting procedures, total knee replacement surgery (Bose and Ramanathan, 2017).

Conclusion

Knowledge of the normative values of popliteal artery in various populations could be of great clinical significance to professionals such as knee surgeons, angiographers, radiologists etc in surgical procedures, interpretation of angiographs, and in popliteal arterial grafting in the cases of disease conditions etc.

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