THE STUDY OF PROFUNDA FEMORIS ARTERY AND VARIATIONS IN ITS ORIGIN AND BRANCHING PATTERNS

Dissertation submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

in partial fulfillment of the

regulations for the award of the degree of

M.D. (ANATOMY)

BRANCH – XXIII

GOVT. STANLEY MEDICAL COLLEGE & HOSPITAL

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI, INDIA

APRIL 2017

CERTIFICATE

This is to certify that the dissertation work done on " **The study of Profunda Femoris Artery and Variations in its Origin and Branching Patterns**" is the bonafide work done by **Dr. S. Manonmani** in the Department of Anatomy, Stanley medical college, Chennai - 600001 during the year 2014 - 2017 under my supervision and guidance in partial fulfilment of the regulation laid down by the Tamilnadu Dr. M.G.R. Medical university, for the M.D. Anatomy (Branch code XXIII) degree examination to be held in April 2017.

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CERTIFICATE OF THE GUIDE

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Station: Chennai.

DECLARATION

I solemnly declare that this dissertation , "**The study of Profunda Femoris Artery and Variations in its Origin and Branching Patterns**" was written by me in the Department of Anatomy, Government Stanley Medical College and Hospital,Chennai under the guidance and supervision of Prof. Dr.S.Chitra M.S., Professor and head of the Department of Anatomy, Government Stanley Medical College, Chennai-600 001.

This dissertation is submitted to the Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the university regulations of the award of Degree of M.D. Anatomy (Branch XXIII) examination to be held in April 2017.

Place:Chennai -1

Date:

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INTRODUCTION

In the current cutting-edge advancements in interventional radiology, even in the present times arteriography is the primary investigation for peripheral occlusive arterial diseases. The profunda femoris artery is frequently used time and again in vascular procedures of the proximal leg. The profunda femoris artery is femoral artery's huge branch originates from its lateral side about 3.5 centimeters lower to the pouparts ligament.

Initially profunda femoris artery is lateral to femoral artery, then runs behind femoral artery and femoral vein along the medial side of the femur. Then it lies between pectineus and adductor longus and runs between adductor longus and adductor brevis. Finally, profunda femoris artery lies between adductor longus and adductor magnus and terminates by piercing the adductor magnus to anastomose with the upper muscular branches of popliteal artery.

Arteria profunda femoris is the cardinal artery that supplies the muscles of thigh. This artery supplies the adductors, extensors and flexor muscles. In addition to that it establishes a number of anastomoses with the terminal branches of common iliac artery and the popliteal artery.

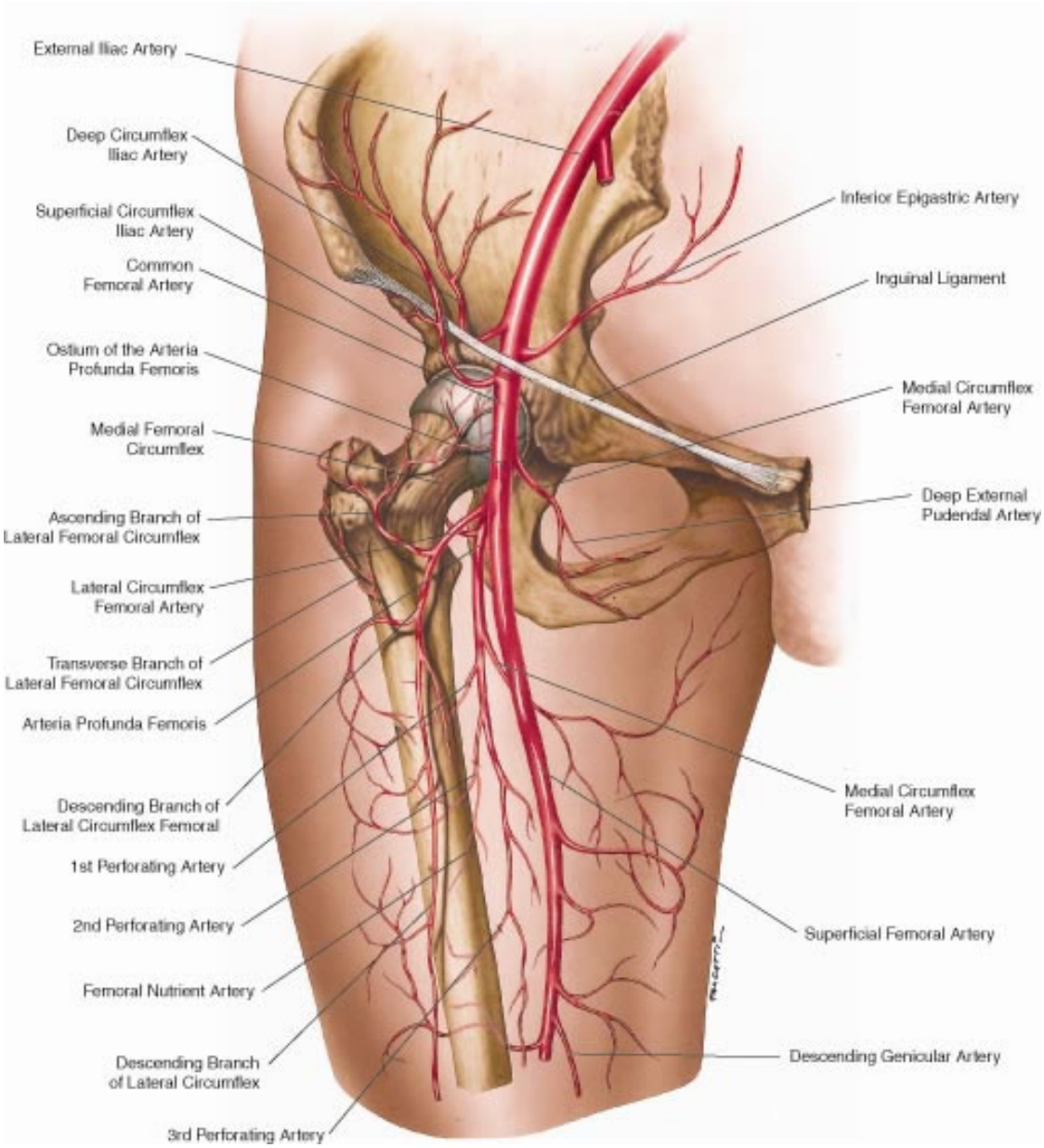


FIGURE 1: CONTENTS OF FEMORAL TRIANGLE

BRANCHES

LATERAL CIRCUMFLEX FEMORAL ARTERY

Profunda femoris artery gives lateral circumflex femoral artery on its lateral side passes between the divisions of the femoral nerve and lies behind sartorius and rectus femoris. It terminates into ascending, transverse and descending branches. Descending branch is rarely an independent branch arising directly from profunda femoris artery or from femoral artery. This branch runs behind the rectus femoris along the anterior border of vastus lateralis.

MEDIAL CIRCUMFLEX FEMORAL ARTERY

Profunda femoris artery gives medial circumflex femoral artery on its posteromedial aspect but many a times from the femoral artery. It supplies the muscles of medial compartment of thigh. Initially it passes between the muscles of the floor of femoral triangle and then between obturator externus and adductor brevis.

Finally, it lies between quadratus femoris and upper border of adductor magnus, whereby terminating into transverse, ascending and descending branches.

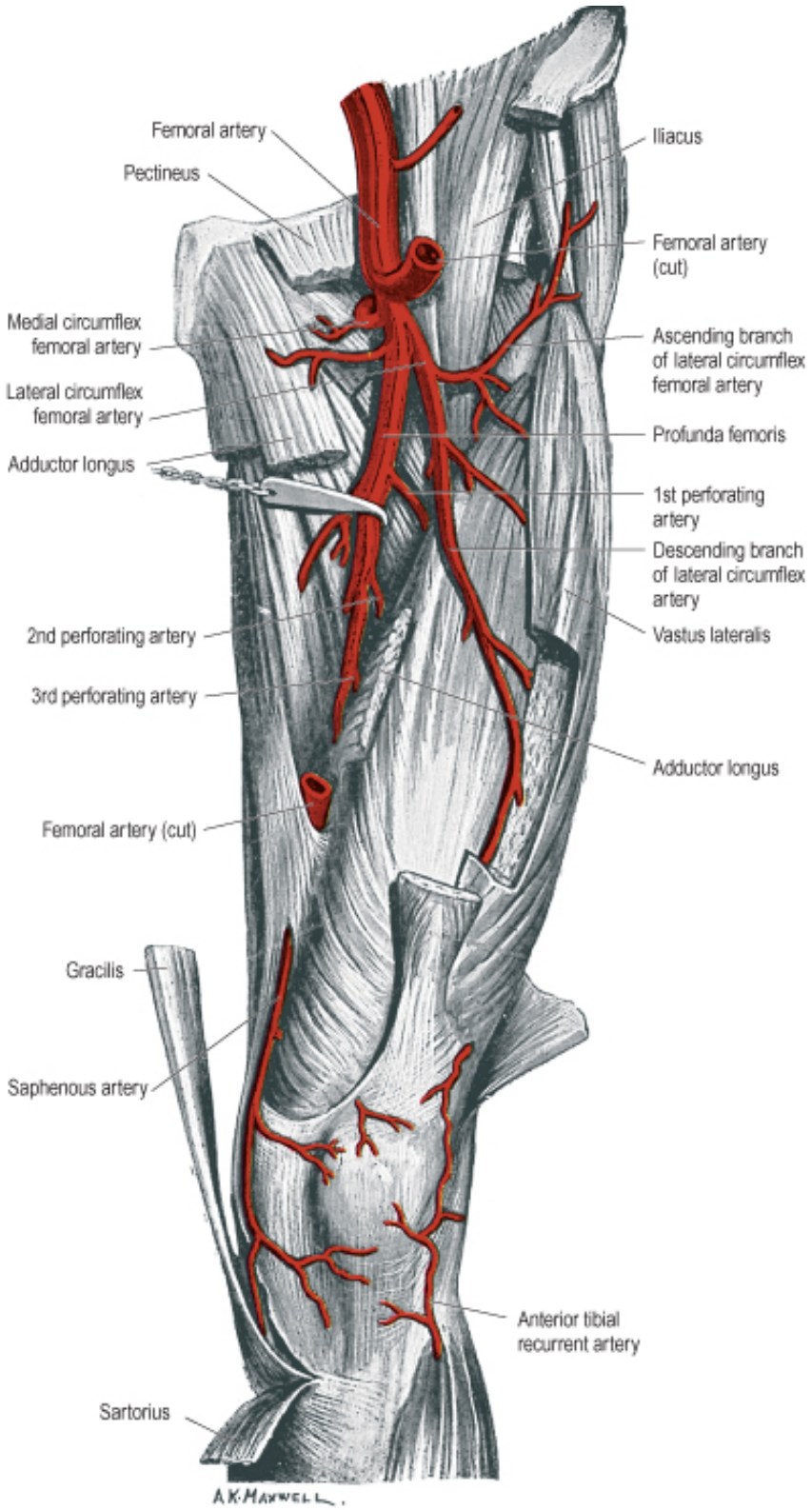
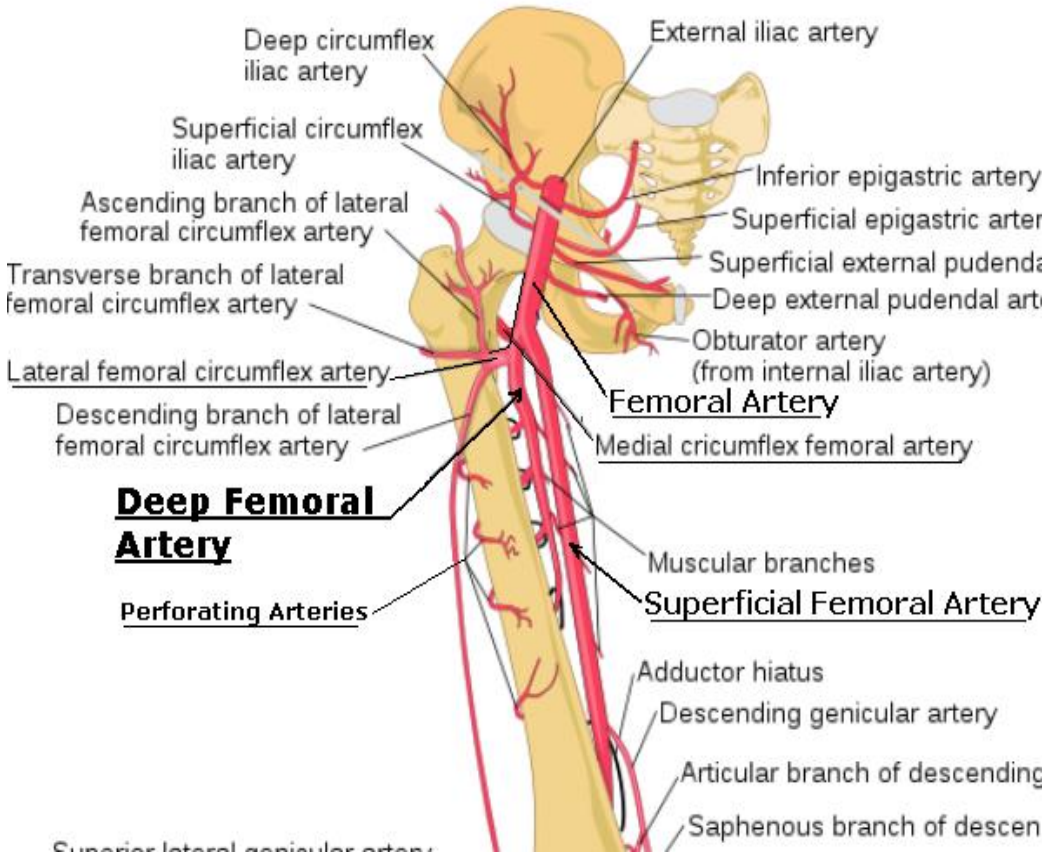


FIGURE 2: THE RIGHT PROFUNDA FEMORIS ARTERY AND ITS BRANCHES

PERFORATING ARTERIES

There are commonly three perforating arteries, as the name implies they pass through the insertion of the adductor magnus to reach back of thigh. They lie along the linea aspera of the femur under small tendinous arches along the insertion of the adductor magnus muscle and gives off muscular, cutaneous and anastomosing branches. The first perforating artery is above the adductor brevis, the second lies over adductor brevis and the third perforating artery is below it. The first perforating artery lies between pectineus and adductor brevis and pierces adductor magnus close to the linea aspera. Sometimes it may pass through the adductor brevis, adductor magnus, biceps femoris and gluteus maximus.

- First perforating artery anastomoses with inferior gluteal, medial and lateral circumflex femoral and second perforating artery.
- Second perforating artery is larger and frequently arising in common with the first. It perforates the insertion of adductor brevis and adductor magnus and terminates into ascending and descending branches. Second perforating artery supplies the posterior femoral muscles finally anastomosing with first and third perforating arteries.
- The third perforating artery originates below adductor brevis and perforates the adductor magnus and finally terminates into branches which supply posterior compartment muscles. The third perforating



- ***FIGURE 3: BRANCHES OF PROFUNDA FEMORIS***

artery anastomoses with perforating arteries present above and below with the terminal branches of profunda femoris artery and muscular branches of popliteal artery.

THE NUTRIENT BRANCH

The nutrient artery of femur generally comes from second perforating artery. If there are two nutrient arteries they come from the first and third perforating arteries. The terminal branch of the profunda femoris artery is sometimes called fourth perforating artery. Other branches of the profunda femoris artery along with the diaphysial arteries supply the femur. Perforating arteries form double chain of anastomoses,

a) one in the adductor muscles and
b) The second one close to the linea aspera.

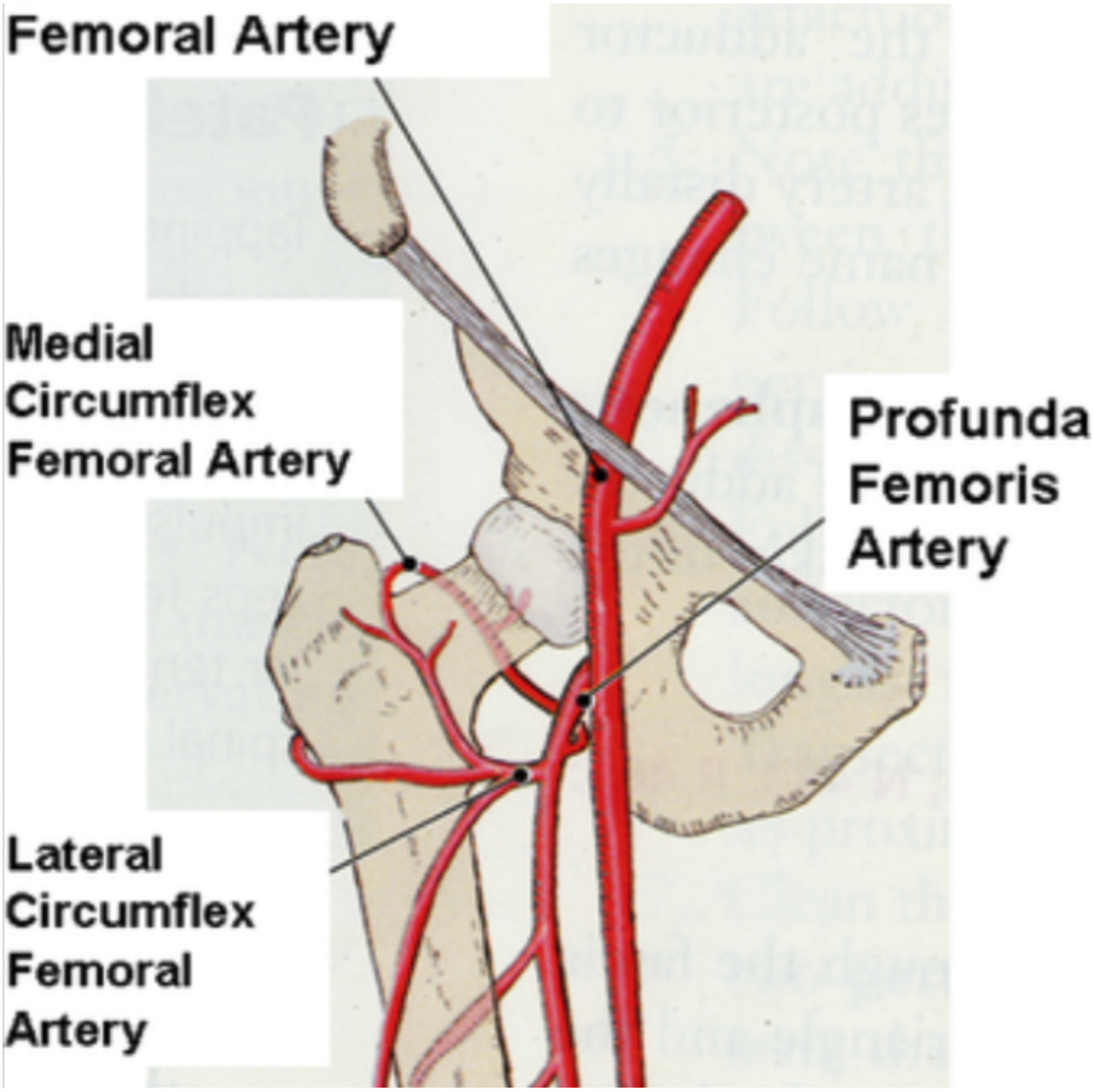


FIGURE 4: CIRCUMFLEX BRANCHES OF THE PROFUNDA FEMORIS ARTERY

AIM OF THE STUDY

Profunda femoris artery and its variations are utmost important topics for Anatomists and Surgeons. Along with femoral artery profunda femoris artery is also a significant artery in the anterior aspect of the thigh.

For analyzing the vascular diseases of lower limb, diagnostic tests like ultrasound, arteriography, digital subtraction angiography, doppler imaging and magnetic resonance imaging are done on profunda femoris artery. Femoral triangle is clinically advantageous and prominent area for accessing femoral artery and femoral vein.

A clear knowledge about the normal anatomy and variations of profunda femoris artery and its circumflex femoral branches is important while performing surgeries of the hip joint. This knowledge is required for avoiding post-surgical complications such as severe secondary haemorrhage and iatrogenic arteriovenous fistula while performing femoral artery puncture.

Orthopedic procedures are always a risk for the profunda femoris artery since the metallic screws used in the procedure may pass through the artery. Usually injuries are misinterpreted and present as late false aneurysms.

Ligation of arteries are contraindicated for proximal injuries because they may form important collateral pathway in atherosclerotic population. Recently the descending branch of lateral circumflex femoral artery is used as newer arterial graft for coronary artery bypass surgery.

At the apex of femoral triangle, the profunda femoris artery and the counterpart vein are separated from femoral vessels by adductor longus. The gunshot or stab injury at this level may injure all vascular structures present in the femoral triangle.

Aim of this study is to perceive and find the normal course of profunda femoris artery, its variations and of origin of its circumflex branches and their variations. Thereby contributing knowledge in performing clinical, diagnostic and surgical procedures.

The expanding scope of interventional radiology has intrigued me to analyze on the variations of profunda femoris arteries in the South Indian population.

PARAMETERS

The following parameters were used in the present study,

1) Origin of profunda femoris artery from femoral artery.
2) Origin of its branches from the origin profunda femoris artery
3) Length and diameter of profunda femoris artery.
4) Course of the artery.
5) Relations with femoral artery and vein in front of thigh.
6) Branching pattern of medial and lateral circumflex branches.

EMBRYOLOGICAL ANATOMY

The arterial supply for lower limbs come from two arteries –the axial and external iliac artery –both of which arises from umbilical artery. The femoral artery originates from external iliac artery and passes in the anterior compartment while axial artery passes in the posterior compartment.

The primary arterial trunk or the axis artery of the lower limb originates from the dorsal root of umbilical artery and runs along the dorsal aspect of thigh, knee and leg. Primary axis artery develops from the fifth lumbar intersegmental artery on the dorsal aspect of the thigh, when the embryo is about 10 mm long and ends in plantar capillary plexus. Femoral artery originates from rete femorale in ventral aspect of the thigh. Femoral artery communicates with the external iliac artery above and sciatic artery below. During its development anastomoses occurs between the axis artery and rete femorale.

The femoral artery passes over the anterior part of thigh and opens a new channel to lower limb. This channel has its origin from a capillary plexus connecting the femoral branches with external iliac artery above and axis artery below.

On the popliteus muscle axis artery gives off a primitive posterior tibial and primitive peroneal branch which runs distally on the muscle and on

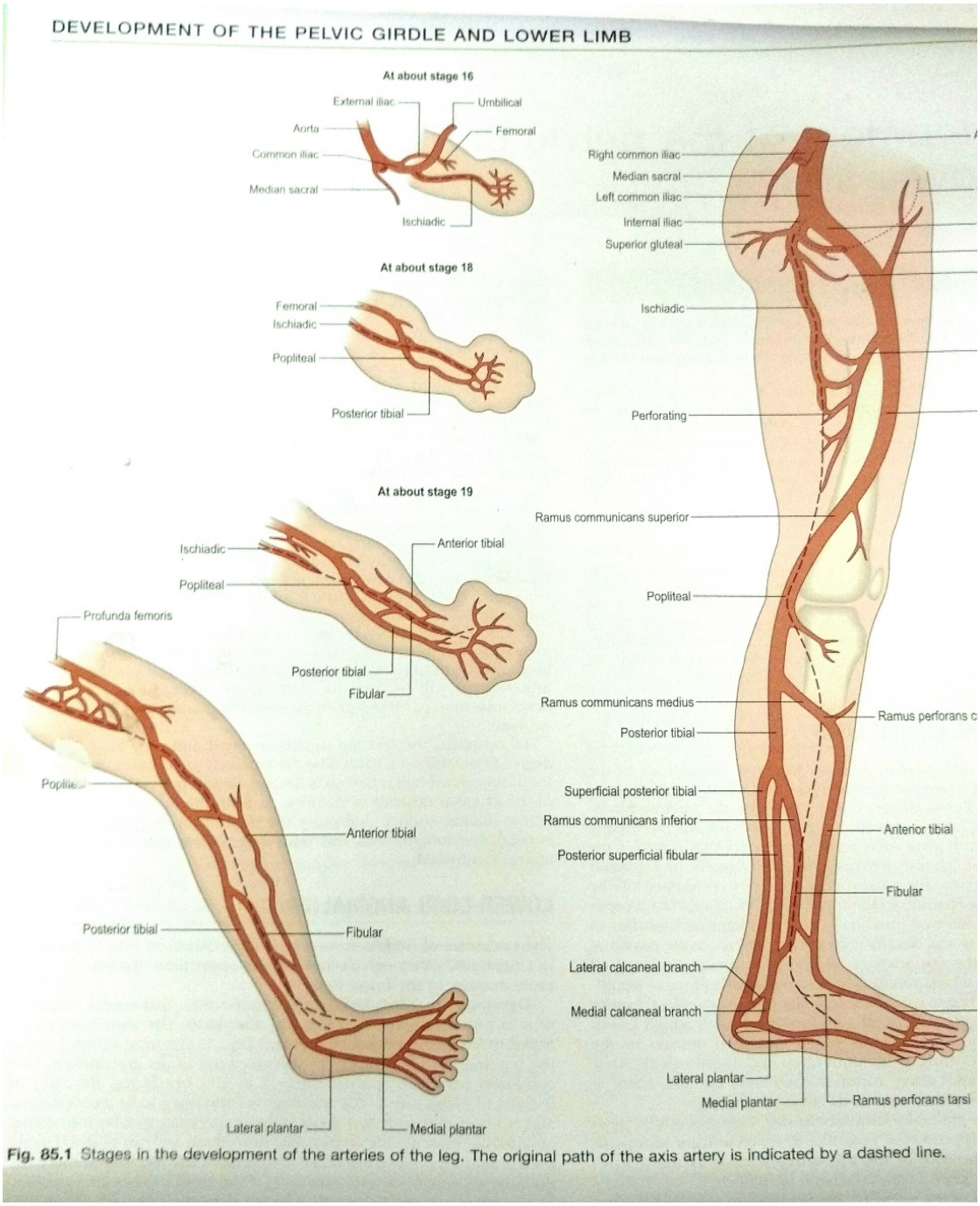


Fig. 85.1 Stages in the development of the arteries of the leg. The original path of the axis artery is indicated by a dashed line.

FIGURE 5: DEVELOPMENT OF LOWER LIMB ARTERIES-EMBRYOLOGY

the tibialis posterior to gain the sole of the foot. At the lower border of popliteus muscle axis artery gives of a perforating branch, which passes anteriorly between tibia and fibula and then goes to dorsum of foot forming the anterior tibial artery and dorsalispedis artery. The primitive peroneal artery establishes one communication with axis artery at distal border of the popliteus and along its course in leg.

When femoral artery increases in size the proximal part of axis artery disappears proximal to its communication with femoral artery. Root of axis artery however persists as inferior gluteal artery and arteria commitants nervi ischiadici.

The variations of lower limb arteries could be because of the divergence in mode and proximodistal level of branching or due to aberrant vessels, arcades or plexus that occur during the development of the blood vessels.

Embryological development of arterial supply of lower limbs is due to morphological and molecular changes that occur in the limb mesenchyme, because of which the vascular variations are more common than expected.

MATERIALS AND METHODS

MATERIALS USED IN THIS STUDY

1. The requirements used for this study were 40 specimens of lower limbs of both sides of 15 males and 5 female cadavers from the Department of Anatomy, Stanley Medical College, Chennai.
2. 10 computerized tomographic lower limb angiogram images from patients who underwent angiographic procedures in the Department of Radiology, Stanley Medical College, Chennai.

The patients were selected for the study after getting ethical committee clearance and proper written consent without disclosing their names.

METHODOLOGY

A) **Dissection** –40 lower limb specimens.

B) **Radiology** – 10 lower limb computerized tomographic angiogram images.

A) DISSECTION METHOD

The dissection was carried out according to the methodology given by Cunningham's manual of practical anatomy. The femoral triangles were dissected as follows:

A transverse incision from the anterior superior iliac spine to pubic tubercle was made. From its midpoint a vertical incision was made up to upper one third of thigh. The skin along with superficial fascia was reflected on either side of vertical incision. Now the superficial structures were identified and separated. The muscles adductor longus and sartorius were well defined. Now the structures covered by femoral sheath along with its compartments were dissected. Femoral vein was medial to femoral artery and now branches of femoral artery were traced.

The profunda femoris artery its medial and lateral circumflex femoral branches were separated and defined. Their origin and course were studied along with the relation of profunda femoris artery to femoral artery and femoral vein.

The distance and the site of origin of the profunda femoris artery to the midinguinal point was measured with the measuring tape and documented.

The site of origin of medial and lateral circumflex femoral arteries from profunda femoris artery with respect to inguinal ligament was observed and documented. The external circumference of profunda femoris artery near its origin from femoral artery was measured with the help of Vernier calipers and documented in millimeters. Length of profunda femoris artery from its origin to first perforating branch also was measured and recorded. The length was measured between the threads tied at the origin of profunda femoris artery and at the origin of its first perforating branch.

The progression of the profunda femoris artery from its origin to the final perforator, and its branching pattern were noted.

B) RADIOLOGICAL STUDY

Computerized tomographic lower limb angiogram images of 5 patients, who underwent this procedure in the Department of Radiology, Stanley Medical College, Chennai 01.

For these patients lower limb computerized tomographic angiography was done. The femoral and profunda femoris artery were photographed and studied. The latest generation of computerized tomography has the ability to capture very thin slices of tissue under study with a gap interval of 0.001mm distance between each slice and has the ability to spontaneously reconstruct the images.

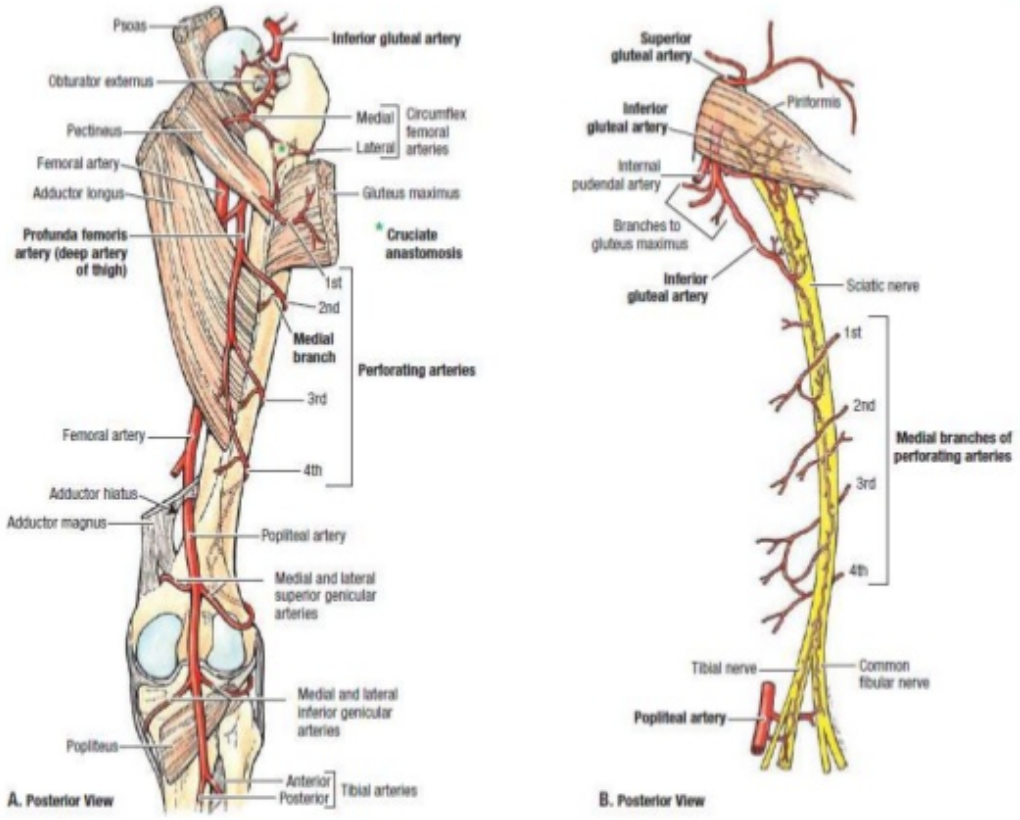


FIGURE 6: PERFORATING BRANCHES OF PROFUNDA FEMORIS ARTERY

The multiple computerized tomographic X-ray tubes oscillate 164 times in one minute and capture the image in a sequence. It was very useful to study angiography of large vessels, its major branches and its variations.

RADIOLOGICAL PROCEDURE

Patient was made to lie down on the couch of computerized tomographic gantry and the limb under study was extended within the preview of computerized tomographic x-ray oscillation. Cephalic vein was cannulated with a venflon and contrast agent Omni phage, a third generation water soluble iodinated contrast was infused through a injector at a rate of 2mg/kg and a series of images where captured within 7 minutes of administration for arterial phase and within 5 minutes for venous phase. From the computerized tomographic series of images, the origin, branching pattern and variations of the profunda femoris artery were studied.

REVIEW OF LITERATURE

1. ORIGIN OF PROFUNDA FEMORIS ARTERY

CUNNNINGHAMS TEXTBOOK OFANATOMY G.J.ROMANES (1964): stated "The profunda femoris artery the largest branch of the femoral artery, arises from the lateral side, at somewhat variable level but usually about 4 centimeters distal to the inguinal ligament".

Siddarth p et al (1985) studied cadavers and stated the median distance of separation of profunda femoris artery from femoral artery measured from the midpoint of the inguinal ligament is 4.4 centimeters.

Clarke SM and Colborn GL (1993) quoted that the average measurement from the origin of profunda femoris to the mid inguinal point is 3-4 centimeters.

Bannister LH et al (1995) studied the cadavers and told the average distance from mid inguinal point to the origin of profunda femoris is 3.5 centimeters.

Henry Hollinshed (1997) stated “that the profunda femoris artery is the main source of blood supply to the muscles of the thigh. It is given off from the lateral side of femoral artery in the femoral triangle”.

Dixit et al (2001) quoted that profunda femoris artery arises from posterolateral aspect of femoral artery 4.75 centimeters from the mid inguinal point midway of femoral triangle.

Keith L Moore (2006) stated “the profunda femoris artery originates from the lateral or posterior side of the femoral artery in the femoral triangle about 1-5 centimeters below the inguinal ligament”.

Volksanovic-Boganea et al (2007) studied the cadavers and quoted that average distance being 3.75 centimeters from mid-inguinal point to origin of profunda femoris over proximal one fourth of femoral triangle.

Richard S Snell (2010) quoted “the profunda femoris artery is the largest and most important branch. It arises from the posterolateral side of femoral artery”.

Prakash, Jyotikumar, A.Kumar Bharathwaj (2010) Vydehi Institute of Medical Sciences White field Bangalore .In this study of cadavers the average distance from the mid inguinal point is 4.2 centimeters.

Lasts Anatomy (2011) stated "Profunda femoris artery usually arises from the lateral side of the femoral artery about 3-4 centimeters distal to the inguinal ligament".

Daksha Dixit study (2011) Department of Anatomy Jawaharlal Nehru Medical College Belgaum. Out of 228 lower limbs dissected, the origin of profunda femoris artery from posterolateral aspect of femoral artery were found in 96 cases. From its posterior aspect in 68 cases, from lateral side in 43 cases and from medial side in 29 cases.

Clinical Anatomy by Neetha Kulkarni (2012) stated "the profunda femoris artery arises from the femoral artery from its lateral side in the femoral triangle and about 3.5-4 centimeters below the inguinal ligament. However, the point of origin is variable".

Gray's Anatomy Susan Standring (2012) stated "the profunda femoris artery is a huge branch that emerges laterally from the femoral artery about 3.5.centimeters distal to the inguinal ligament".

Text Book of Anatomy by Asim Kumar Dutta (2012) told "The profunda femoris artery is the largest branch of femoral artery and it arises from lateral side of the femoral artery about 3.5 centimeters below inguinal ligament".

I. SITE OF ORIGIN OF ITS BRANCHES

SiddarthP et al(1985) done cadaveric study and stated that origin of medial circumflex femoral artery from profunda femoris artery is 79% and femoral artery is 21%

Clarke SM and Colborn GL (1993) in this cadaveric study noticed the occurrence of origin of medial circumflex femoral artery from profunda femoris artery is 53% and from femoral artery 47%.

Henry Hollinshed (1997) stated "the medial circumflex femoral artery and the lateral circumflex arteries are branches of the profunda femoris artery in the femoral triangle".

Gautier E et al (2000) in his cadaveric study found the prevalence of origin of middle circumflex artery from profunda femoris artery is 83.3% and from femoral artery is 16.7%.

Dixit DP et al (2001) had done a cadaveric study and quoted genesis of medial circumflex femoral artery from profunda femoris artery is 62.5% and from femoral artery is 16%. Lateral circumflex femoral artery from profunda femoris artery is 83.34% and from femoral artery is 16.66%.

Futenda H et al (2005) had done angiographic study and found genesis of lateral circumflex femoral artery from profunda femoris is 78.6% and from femoral artery is 21.4%.

Tanyeli E et al (2006) in his cadaver study found medial circumflex femoral artery originated from profunda femoris artery in 79% and from femoral artery in 21%.

Choi SW et al (2007) in his cadaver study found prevalence of origin of lateral circumflex femoral artery from profunda femoris artery is 86.8% and from femoral artery is 13.2%.

Tansatit T et al (2008) had done a cadaver study and quoted that, prevalence of origin of lateral circumflex femoral artery from profunda femoris artery is 56.67% and from femoral artery is 43.33%

Prakash, Jyothi Kumari(2009) Studied of variations of the origin of the profunda femoris artery and its circumflex branches .Vydhegi Institute of Medical Sciences Bangalore. In this study the prevalence of origin of medial circumflex femoral artery from profunda femoris arteryis67.2% and from

femoral artery is 32.8%. The lateral circumflex femoral artery originated profunda femoris artery in 81.25% and from femoral artery in 18.75%.

Snell's Anatomy, Richard S. Snell (2010) stated "the profunda femoris artery passes posterolateraly in the femoral triangle. Before it leaves the femoral triangle, the deep femoral artery gives of two of its largest branches, the lateral and medial circumflex femoral arteries. The lateral circumflex femoral artery typically arises from the lateral side of the upper end of the profunda femoris artery. In some 18% or so of instances the lateral circumflex artery is given by the femoral artery above the profunda femoris artery. The medial circumflex femoral artery arises from the medial side of the profunda femoris artery, sometimes directly from the femoral artery".

Last's Anatomy (2011) quoted "the lateral circumflex femoral artery arises from the lateral side of the profunda femoris artery or occasionally from the femoral artery. Medial circumflex femoral artery arises from the medial side of the profunda femoris artery occasionally from the femoral artery often above its lateral companions".

Gray's Anatomy (2012) stated "the lateral circumflex artery is a laterally running branch given off near the root of the profunda femoris artery. The lateral circumflex femoral artery may arise from the femoral artery. The medial circumflex femoral artery commonly separates from the

posteromedial aspect of the profunda femoris artery, but often separates from the femoral artery itself".

Apurva Darji, Shrumalar (2015) did a cadaver study of variations in the origin of medial circumflex artery in the Department of Anatomy BJ Medical College, Ahmedabad. They observed mode of origin of medial circumflex femoral artery from profunda femoris artery is 86.6% and from femoral artery is 13.4%.

2. II.DISTANCE OF ORIGIN OF ITS BRANCHES FROM THE ORIGIN OF PROFUNDA FEMORIS ARTERY

Prakash et al (2010) in his cadaveric study quoted the average measurement between the origins of lateral circumflex femoral artery from profunda femoris artery to origin of profunda femoris artery was 2.5centimeters. The distance of origin of medial circumflex femoral artery from origin of profunda femoris artery was between 1-2 centimeters.

Daksha Dixit (2011) the study of variations in the origin of profunda femoris artery and its circumflex branches. He observed the distance of origin of lateral circumflex femoral artery from origin of profunda femoris artery was between 20-30millimeters.

3. COURSE OF THE ARTERY

Cunningham's Textbook of Anatomy (1964) quoted "Profunda femoris artery lies at first anterior to the iliacus and the pectineus and then passing out of the femoral triangle between pectineus and adductor longus. Profunda femoris artery continues behind adductor longus lying anterior to the adductor brevis and adductor magnus".

Hollinshed (1997) stated **"**profunda femoris artery is the cardinal source of blood supply to the muscles of the thigh. This artery passes downward and medially to the apex of the femoral triangle, next it descends deep to the adductor longus. From above downwards the profunda femoris artery lies on these muscles the pectineus, the adductor brevis and adductor magnus".

Keith L Moore (2010) stated **"**profunda femoris artery passes deeply between pectineus and adductor longus, descending posterior to adductor longus to the medial side of femur. There by dividing into four perforating arteries that pass through the adductor magnus muscle winding around femur

to supply the muscles in medial, posterior and lateral part of anterior compartments".

Snell's Anatomy (2010) quoted "Profunda femoris artery after it has given off its circumflex femoral branches in the femoral triangle, the artery runs down on the surface of the pectineus and adductor brevis muscle. On reaching the upper margin of the adductor longus, it passes behind the muscle and comes directly to the front of the adductor magnus. As a rule there are four perforating branches, including the terminal branch of the deep femoral artery. The usual pattern for the first two perforating vessels is to penetrate the adductor brevis and the upper segment of the adductor magnus, and for the last two branches, including the terminal branch to perforate the adductor magnus only".

Lasts Anatomy (2011) stated "Profunda femoris artery passes between pectineus and adductor longus where the upper border of the muscle separates the femoral artery and profunda femoris artery. The profunda femoris artery continues down on adductor brevis and magnus and ends as fourth perforating artery".

Text book of Anatomy by Asim Kumar Dutta (2012) stated "Profunda femoris artery runs in the interval between adductor longus and adductor

brevis. It lies on the adductor longus, adductor brevis and on adductor magnus, where it ends as the fourth perforating artery".

Gray's Anatomy (2012) stated "profunda femoris artery is lateral to femoral artery and spirals posterior to femoral artery and vein to the medial side of the femur. The artery passes in between the pectineus and adductor longus, then between adductor longus and adductor brevis. It continues to descend between adductor longus and adductor magnus and finally pierces the adductor magnus to anastomose with upper muscular branches of the popliteal artery".

Neetha Kulkarni (2012) quoted "first profunda femoris artery lies on the anterior aspect of pectineus muscle. In the femoral triangle the profunda femoris artery passes through the gap between pectineus and adductor longus to enter the adductor compartment.

In its further descent the profunda femoris artery lies at first between adductor longus in front and adductor brevis behind. At the lower border of adductor brevis it lies between the adductor longus in front and adductor brevis behind. At the level of the mid-thigh it enters the adductor magnus to continue as the fourth perforating artery.

The first to third perforating arteries arise in relation to the adductor brevis muscle, first at the level of its upper border, the second in front of it and third at its lower border".

T. S. Ranganathan (2013) stated "the profunda femoris artery runs on iliopsoas and passes behind the femoral artery on pectineus. Then the profunda femoris artery leaves the femoral triangle by passing in the interval between the pectineus and adductor longus. Profunda femoris artery descends first in between the adductor longus and brevis. Secondly between the adductor longus and magnus and finally it ends as the fourth perforating branch".

Cunningham's manual of practical anatomy (2014).Stated "Profunda femoris artery is the main artery supplying the thigh goes downwards behind the femoral artery and passes posterior to the adductor longus close to the femur".

Inderbir Singh's Text book of Anatomy (2016) stated "Profunda femoris artery passes between the pectineus and the adductor longus then between adductor longus and adductor brevis and then between adductor longus and adductor magnus".

4. DIAMETER OF PROFUNDA FEMORIS ARTERY

A study of variations of profunda femoris artery by D.Dixit (2011).The diameter of profunda femoris artery in this study was 4.8 millimeters.

Journal of Clinical Research volume 4 Issue I (2013) .Anatomical variations of profunda femoris artery. The mean width of femoral artery was 10 millimeters and that of profunda femoris artery was 6 millimeters.

5. RELATIONS WITH FEMORAL ARTERY AND VEIN

Cunningham's Textbook of Anatomy (1964) stated "Between Profunda femoris artery and femoral artery are its own profunda femoris vein and the femoral vein and below the adductor longus. In rare cases the femoral artery is small and ends in the profunda femoris artery and circumflex branches and the inferior gluteal artery forms the principle vessel of the lower limb".

Hollinshed (1997) quoted "Profunda femoris artery is given off from the lateral side of the femoral artery in the femoral triangle and passes downwards, where femoral artery, femoral vein and profunda femoris vein lie anterior to it".

Keith L Moore (2010) stated “profunda femoris artery lies in between the femoral artery and the adductor longus at the middle third of the thigh and gives of 3-4 perforating arteries that wrap around the posterior aspect of femur”.

Snell’s Anatomy (2010) stated “ Profunda femoris artery has given off its circumflex femoral branches in the femoral triangle, the profunda femoris artery runs down behind the femoral artery and femoral vein on the surface of the pectineus and adductor brevis muscle”.

Last’s Anatomy (2011) stated “the profunda femoris vein lies in front of the profunda femoris artery and turns medially to pass through the angle between the femoral artery and its profunda femoris branch to drain in to the femoral vein”.

Gray’s Anatomy (2012) stated “the profunda femoris artery is related anteriorly to the femoral artery and profunda femoris vein and distally the adductor longus separating the profunda femoris artery from the femoral artery”.

Text Book of Anatomy by Asim Kumar Dutta (2012) stated “Profunda femoris artery originates from the lateral side of the femoral artery and spirals medially behind the femoral vessels”.

Neeta Kulkarni –Text Book of Anatomy (2012) quoted "from its origin, the profunda femoris artery gradually turns medially to pass behind the femoral vessels. At the level of the apex off femoral triangle, the profunda femoris artery and accompanying veins are separated from the femoral vessels by adductor longus".

T.S.Ranganathan (2013) stated "Profunda femoris artery runs on iliopsoas and passes behind the femoral artery on the pectineus".

Cunningham's Manual of Practical Anatomy (2014)-G.J.Romanes stated "profunda femoris artery originates from the posterolateral aspect of femoral artery".

Inderbir Singh's Text Book of Anatomy (2016) quoted "Anterior to the profunda femoris artery is the femoral artery which is separated by the femoral vein and profunda femoris vein and the adductor longus muscle".

6. BRANCHING PATTERN OFMEDIAL AND LATERAL CIRCUMFLEX FEMORAL ARTERIES

The variability of selection in the capillary channels when the arterial system of the lower limb is developing have long been considered causing the

Lateral circumflex femoral artery

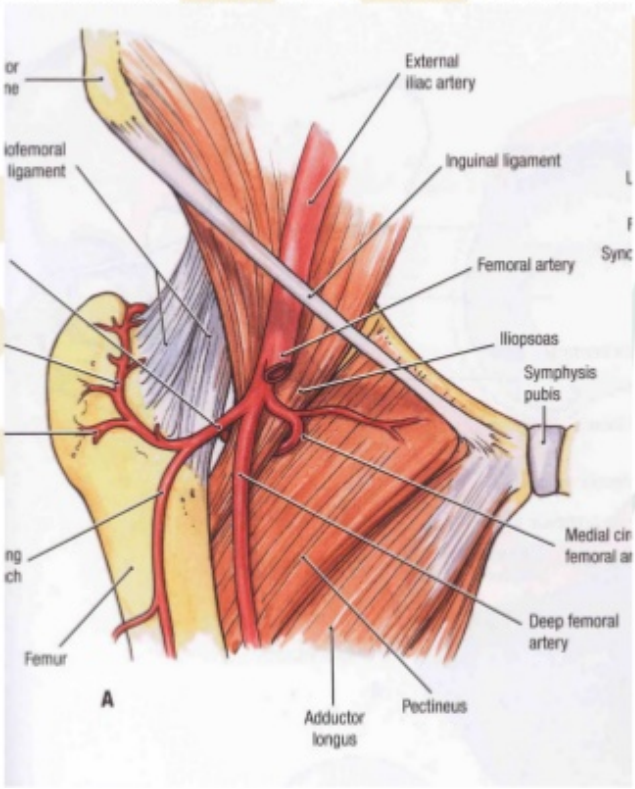


FIGURE 7: LATERAL CIRCUMFLEX ARTERY BRANCHES SUPPLYING THE HEAD OF FEMUR

variations in the origin of the circumflex femoral arteries. The circumflex femoral arteries are known to have four well known arrangements.

PATTERNI: Lateral circumflex femoral and medial circumflex femoral arteries arise from the profunda femoris artery.

PATTERNII: Medial circumflex femoral artery arise from the femoral artery and the lateral circumflex femoral artery from profunda femorisartery.

PATTERNIII: Lateral circumflex femoral artery arise from the femoral artery and medial circumflex femoral artery from profunda femoris artery.

PATTERNIV: The femoral artery serves as origin for both the arteries.

Williams et al (1930) in his study of480 limbs59% were of pattern I and 36.4% of pattern II and 4.6% of pattern III. He introduced a newer parameter where the femoral or the profunda femoris artery may give rise to the lateral circumflex's femoral arteries descending branch.

Keen (1961) He studied 280 limbs out of which 42% were of pattern I and 51% were of pattern II and 7% were of pattern III.

Cunningham's Textbook of Anatomy, G.J. Romanas (1964) stated "the lateral circumflex femoral artery springs from the profunda femoris artery

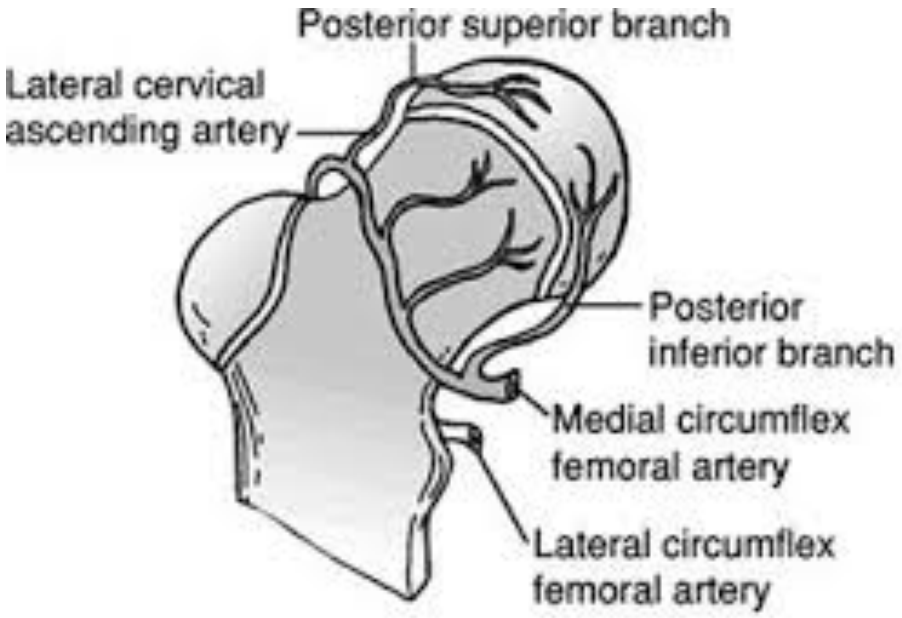


FIGURE 8: CIRCUMFLEX BRANCHES OF DEEP FEMORAL ARTERY

near its origin or occasionally from the femoral artery proximal to the origin of the profunda femoris artery. The medial circumflex femoral artery arises from the profunda femoris artery at the same level as the lateral circumflex femoral artery".

Gulliet et al (1979) in his study of 90 limbs 63.3% were of pattern I and 33.3% were of pattern II and 1.1% were of pattern III.

Siddharth et al (1985) He had done the study in 100 specimens and quoted that 70% of branching patterns of profunda femoris were of pattern I.

Bergman RT et al (1996) studied 123 cases and found that in 200 lower limbs the origin of lateral and medial circumflex arteries was from the profunda femoris artery. They also found that in 41 cases that the medial circumflex artery originated from the femoral artery and in about 29 cases they found the lateral circumflex artery arising from the femoral artery.

Massoud and Fletcher (1999)In his study found that out of 188 lower limb specimens, in 83.8% both lateral and medial circumflex arteries arose from profunda femoris artery that is pattern I, 9.2% fall under pattern II and 6.6% fall under pattern III.

Vazquezet al (2007) in the study of 221 human cadavers the branching pattern of type I was 78.8% and pattern II was 20.5% and 0.5% were of pattern III.

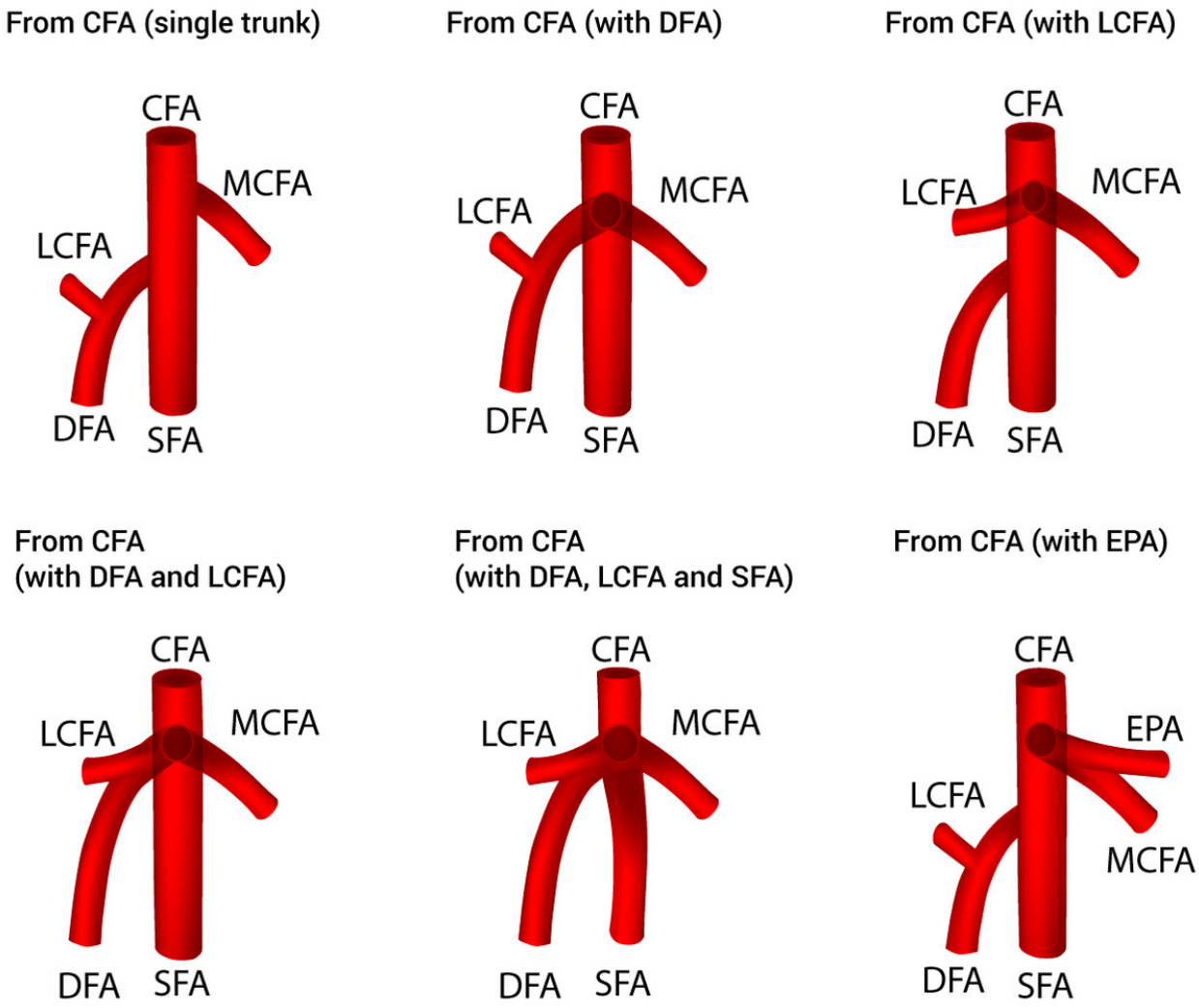


FIGURE 9: VARIOUS BRANCHING PATTERNS OF CIRCUMFLEX BRANCHES OF PROFUNDA FEMORIS ARTERY

Daksha Dixit et al (2011) in their study of 228 lower limbs, found that in 53 cases the medial circumflex femoral artery separated from the femoral artery. They also found the lateral circumflex femoral artery separated from the femoral artery in just 18 cases.

Study done by Professor R.Chitra and K.S.N.Prasad (2015)published in International Journal of Anatomy and Researches .The patterns of circumflex femoral arteries mostly coincided with that of Williams et al. Branching pattern of circumflex femoral arteries were of pattern I in 56%,pattern II in 36% and pattern III was 8%.

OBSERVATION

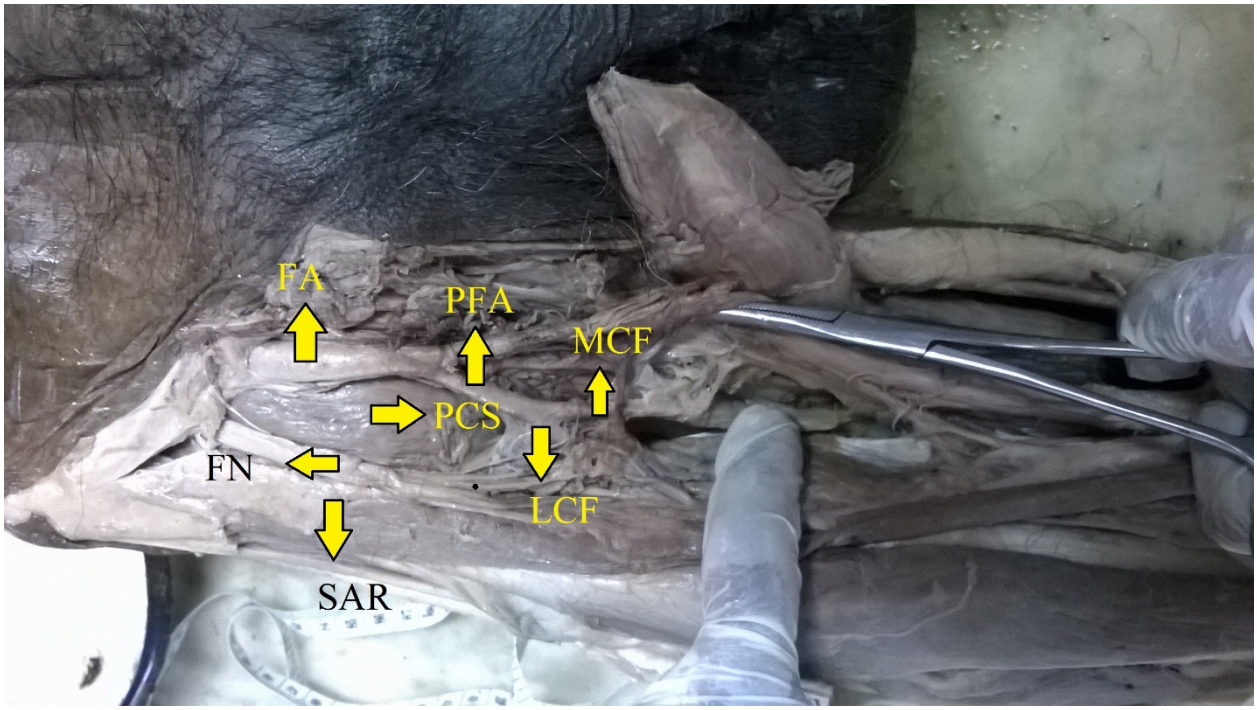
The site of origin, length, diameter, course, relations and branching pattern of profunda femoris artery were studied by

a) Dissection method- 40 Specimens
b) Radiological study - From lower limb computerized tomographic angiogram-10 Images

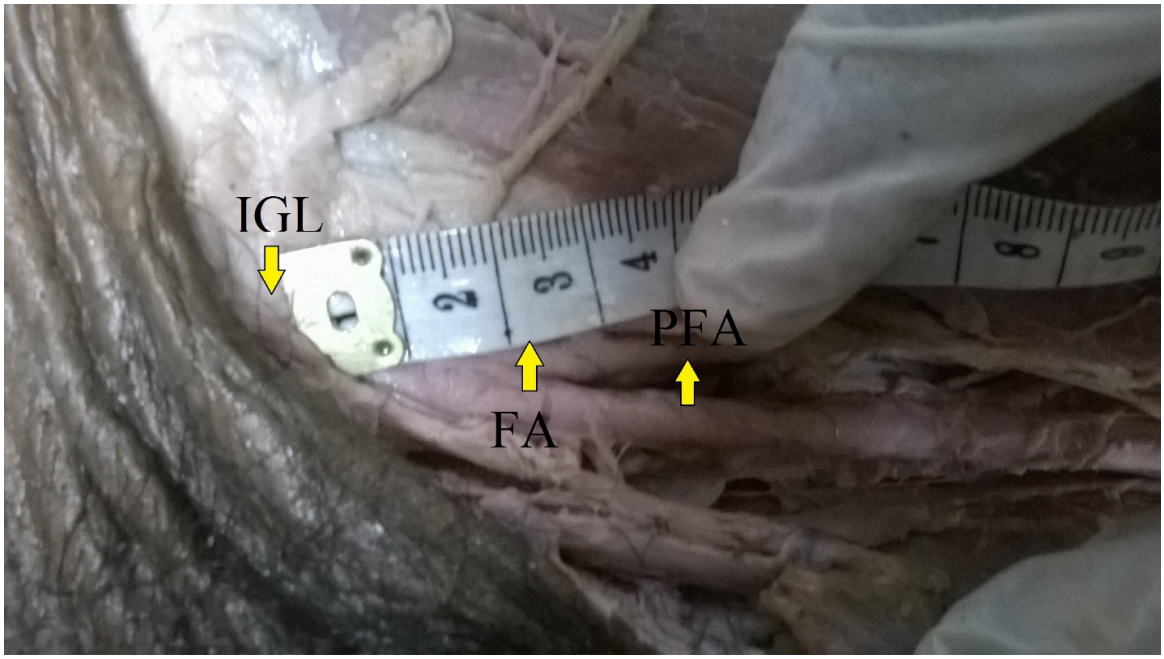
The observations were summarized in accordance with the parameters taken for the study.

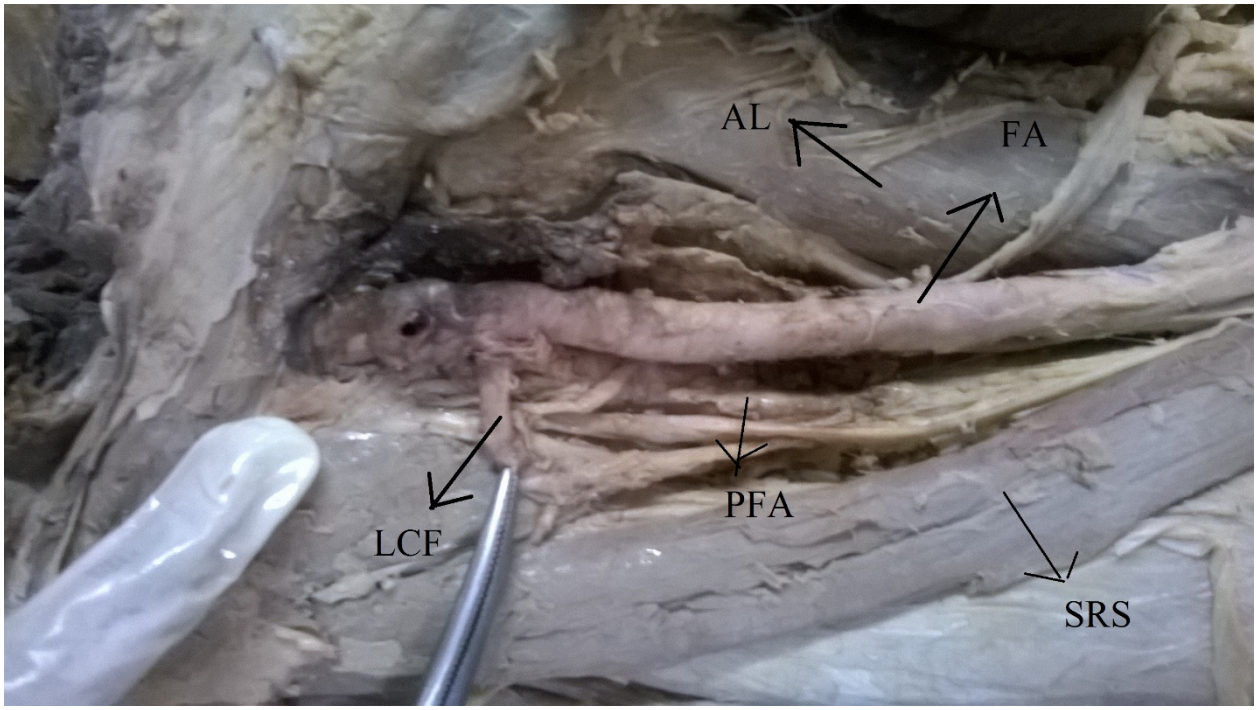
1. A) ORIGIN OF PROFUNDA FEMORIS ARTERY

In this study of 40 specimens, the profunda femoris artery originated from femoral artery in all cases, from its posterolateral aspect. The above mentioned observation has been tabulated in **Table 1, Specimen 1, 2&3.**



SPECIMEN 1 SHOWING BRANCHES OF PROFUNDA FEMORIS ARTERY AT FEMORAL TRIANGLE. PCS-PECTINIUS SAR-SARTORIUS FA-FEMORALARTERY FN-FEMORAL NERVE LCF-LATERAL CIRCUMFLEX FEMORAL MCF-MEDIAL CIRCUMFLEX FEMORA





SPECIMEN 2 &3 SHOWING HIGH ORIGIN OF PROFUNDA FEMORIS ARTERY SRS-SARTORIUS PFA-PROFUNDA FEMORIS ARTERY AL-ADDUCTOR LONGUS

SITE OF ORIGIN OF PROFUNDA FEMORIS ARTERY

S.NO	Total number of Adult specimens (40)			
	Right Side(20)	%	Left Side(20)	%
1.From posterolateralaspect of femoral artery	20	100	20	100
2.Other modes of origin	-	-	-	-

TABLE 1

1. B) DISTANCE FROM MIDINGUINAL POINT

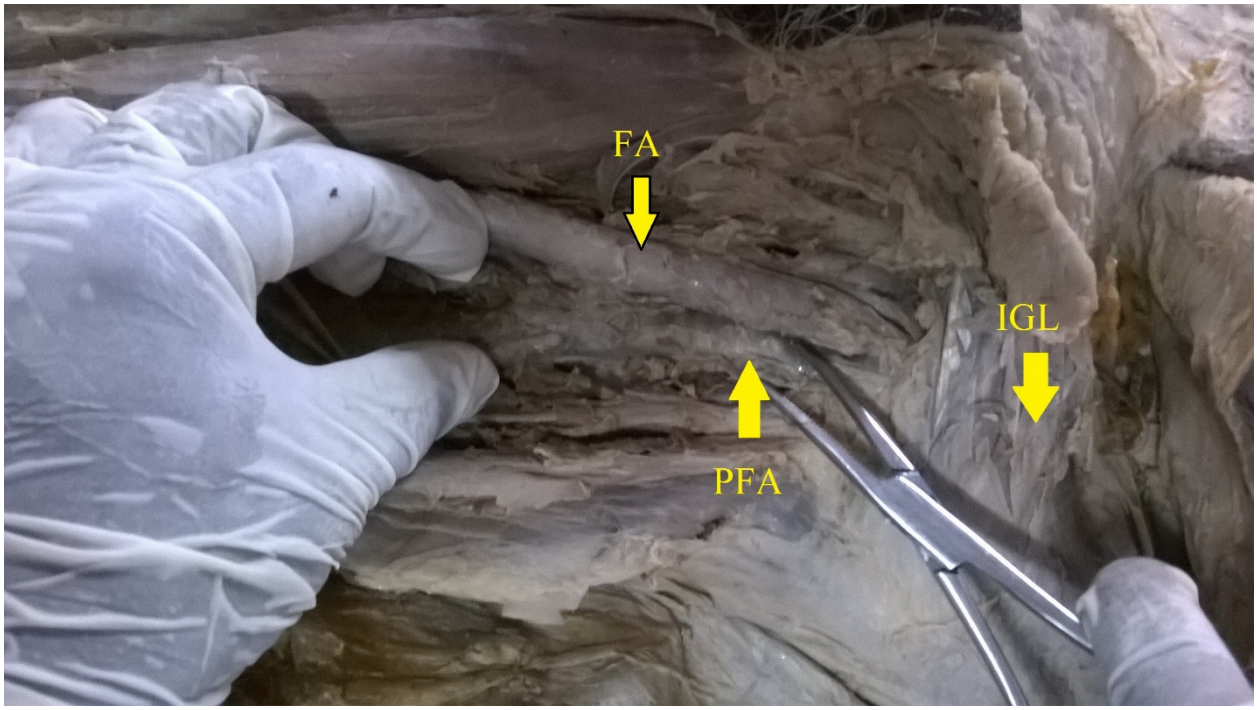
In this study of 40 lower limb specimens the average distance from mid-inguinal point was 3.95 centimeters. In two specimens, the profunda femoris artery took origin from femoral artery at 2centimeters from mid-inguinal point that is 5%. In 1 specimen the distance was 2.5 centimeters from mid inguinal point that is 2.5% and in another specimen it was 2.7 centimeters that is 2.5%. The above mentioned observation has been tabulated in table 2 & chart 1, 2.

DISTANCE FROM MID INGUINAL POINT

S.no	Distance (mm-millimeters)	Total number of adult specimens(40)			
		Right Side (20)	%	Left Side (20)	%
1	20-30mm	2	10	2	10
2	30-40 mm	7	35	6	30
3	40-50 mm	9	45	8	40
4	50-60 mm	2	10	4	10

TABLE 2

In this study the average distance from mid inguinal point to origin profunda femoris artery from femoral artery, on right side was 38millimeters and on left side was 41millimeters.



SPECIMEN 4 & 5 SHOWING THE HIGH ORIGIN OF PROFUNDA FEMORIS ARTERY IGL-INGUINAL LIGAMENT FA- FEMORAL ARTERY PFA- PROFUNDA FEMORIS

DISTANCE FROM MID INGUINAL POINT

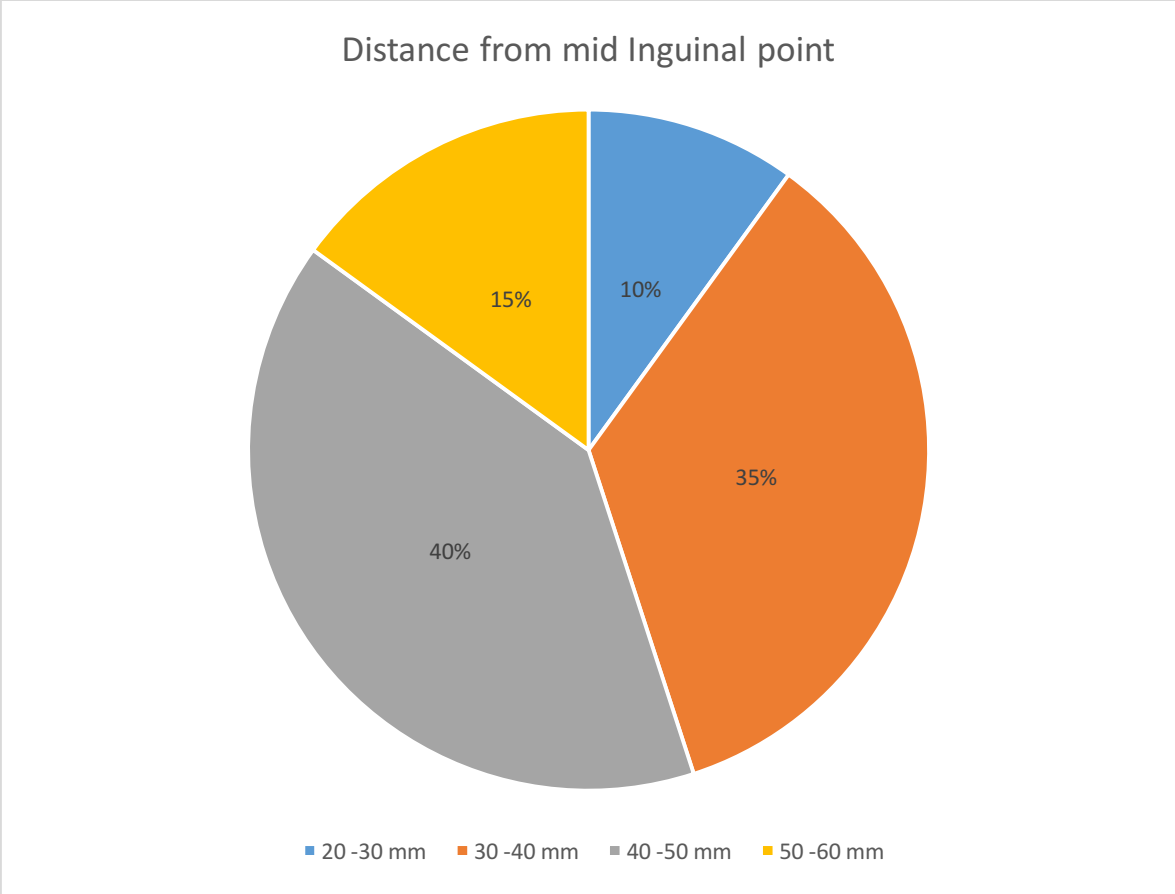


CHART 1

DISTANCE FROM MID INGUINAL POINT

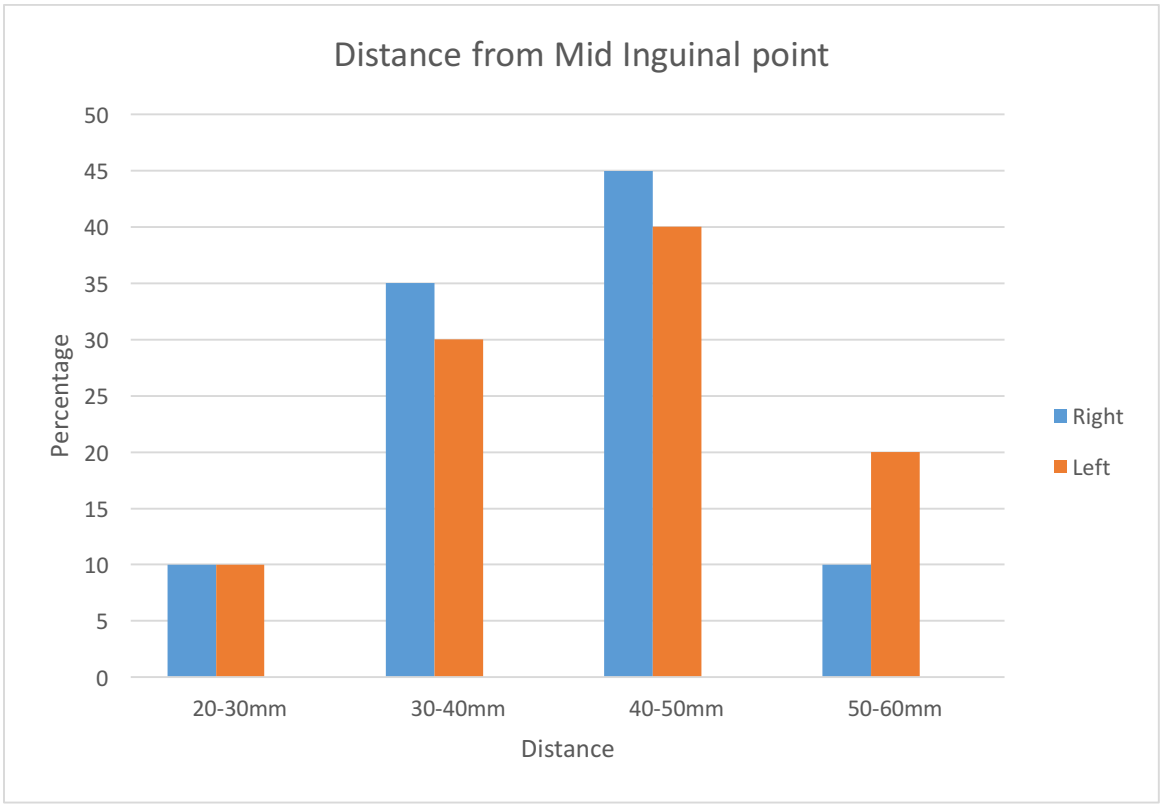


CHART 2

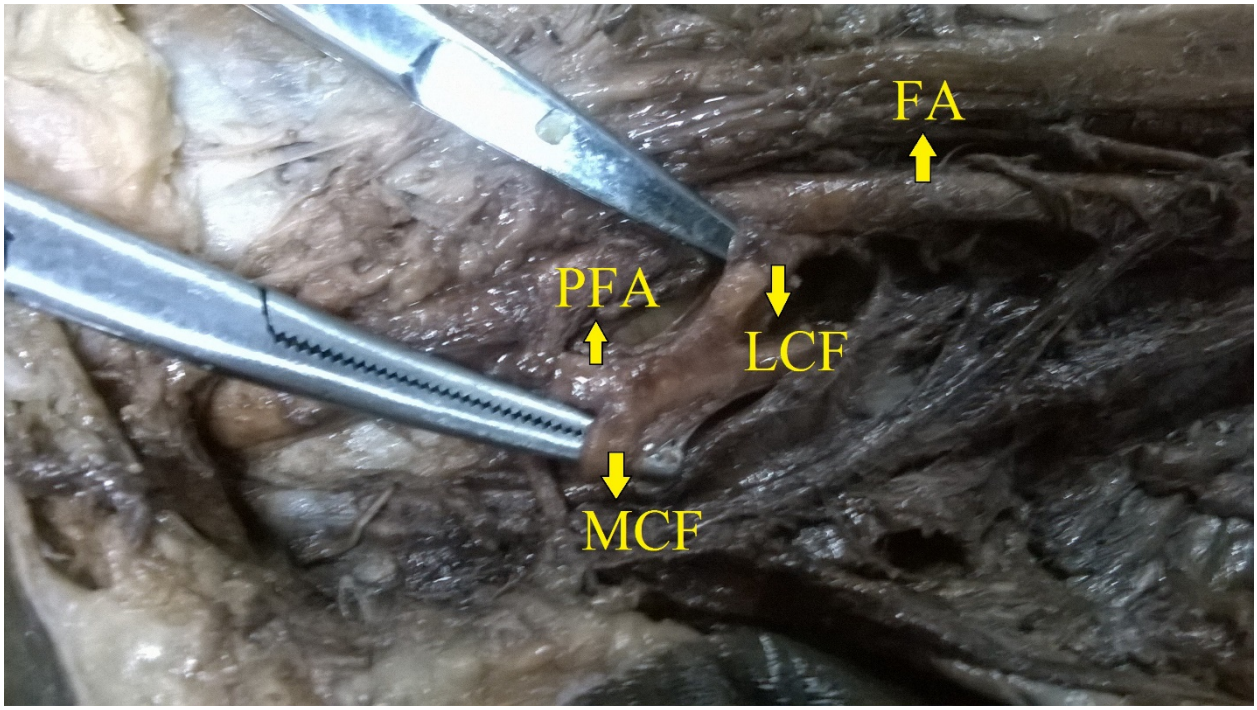
2 A) SITE OF ORIGIN OF ITS BRANCHES

In this study of 40 specimens' medial circumflex femoral artery originated from femoral artery in all specimens, whereas lateral circumflex femoral artery originated from femoral artery in 2 specimens which is 5%. In 2 specimens the branches of the lateral circumflex femoral artery arose from femoral artery directly which is 5%. The above observations have been tabulated in **table 3, 4, chart 3 & specimen 11.**

SITE OF ORIGIN OF LATERAL CIRCUMFLEX FEMORAL ARTERY

S.no	Site of origin	Total number of specimens(40)			
		Right side (20)	%	Left Side cases(20)	%
1	From profunda femoris artery	18	90	19	95
2	From femoral artery as a common trunk	-	-	-	-
3.	From femoral artery	2	10	1	5
4.	Absent lateral circumflex femoral artery	-	-	-	.

TABLE 3



SPECIMEN 6 SHOWING THE MEDIAL AND LATERAL CIRCUMFLEX BRANCHES OF PROFUNDA FEMORIS ARTERY FA-FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTERY LCF-LATERAL CIRCUMFLEX FEMORAL ARTERY MCF-MEDIAL CIRCUMFLEX FEMORAL

SITE OF ORIGIN OF LATERAL CIRCUMFLEX FEMORAL ARTERY

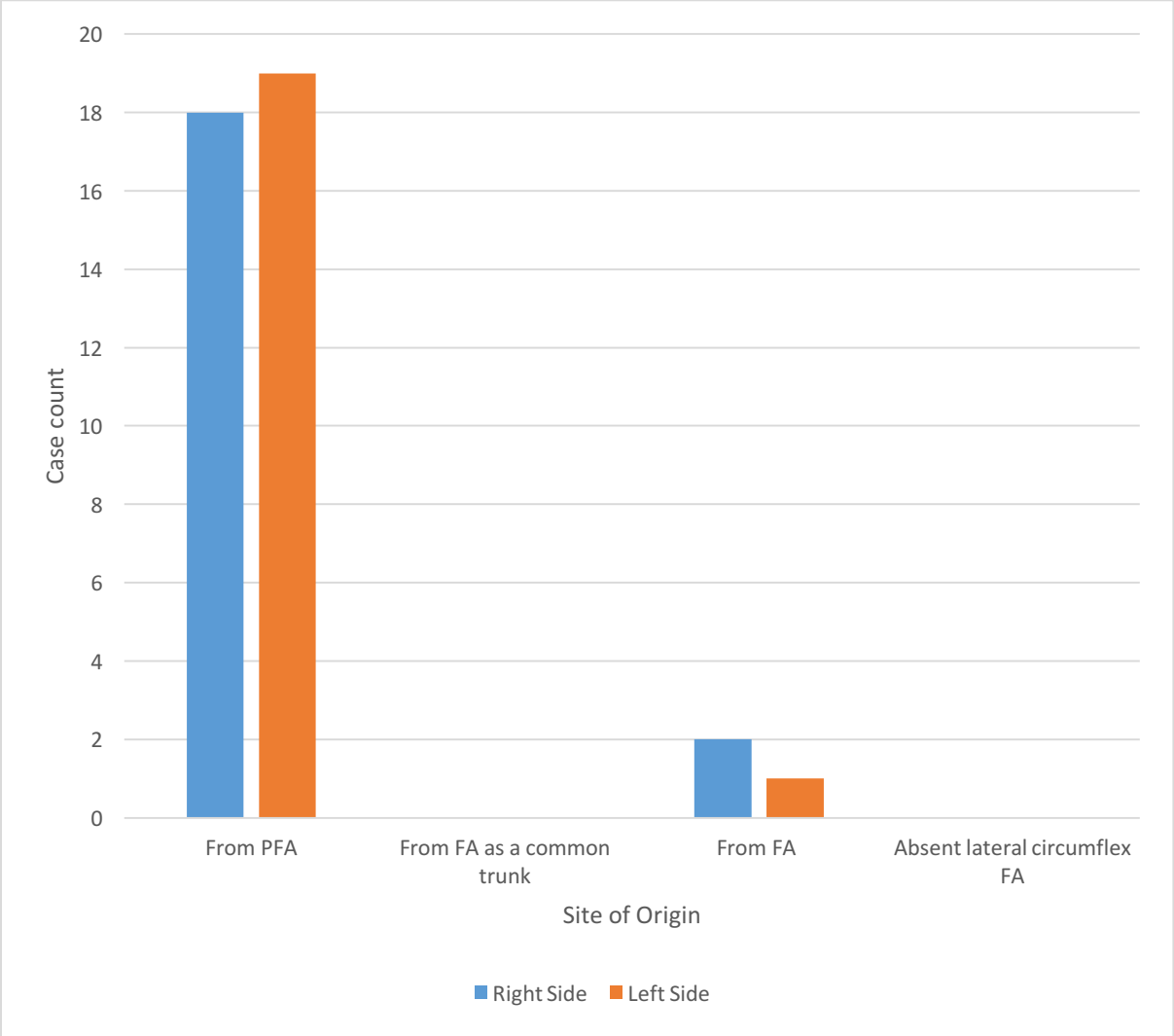


CHART 3

SITE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

S.no	Site of origin	Total number of specimens(40)			
		Right side (20)	%	Left Side cases(20)	%
1	From profunda femoris artery	20	100	20	100
2	From femoral artery as a common trunk	-	-	-	-
3.	From femoral artery	-	-	-	-
4.	Absent medial circumflex femoral artery	-	-	-	.

TABLE 4

2. B) DISTANCE OF ORIGIN OF LATERAL CIRCUMFLEX FEMORAL ARTERY FROM THE ORIGIN OF PROFUNDA FEMORIS ARTERY

The average distance of origin of lateral circumflex femoral artery from the origin of profunda femoris artery in this study was between 1 -3 centimeters.

The above mentioned observations have been tabulated in **table 4 and Chart 4 and 5.**

DISTANCE OF ORIGIN OF LATERAL CIRCUMFLEX FEMORAL ARTERY

Distance(mm-millimeters)	Total number of adult specimens (40)	
	Right Side(20)	Left side(20)
0-10	1	-
11-20	13	15
20-30	6	5

TABLE 5

DISTANCE OF ORIGIN OF LATERAL CIRCUMFLEX FEMORAL ARTERY

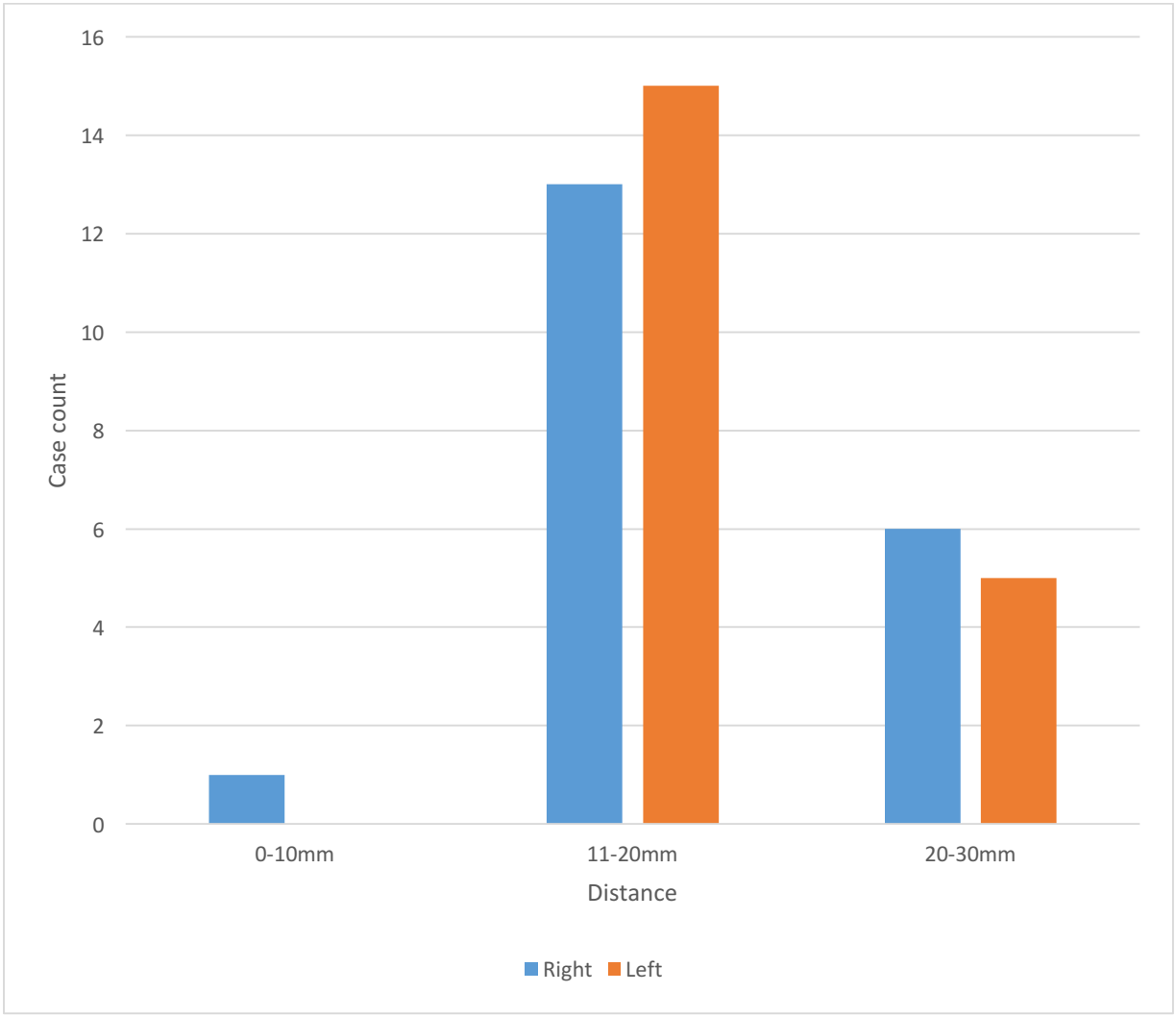


CHART 4

DISTANCE OF ORIGIN OF LATERAL CIRCUMFLEX FEMORAL ARTERY

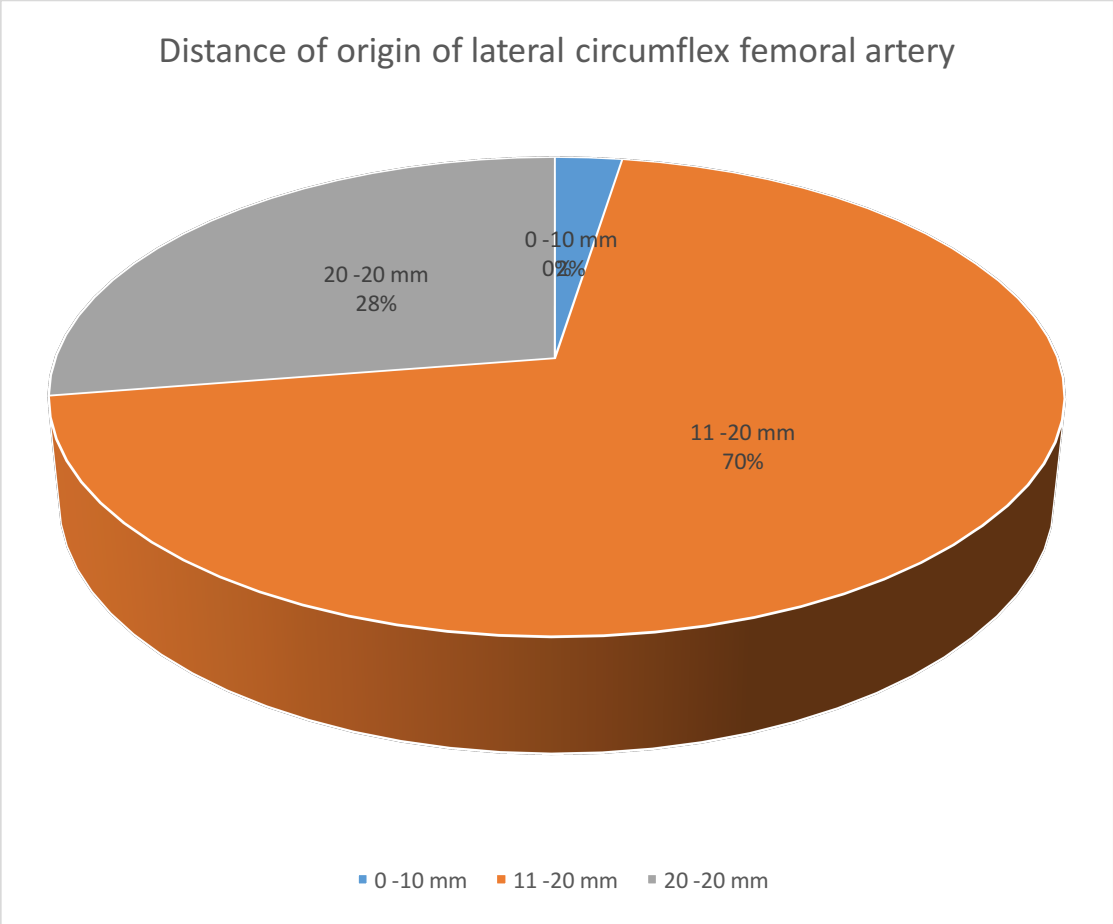


CHART 5

DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX ARTERY FROM THE PROFUNDA FEMORIS ARTERY

The average distance of origin of medial circumflex femoral artery from profunda femoris artery was between1-3 centimeters. The above mentioned observations has been tabulated in **table 5 & chart 6, 7.**

DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

Distance(mm)	Total Number of specimens(40)	
	Right Side(20)	Left Side(20)
0-10	-	-
11-20	8	6
21-30	12	14
31-40	-	-
41-50	-	-

TABLE 6

DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

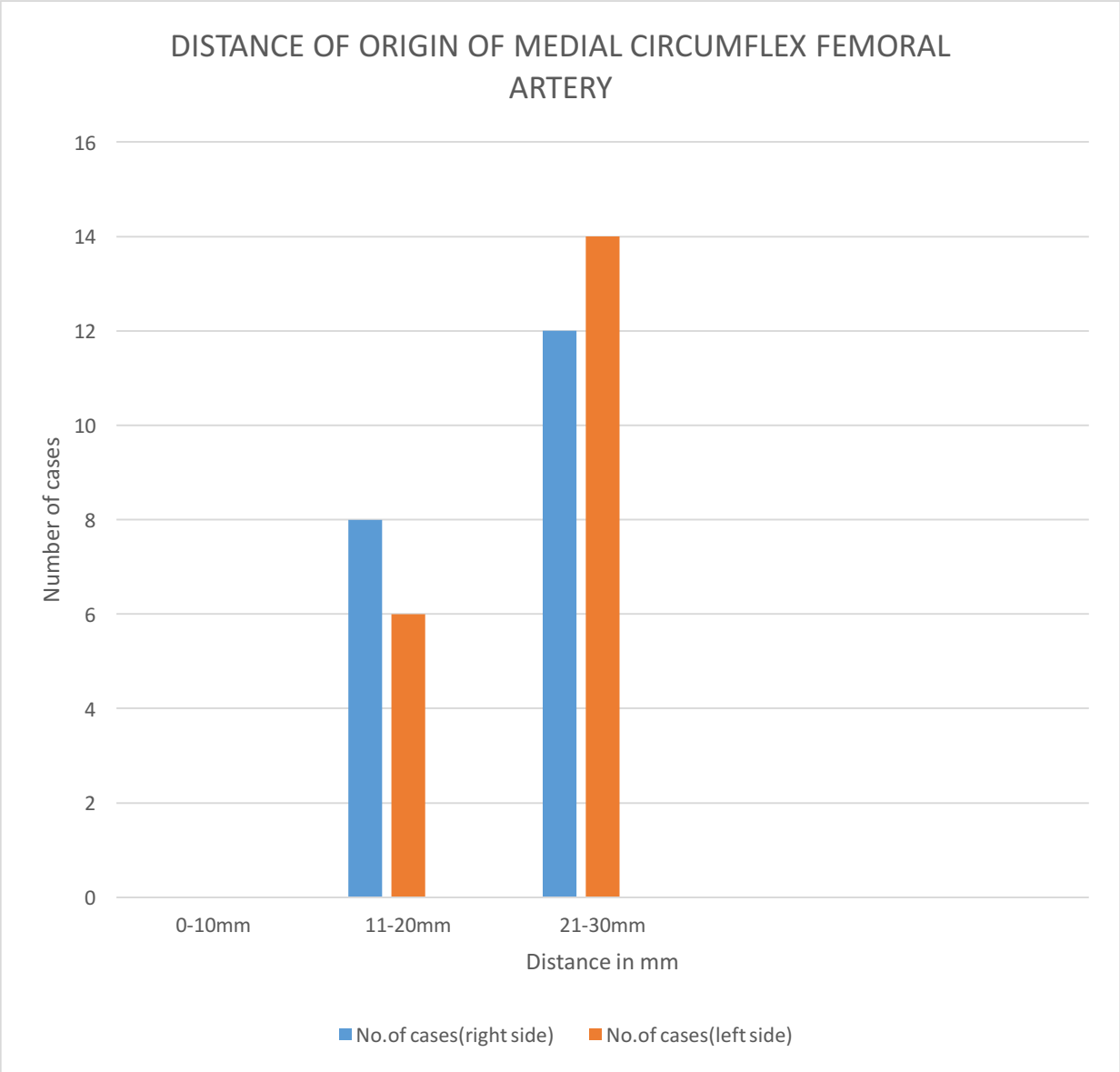
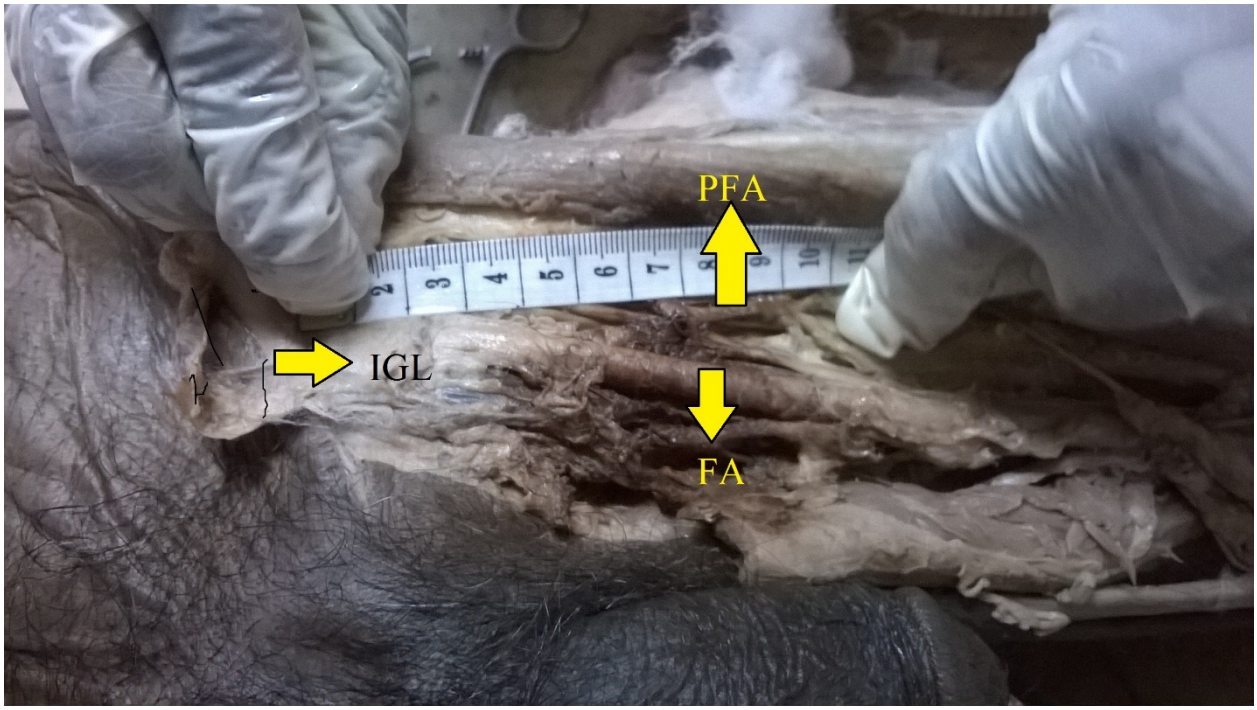


CHART 6



SPECIMEN 7 SHOWING THE MEASUREMENT OF LENGTH OF PROFUNDA FEMORIS ARTERY FROM ITS ORIGIN TO FIRST PERFORATOR .IGL-INGUINAL LIGAMENT FA-FEMORAL ARTERY PFA PROFUNDA FEMORIS ARTERY

DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

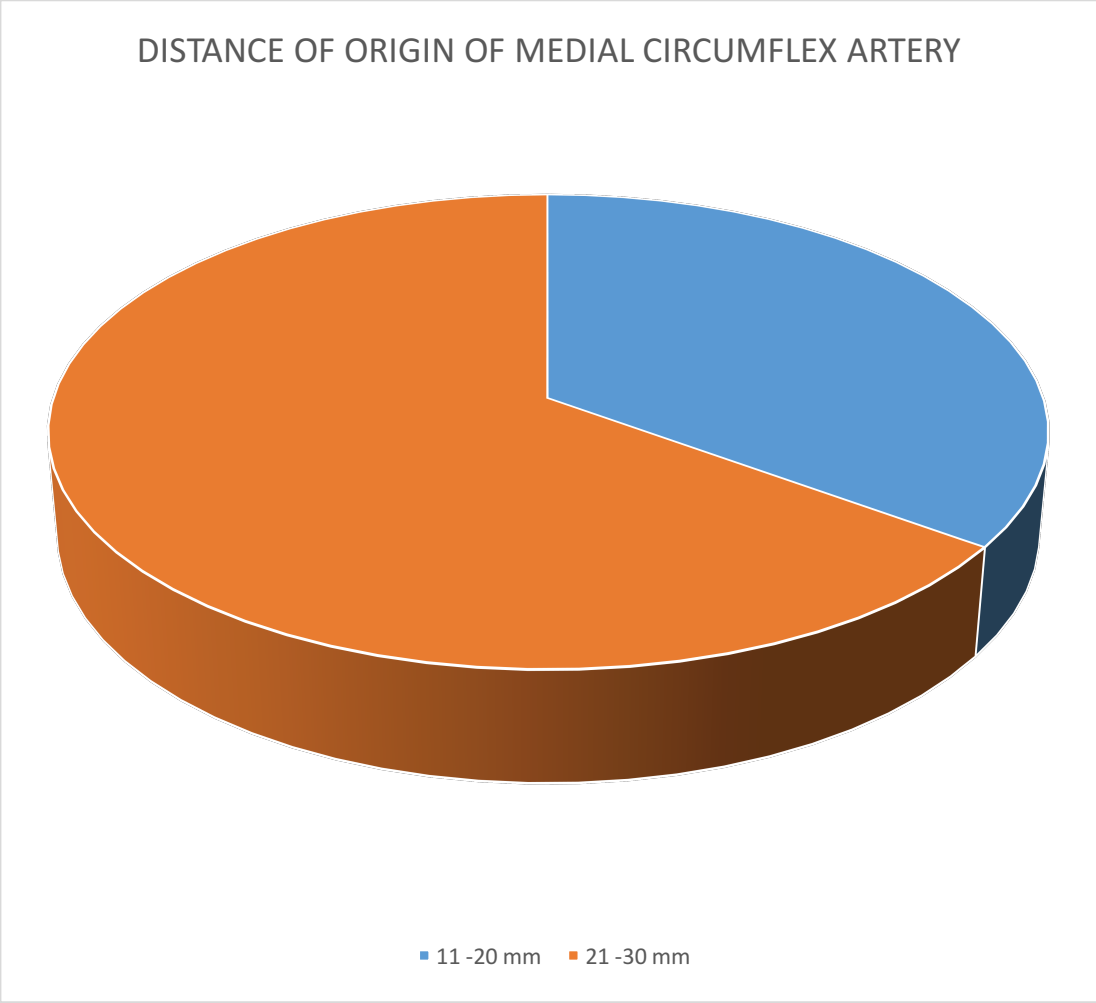


CHART 7

2. A) LENGTH OF THE PROFUNDA FEMORIS ARTERY:

The length of the profunda femoris artery was measured (in centimeters) from its origin to the first perforating branch, using measuring tape in all the specimens. In the present study the average length of the profunda femoris artery in adult cadavers was 11.5 centimeters. The above mentioned observations has been tabulated in **table 7 & chart 8, 9, specimen 8.**

LENGTH OF THE PROFUNDA FEMORIS ARTERY

s.no	Range Length in centimeters	Adult specimens(40)			
		Right Side(20)	%	Left Side(20)	%
1	10-11	7	17.5	6	15
2	11-12	8	20	10	25
3	12-13	5	12.5	4	10

TABLE 7

LENGTH OF THE PROFUNDA FEMORIS ARTERY

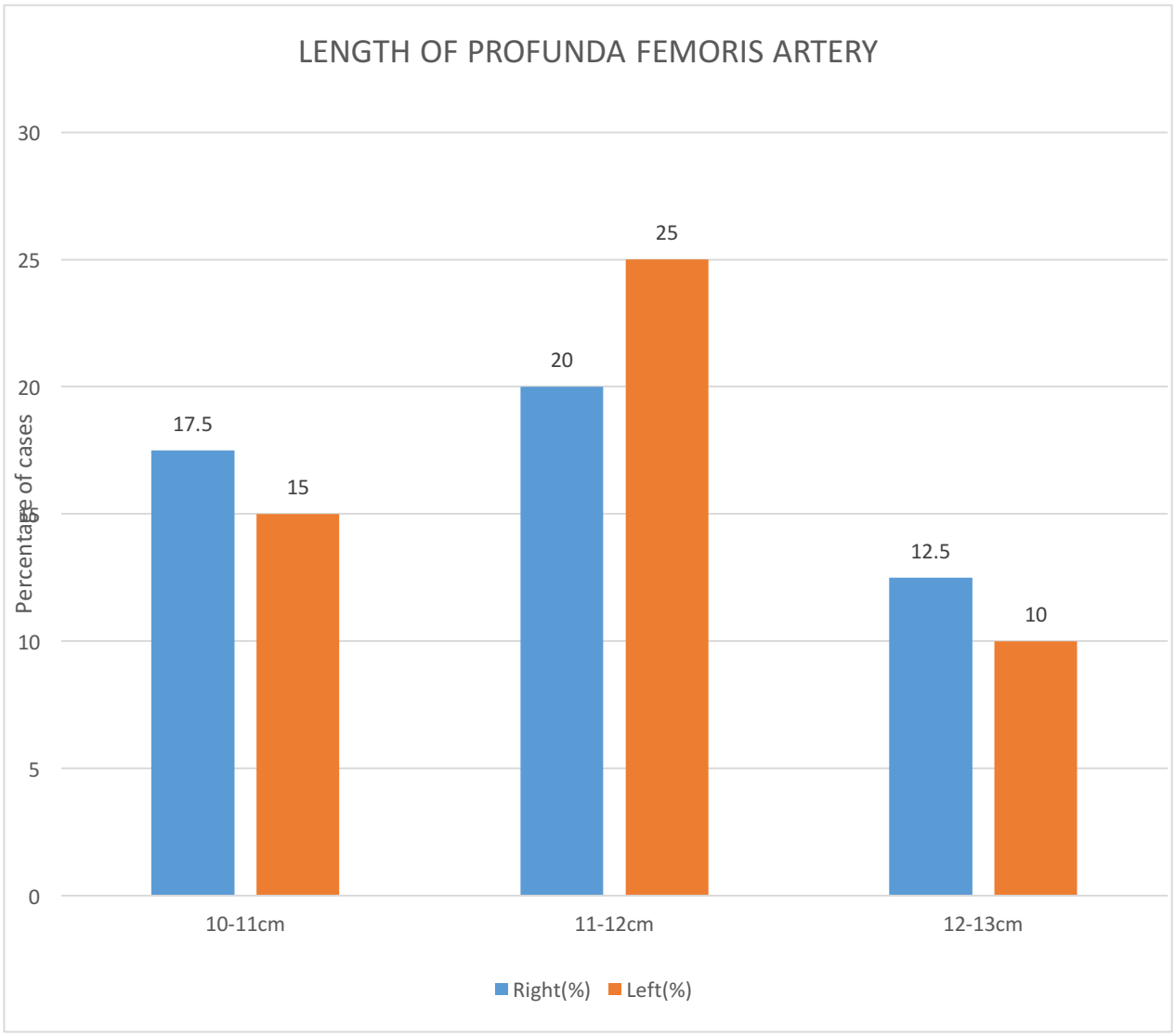


CHART 8

LENGTH OF THE PROFUNDA FEMORIS ARTERY

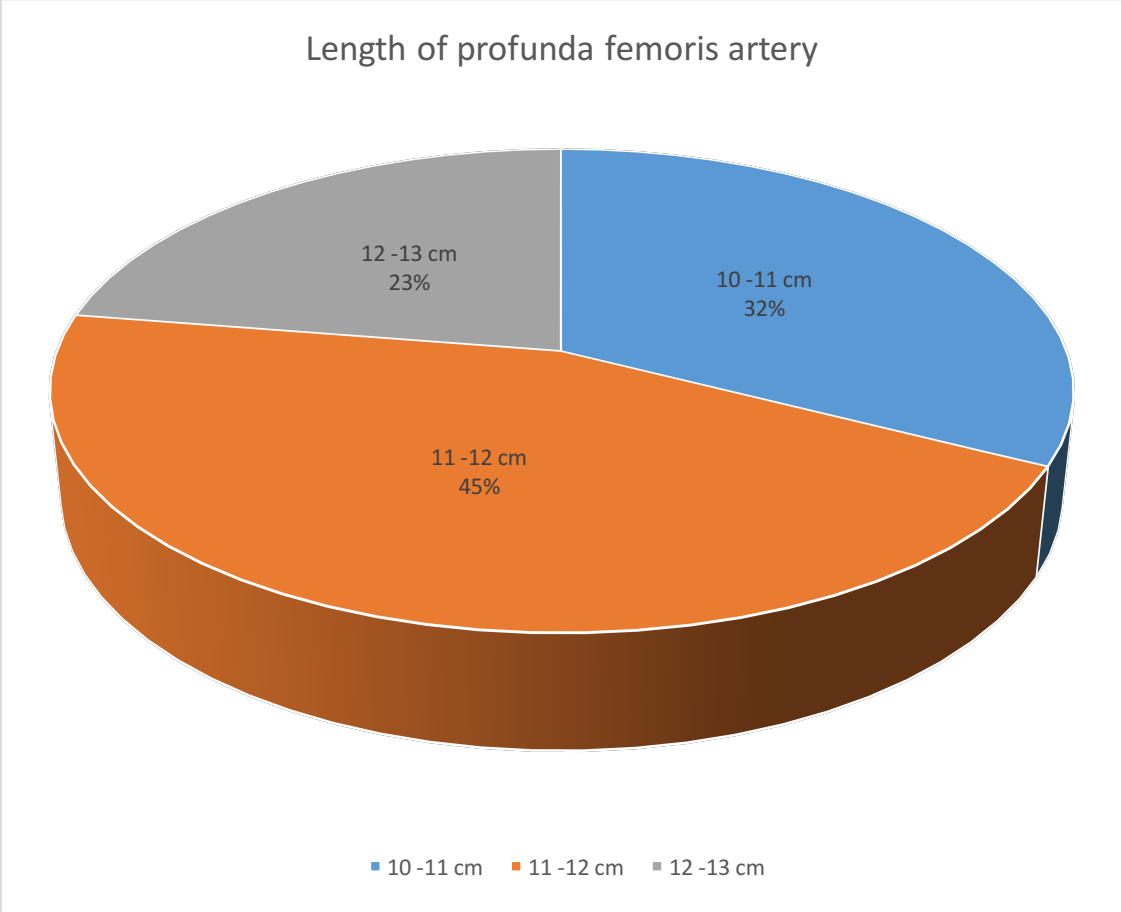
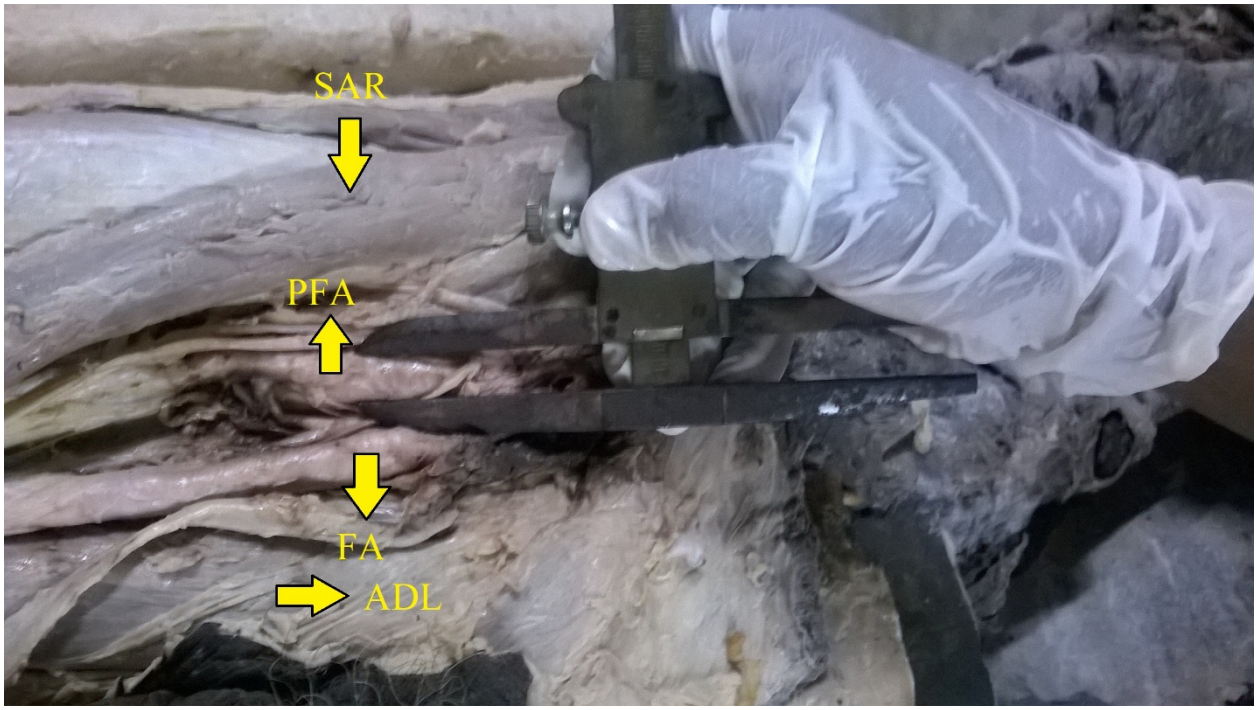


CHART 9



SPECIMEN 8 SHOWING THE MEASUREMENT OF DIAMETER OF PROFUNDA FEMORIS ARTERY ADL- ADDUCTOR LONGUS FA-FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTERY

3. B) DIAMETER OF PROFUNDA FEMORIS ARTERY:

The external circumference of profunda femoris artery was measured using standard caliper (Vernier caliper).

The average diameter of the profunda femoris artery in adult cadavers in the present study was 5.4millimeters. The mentioned observation has been tabulated in **table 8 & chart 10, 11, Specimen 9.**

DIAMETER OF PROFUNDA FEMORIS ARTERY

Diameter(Range) in mm	Total number of specimens(40)			
	Right Side(20)	%	Left Side(20)	%
4-5	-		4	10
5-6	15	37.5	11	27.5
6-7	5	12.5	4	10
7-8	-	-	1	2.5

TABLE 8

The average diameter of the profunda femoris artery was found to be 5.4millimeters in this study

DIAMETER OF PROFUNDA FEMORIS ARTERY

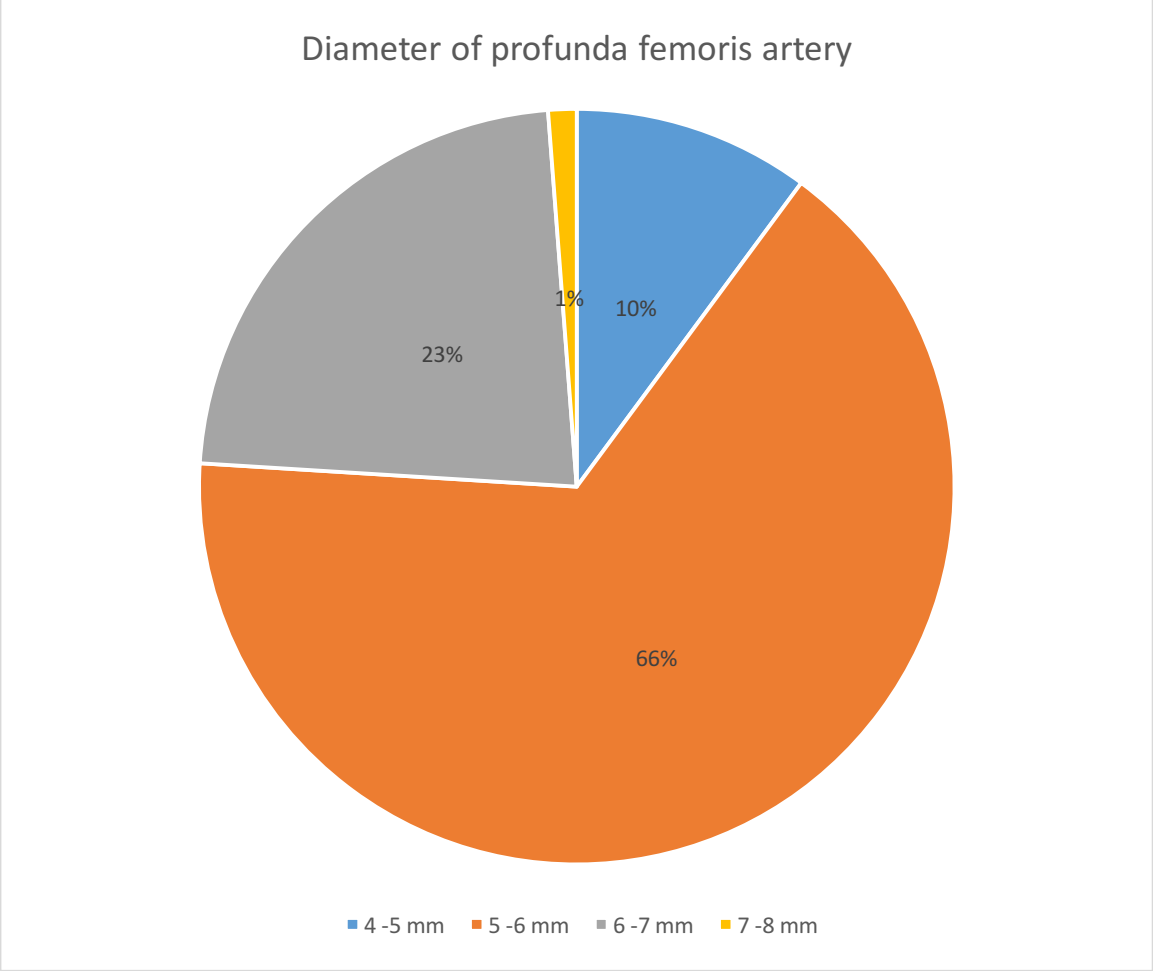


CHART 10

DIAMETER OF PROFUNDA FEMORIS ARTERY

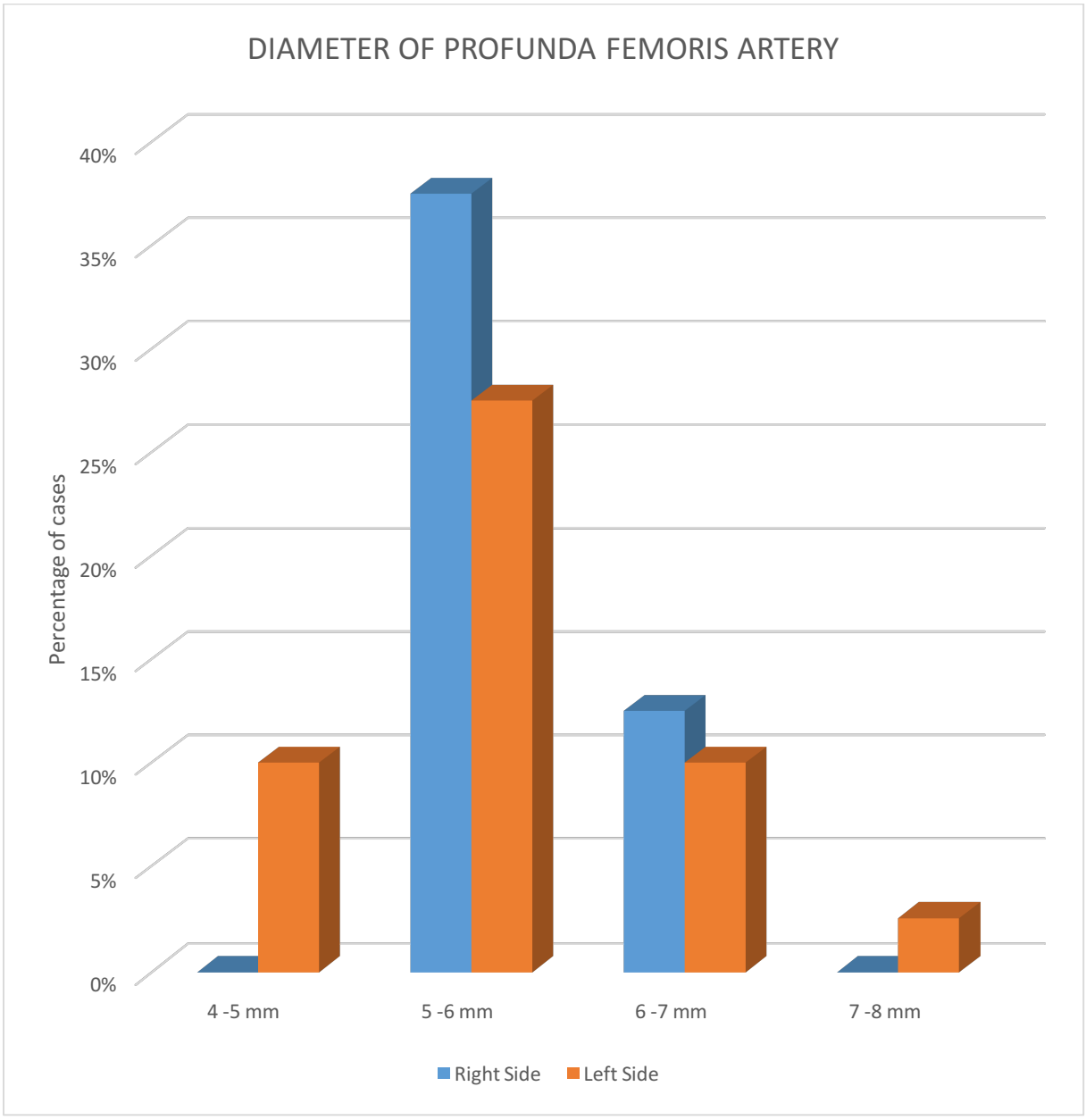
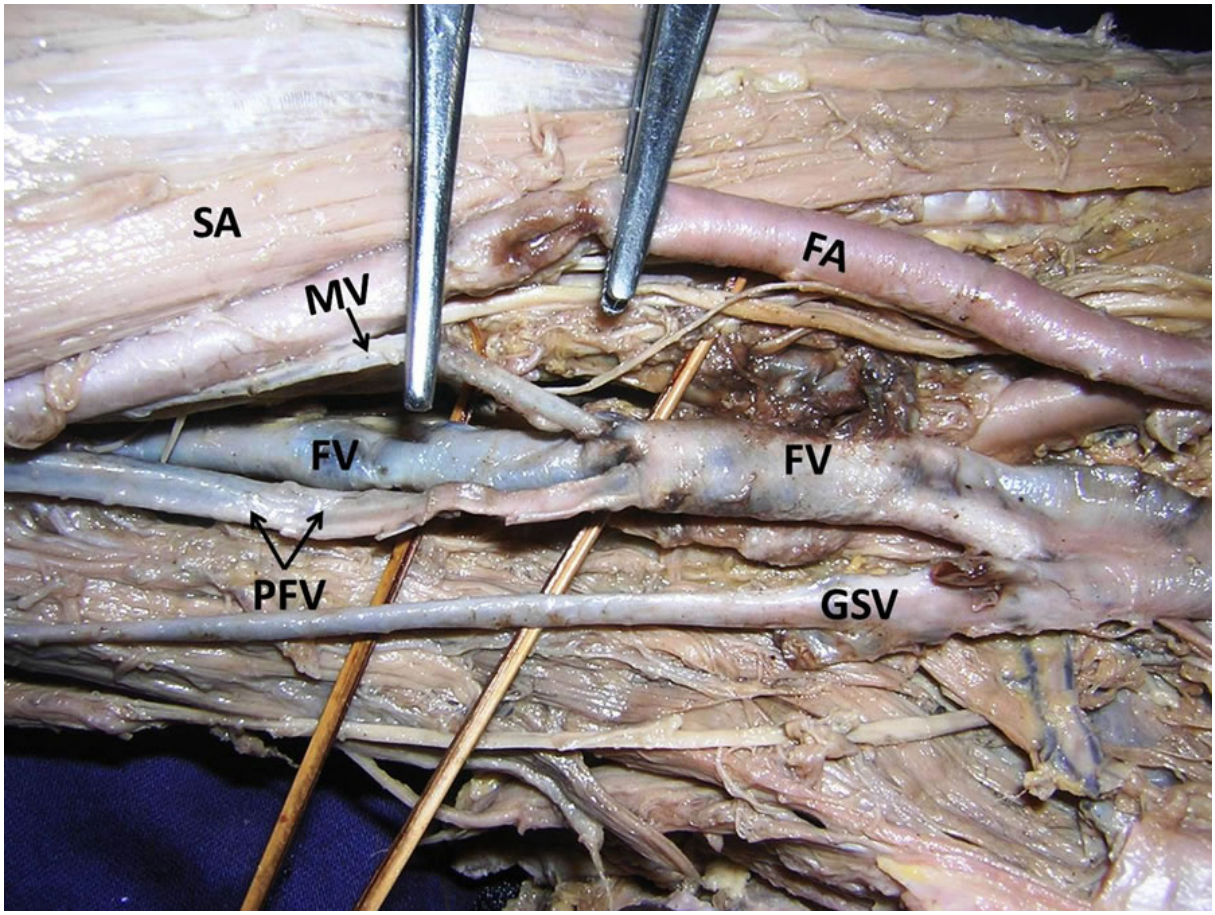


CHART 11



SPECIMEN 9 SHOWING THE RELATION OF FEMORAL VEIN AND PROFUNDA FEMORIS VEIN TO PROFUNDA FEMORIS ARTERY GSV-GREAT SAPHENOUS VEIN PFV-PROFUNDA FEMORIS VEIN FV-FEMORAL VEIN FA-FEMORAL ARTERY SA-SARTORIUS

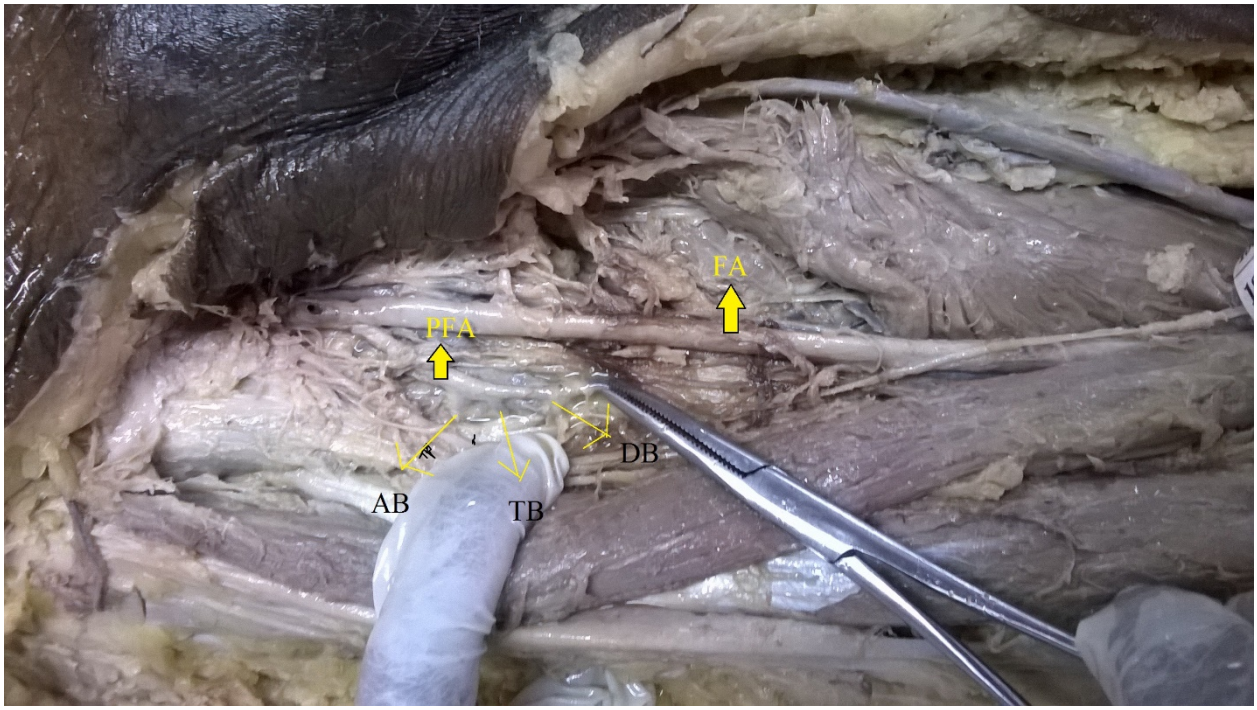
4) RELATION OF PROFUNDA FEMORIS ARTERY WITH FEMORAL ARTERY AND FEMORAL VEIN

In all the 40 specimens femoral artery and femoral vein were related superficially to the profunda femoris artery in all femoral triangles, no variations were found in this regard. The above mentioned observation has been tabulated in **table 9 & Chart 12, Specimen 7**

RELATION OF PROFUNDA FEMORIS ARTERY WITH FEMORAL ARTERY AND FEMORAL VEIN

S.no	Relation of femoral artery and vein	Total number of specimens(40)			
		Right Side (20)	%	Left Side (20)	%
1	profunda femoris artery lying superficial	-	-	-	-
2	profunda femoris artery lying deep	20	100	20	100

TABLE 9



SPECIMEN 10 SHOWING THE BRANCHES OF LATERAL CIRCUMFLEX FEMORAL ARTERY'S, BRANCHES ARISING DIRECTLY FROM PROFUNDA FEMORIS ARTERY AB-ASCENDING BRANCH TB-TRANSVERSE BRANCH DB-DESCENDING BRANCH FA –FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTERY

RELATION OF PROFUNDA FEMORIS ARTERY WITH FEMORAL ARTERY AND FEMORAL VEIN

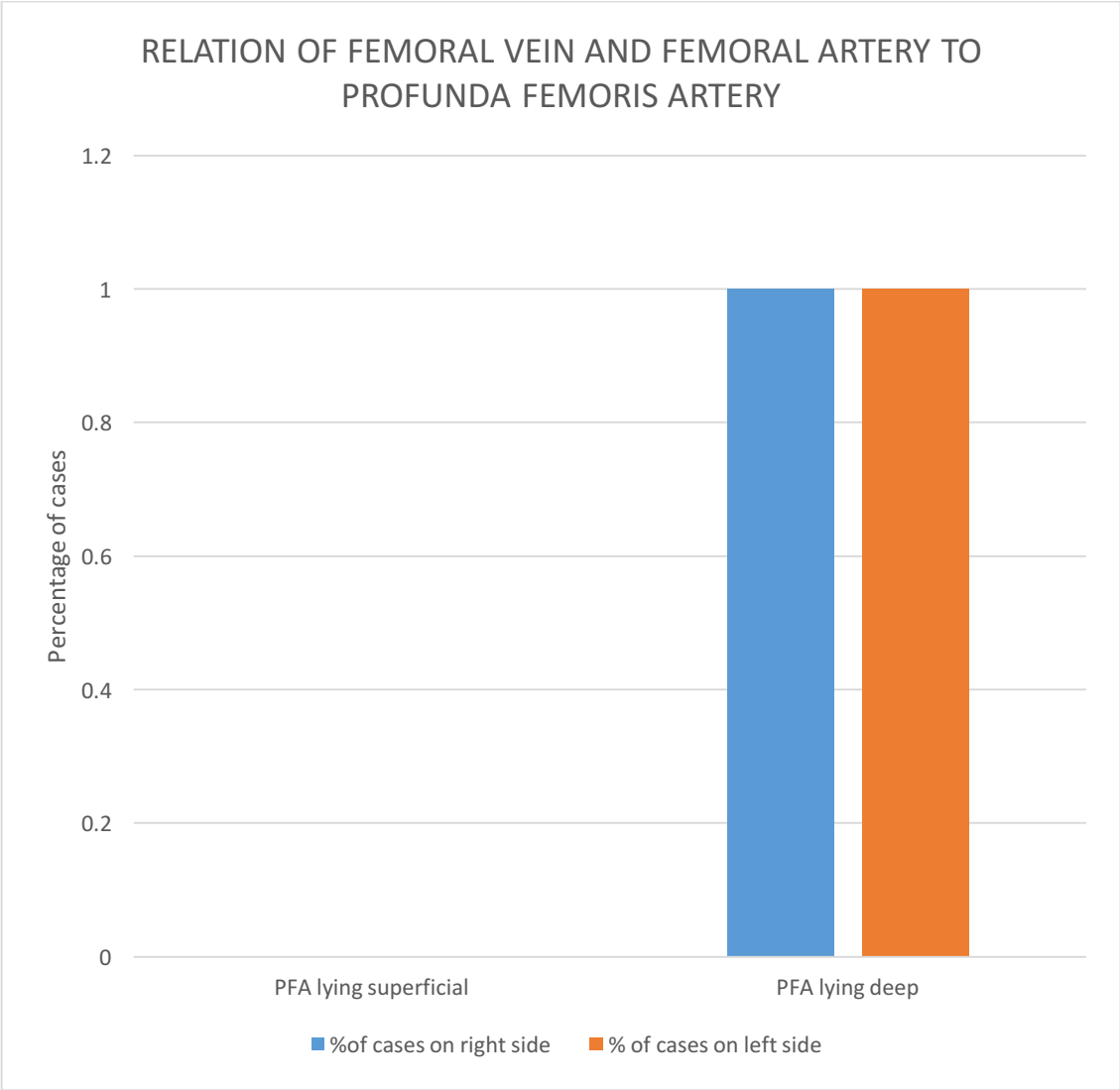
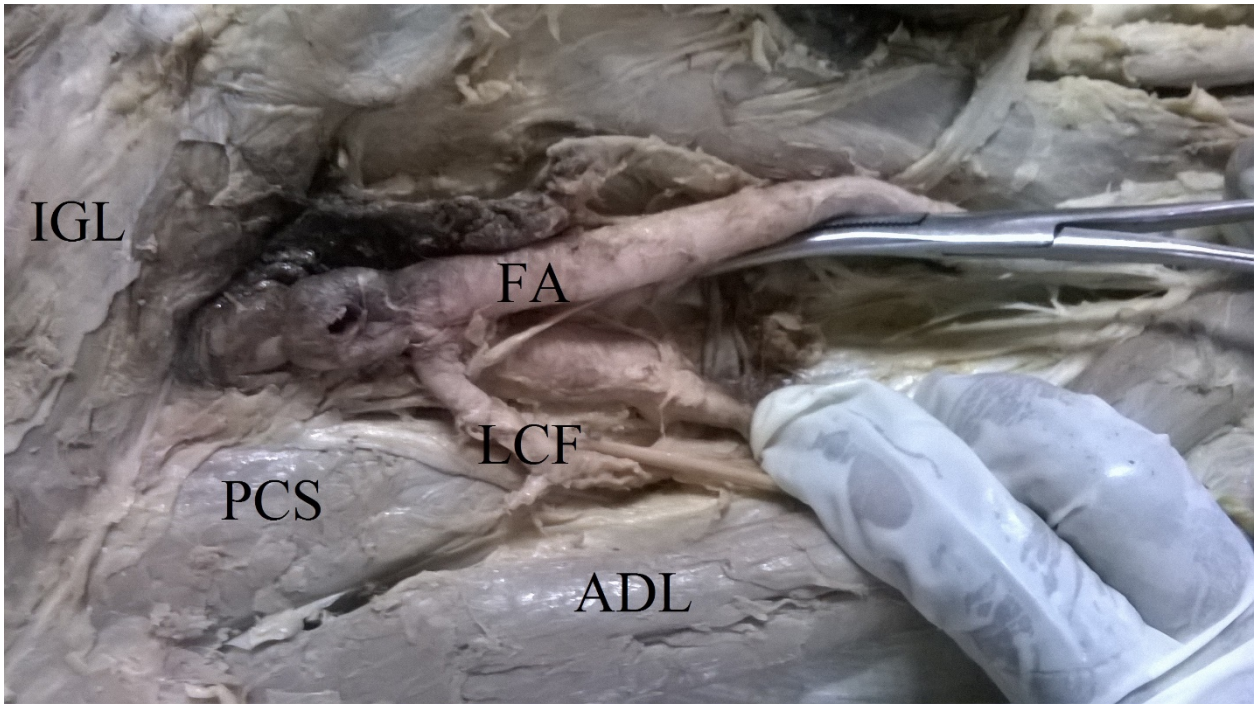


CHART 12



SPECIMEN 11: SHOWING LATERAL CIRCUMFLEX FEMORAL ARTERY ARISING DIRECTLY FROM FEMORAL ARTERY ADL-ADDUCTOR LONGUS IGL-INGUINAL LIGAMENT FA-FEMORAL ARTERY LCF –LATERAL CIRCUMFLEX FEMORAL PCS-PECTINIUS

5. COURSE OF THE ARTERY

In this study the profunda femoris artery has found to have normal course from its origin to the fourth perforating artery except in 4 specimens the branching pattern was different.

6. BRANCHING PATTERN:

1. In this study both medial and lateral circumflex femoral arteries arose from femoral artery in 36 specimens that is 90% is of pattern I. In 2 specimens the lateral circumflex femoral artery arose from femoral artery that is 5% of pattern III .In two specimens the ascending, descending and transverse branches of lateral circumflex femoral artery arose from femoral artery which is 5%.is of pattern III.

The above mentioned observation has been tabulated in **table 10 & Chart 13, 14, 15.**

BRANCHING PATTERN OF PROFUNDA FEMORIS ARTERY

Types	Total number of specimens(40)			
	Right Side(20)	%	Left Side (20)	%
Pattern I	16	90	20	100
Pattern II	-	-	-	-
Pattern III	4	10	-	-
Pattern IV	-	-	-	-

TABLE 10

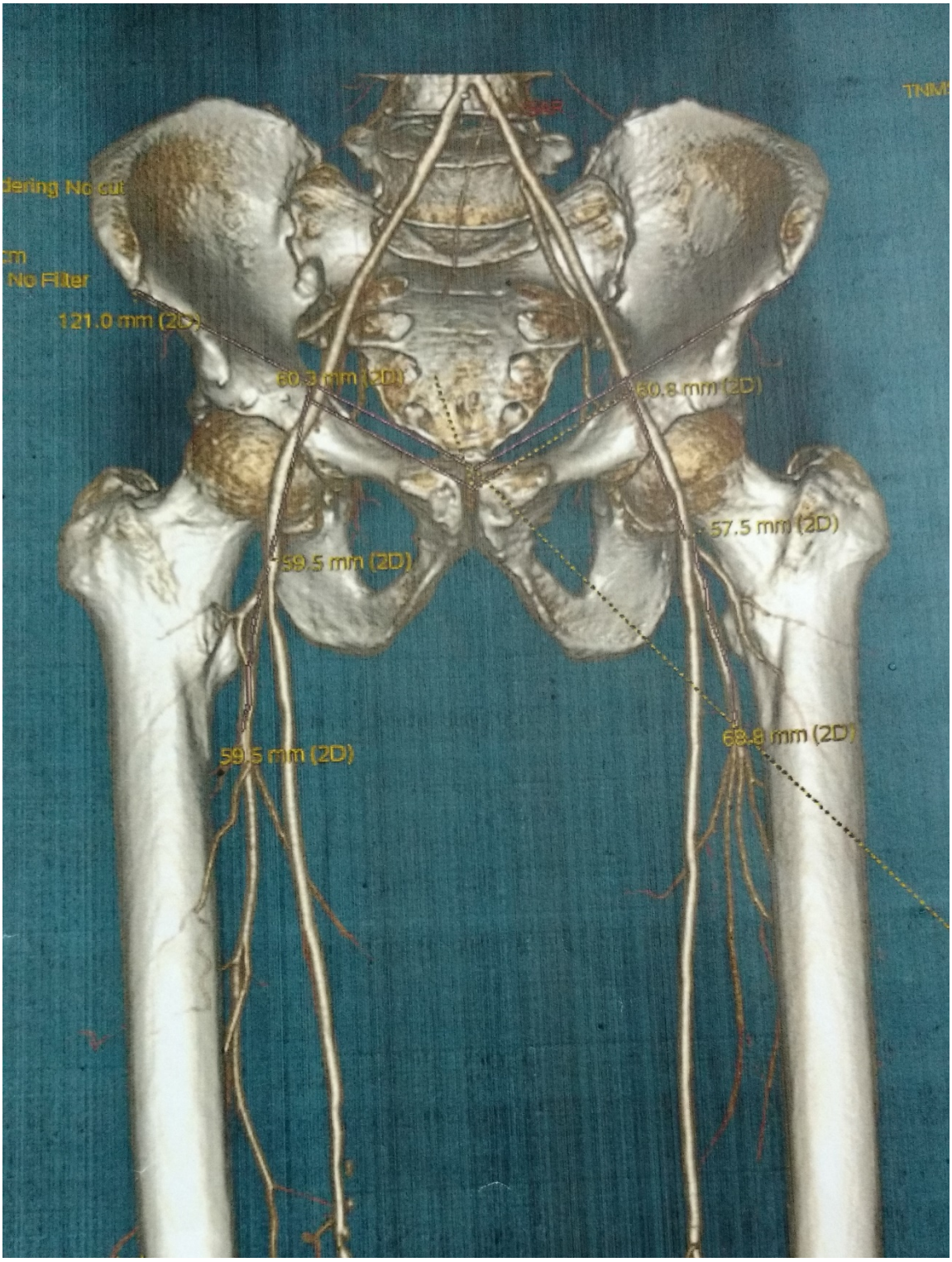


FIGURE 11: RADIOLOGICAL IMAGE- SHOWING THE MEASUREMENT OF DISTANCE OF ORIGIN OF PROFUNDA FEMORIS ARTERY FROM INGUINAL LIGAMENT

BRANCHING PATTERN OF PROFUNDA FEMORIS ARTERY

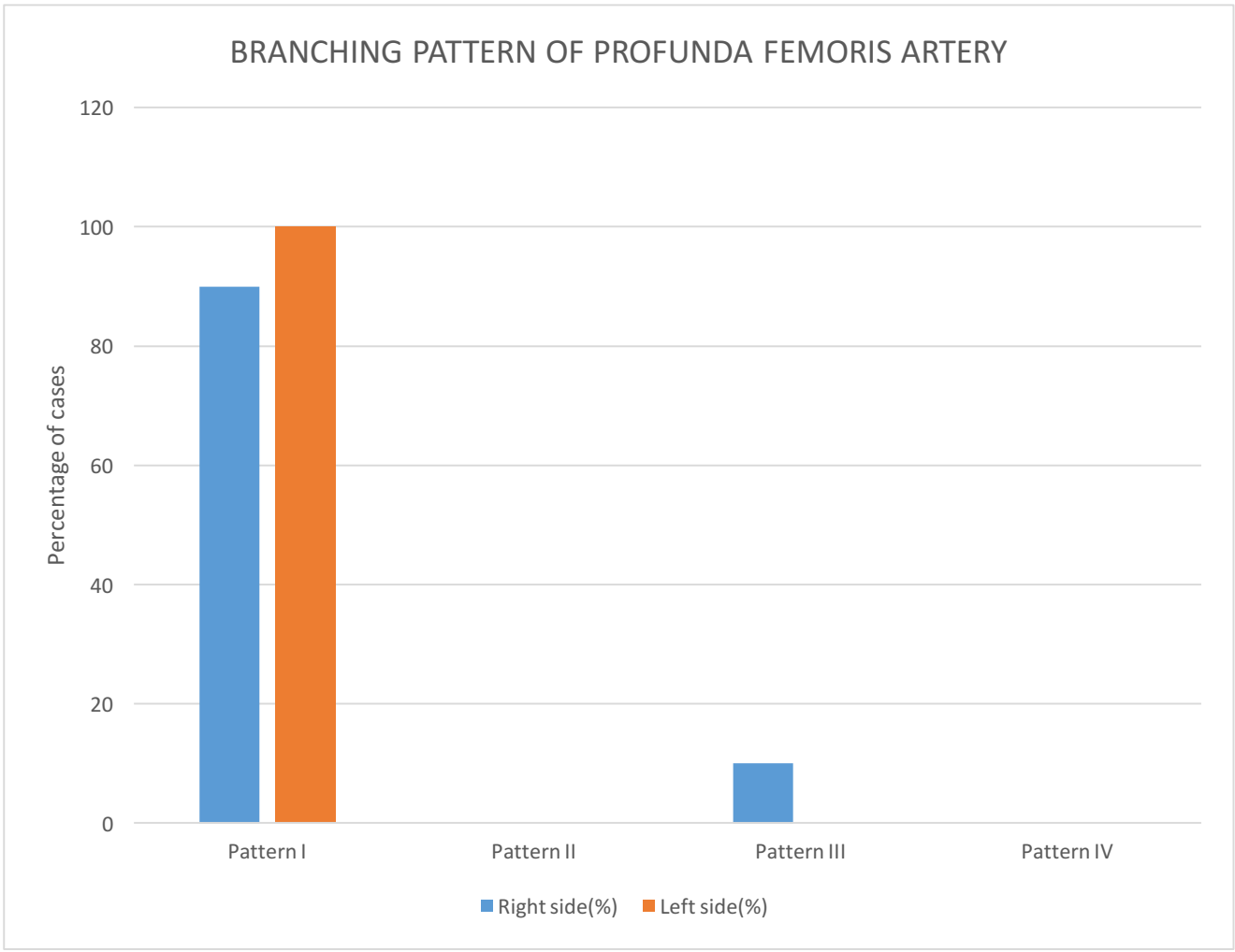


CHART 13

BRANCHING PATTERN:

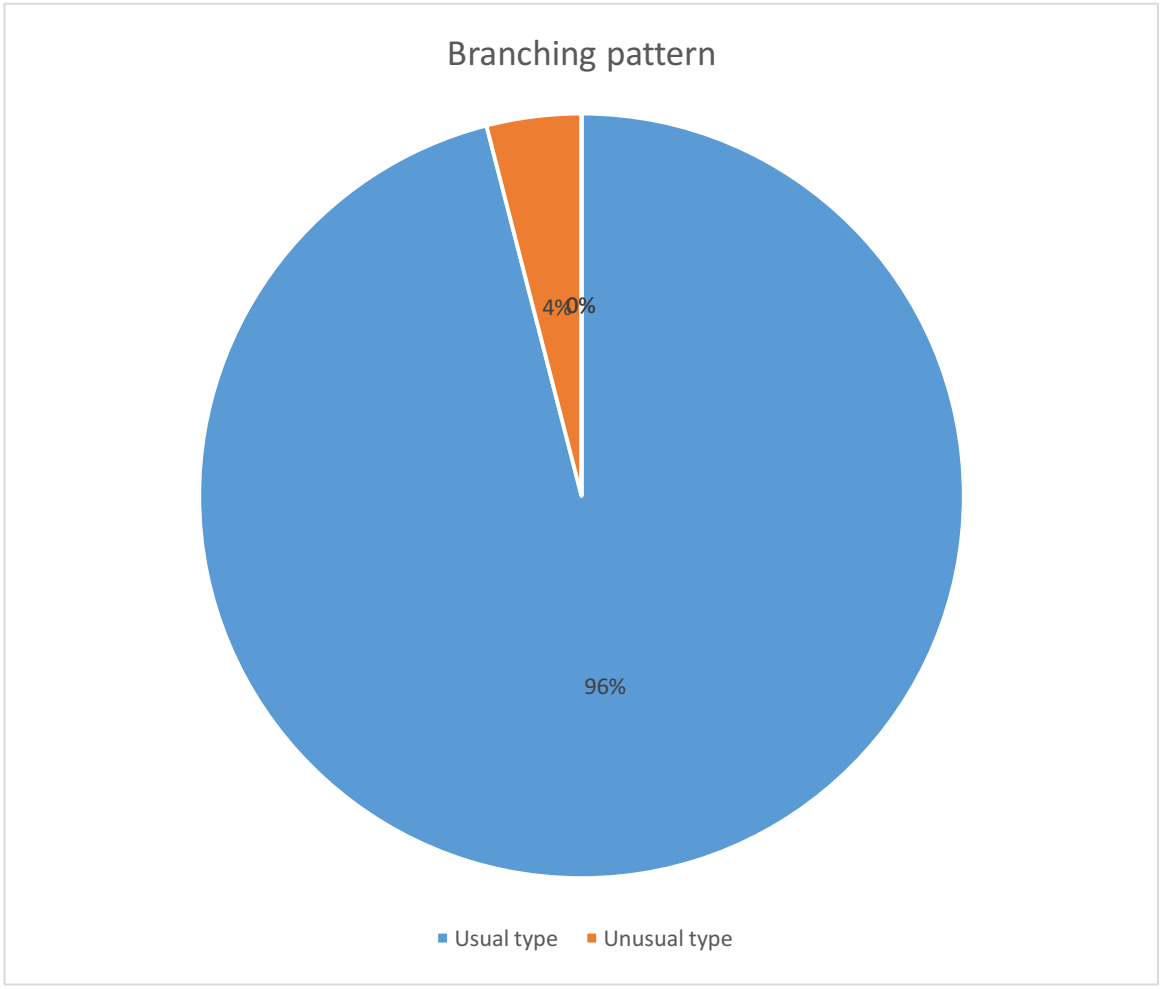


CHART 14

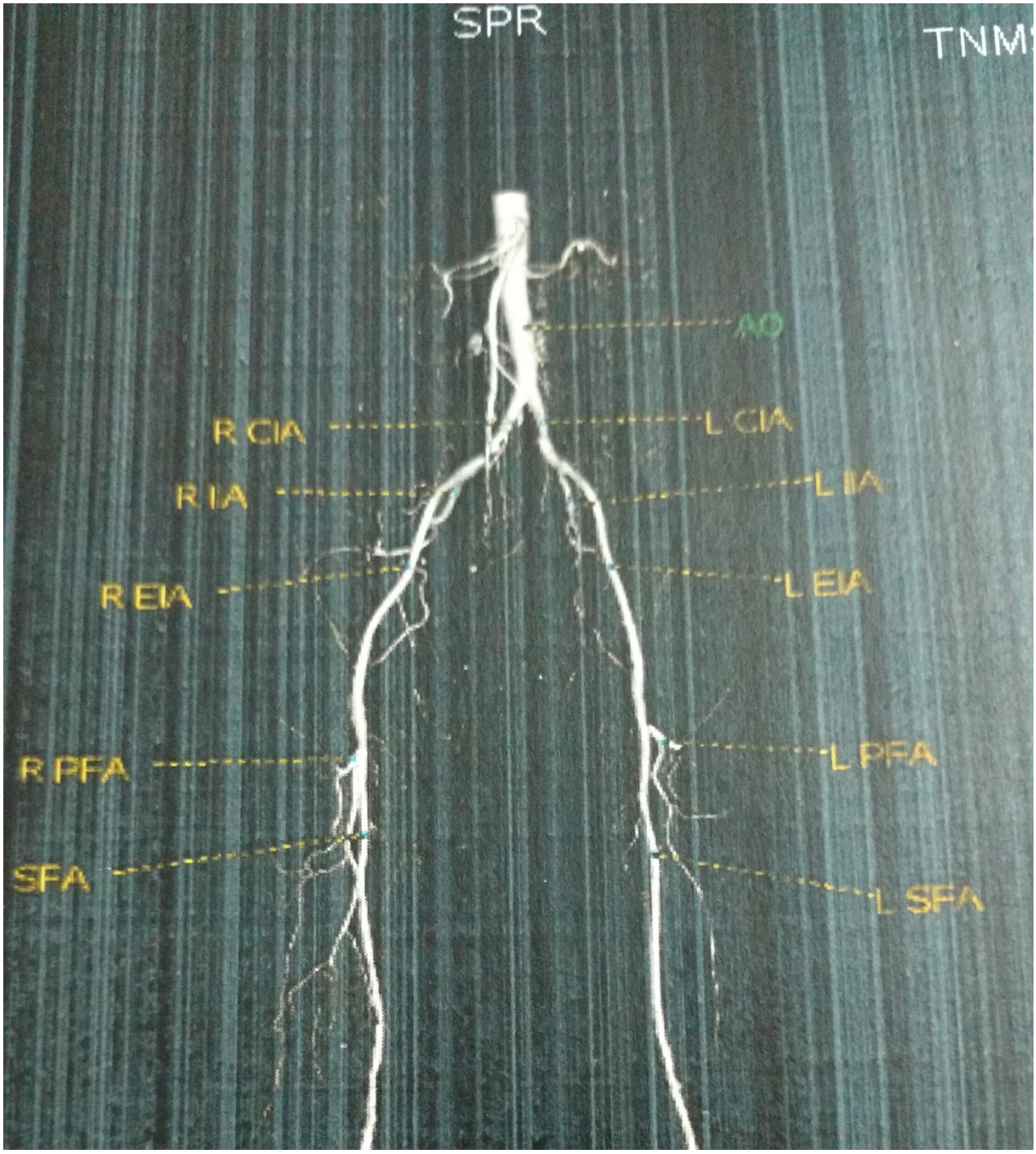


FIGURE 12: RADIOLOGICAL IMAGE-SHOWING THE NORMAL BRANCHING PATTERN OF PROFUNDA FEMORIS ARTERY RIA, LIA-RIGHT AND LEFT INTERNAL ILIAC ARTERY. RPFA, LPFA-RIGHT AND LEFT PROFUNDA FEMORIS ARTERY SFA-SUPERFICIAL FEMORAL ARTERY

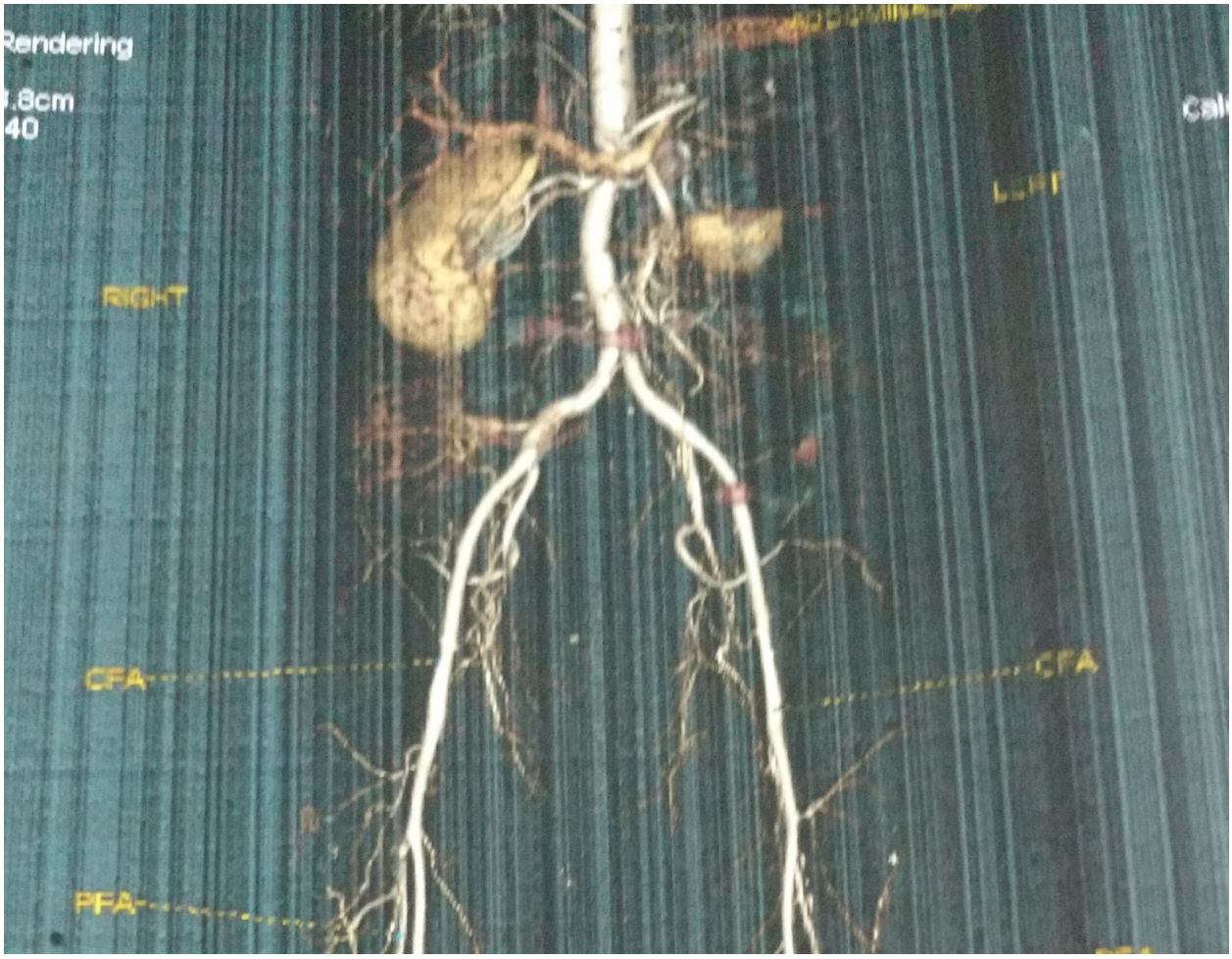


FIGURE 13: RADIOLOGICAL IMAGE –NORMAL BRANCHING PATTERN OF PROFUNDA FEMORIS ARTERY CFA-COMMON FEMORAL ARTERY PFA PROFUNDA FEMORIS ARTERY

BRANCHING PATTERN TYPES:

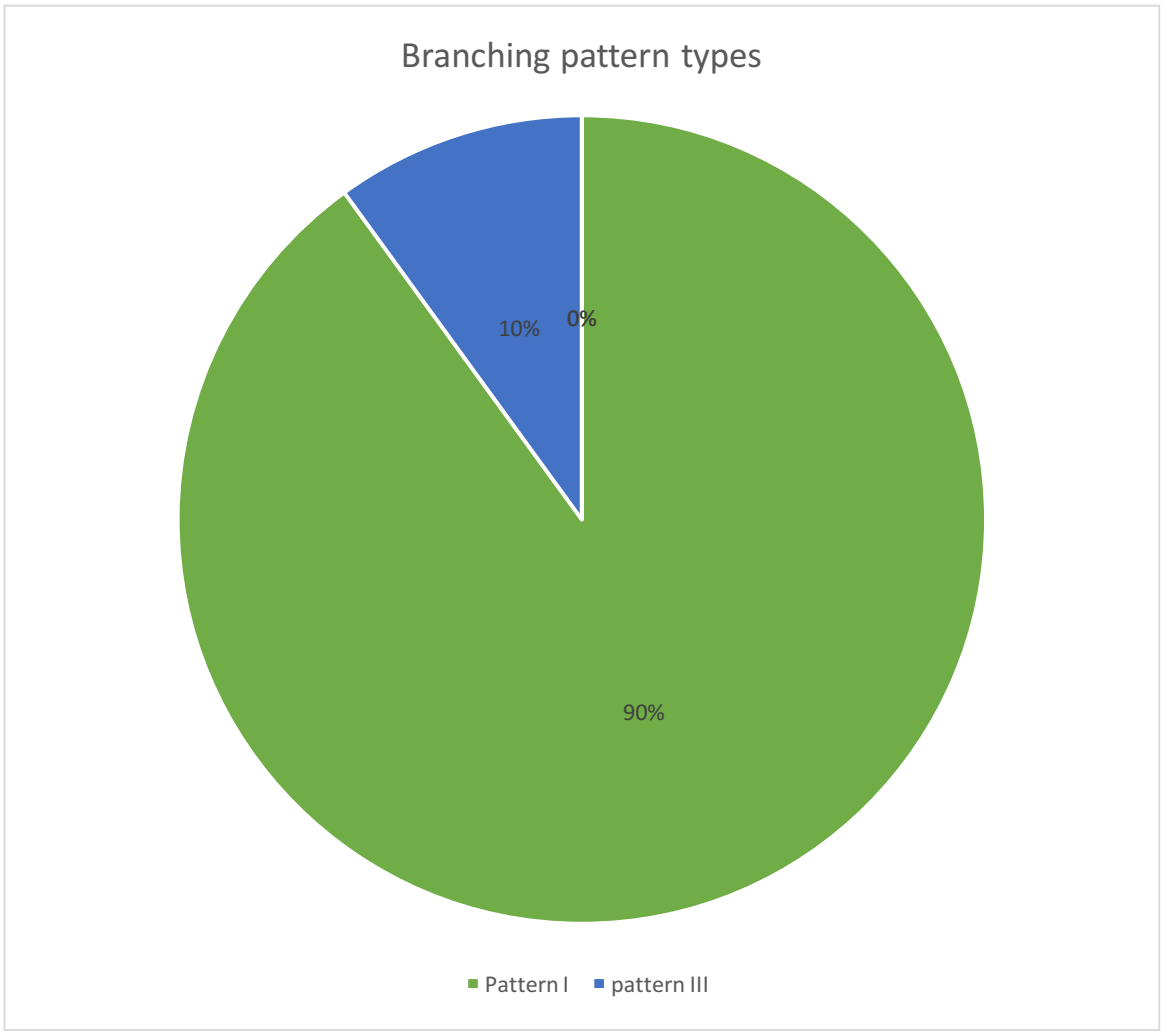


CHART 15

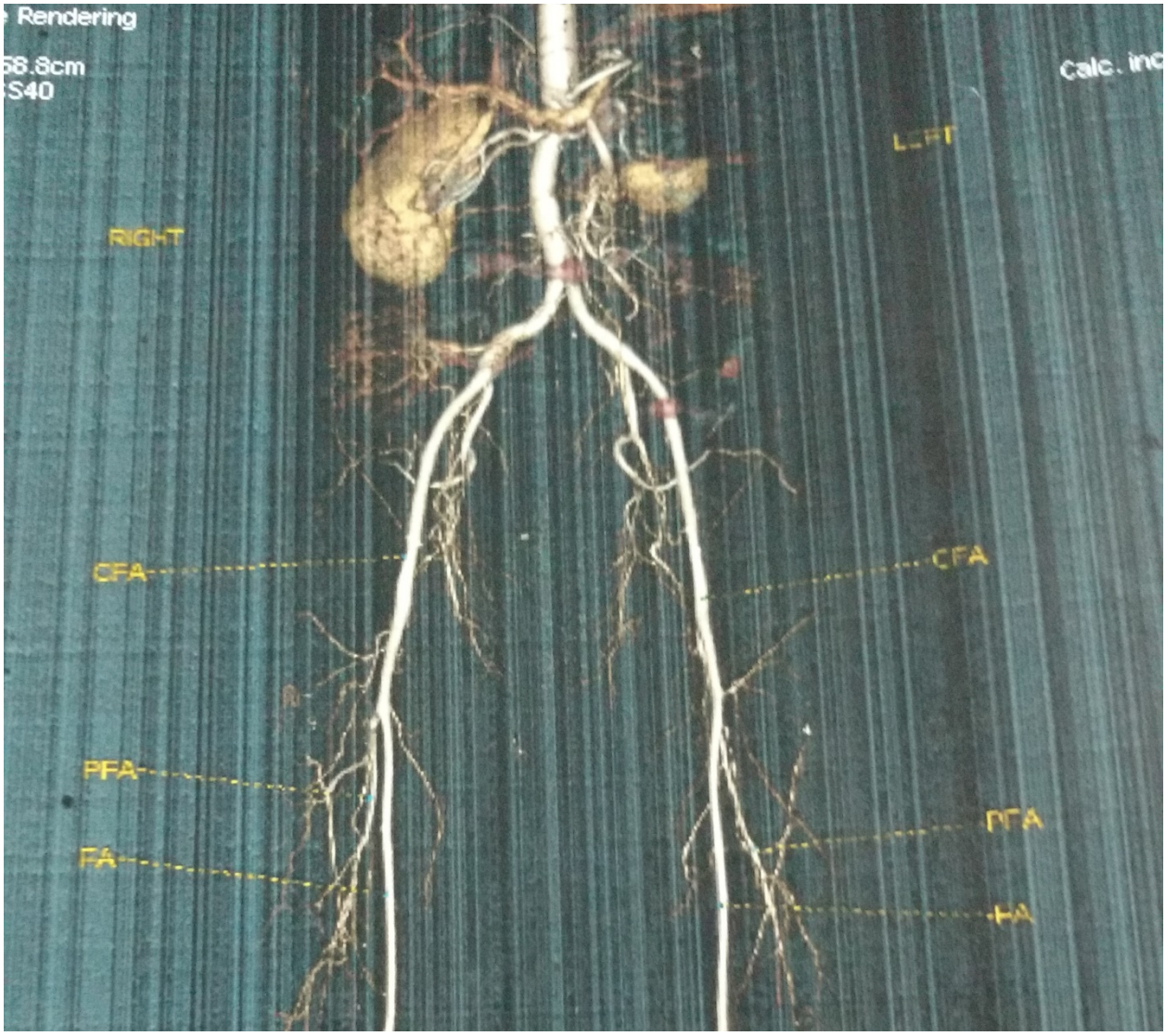


FIGURE 14: RADIOLOGICAL IMAGE –NORMAL BRANCHING PATTERN OF PROFUNDA FEMORIS ARTERY CFA-COMMON FEMORAL ARTERY FA-FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTEERY

RADIOLOGICAL STUDY

In this study of profunda femoris artery 10 images were obtained from computerized tomographic angiograms. All the 10 images followed the normal branching pattern of circumflex femoral arteries from profunda femoris artery. The distance of separation of profunda femoris artery from inguinal ligament was ranging from 3.5 to 5 cm.

DISCUSSION

1. A) SITE OF ORIGIN OF PROFUNDA FEMORIS ARTERY

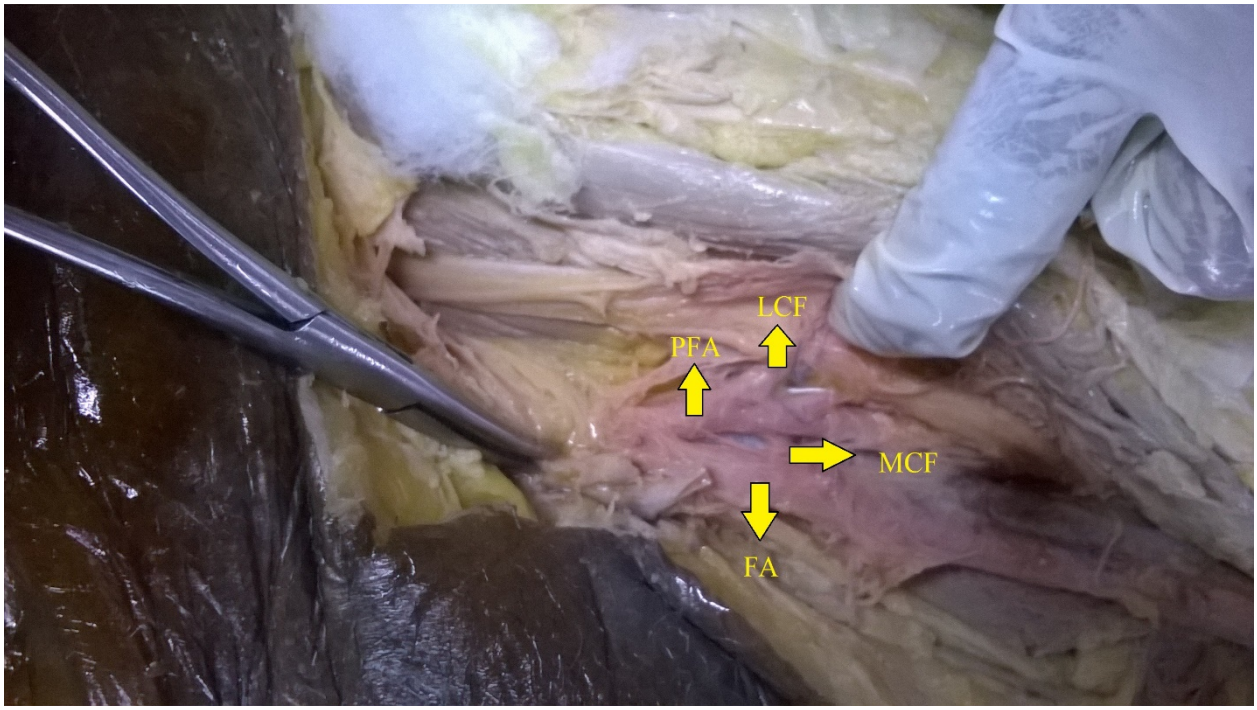
Henry Hollinshed (1997), Keith L Moore (2006) Lasts Anatomy (2011) "described that the profunda femoris artery arises from posterolateral or lateral side of the femoral artery'.

Dixit pp et al (2001)-quoted profunda femoris artery arises from posterolateral aspect of femoral artery.

In this present study of40 specimens the site of origin of profunda femoris artery was from posterolateral aspect of the femoral artery that is 100%.No variations were observed with respect to the site of origin.

1. B) DISTANCE OF ORIGIN OF PROFUNDA FEMORIS ARTERY FROM MIDINGUINAL POINT:

KeithL Moore 2006, **Lasts Anatomy** 2011, Gray's **Anatomy** 2012 "quoted that the profunda femoris artery arises from the lateral aspect of the femoral artery about 3-5 centimeters distal to the inguinal ligament".



SPECIMEN 12 SHOWING THE CIRCUMFLEX BRANCHES OF PROFUNDA FEMORIS ARTERY FA-FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTERY LCF-LATERAL CIRCUMFLEX FEMORAL ARTERY MCF-MEDIAL CIRCUMFLEX FEMORAL ARTERY

Bannister LH et al 1995 and **D Dixit** 2011 studied the cadavers and told that average distance from mid inguinal point to the origin of profunda femoris is 3-5centimeters.

In this study the average distance from mid inguinal point to origin of profunda femoris artery was 3.95 centimeters.

The above observation has been tabulated in **table 11 & chart 16, 17.**

DISTANCE OF ORIGIN OF PROFUNDA FEMORIS ARTERY FROM MID INGUINAL POINT

Name of the author	Average distance in cm
Snell	4
Grays	3.5
Siddarth	4.4
Vukosanovic	3.75
Prakash	4.2
Clark SM colborn	4.1
Dixit	4.75
Bannister	3.5
Present study	3.95

TABLE 11

This value coincides with most of the studies done in the past. In two specimens there was high origin of profunda femoris artery at 2 centimeters from the mid inguinal point.

DISTANCE OF ORIGIN OF PROFUNDA FEMORIS ARTERY FROM MID INGUINAL POINT

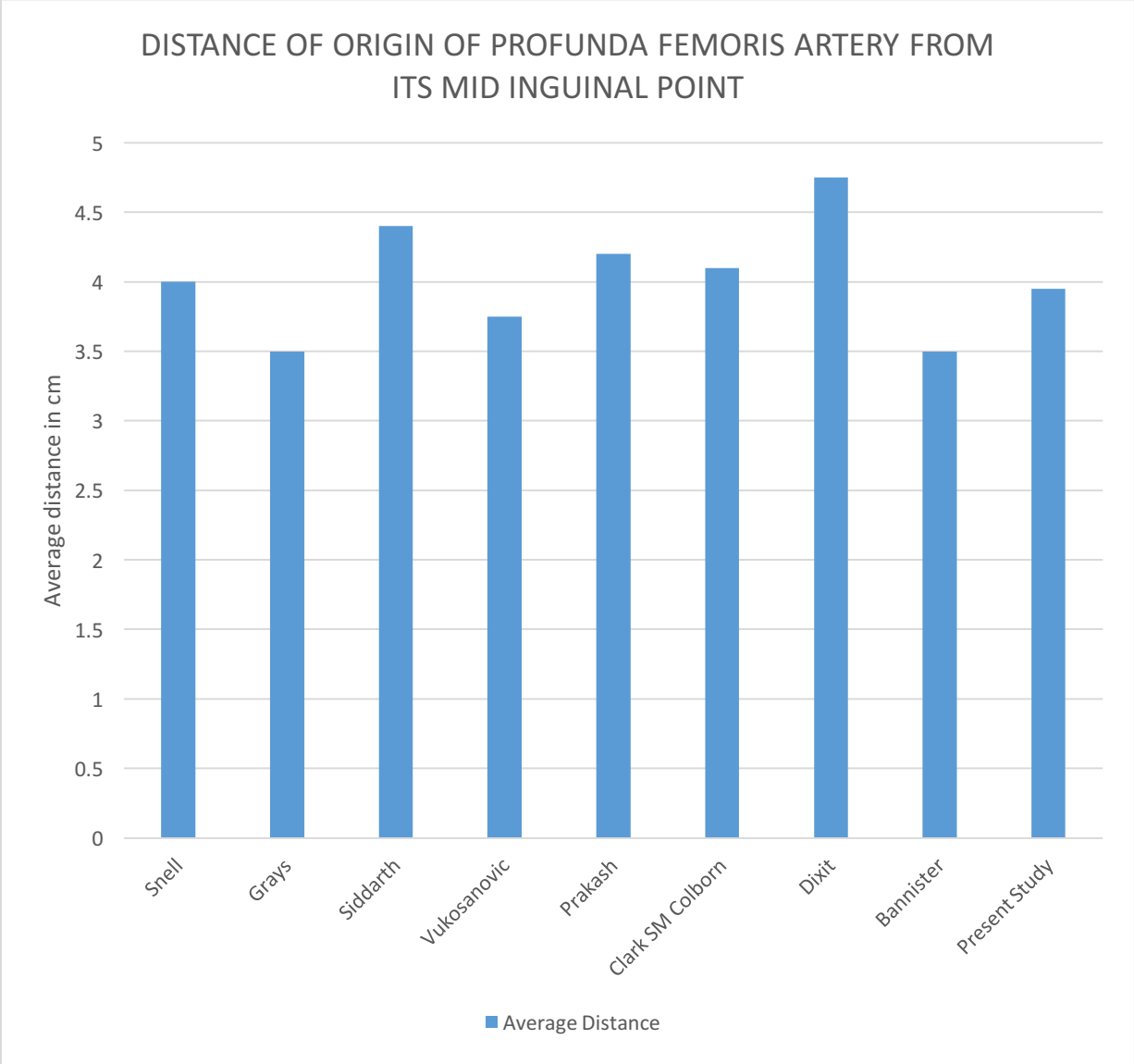
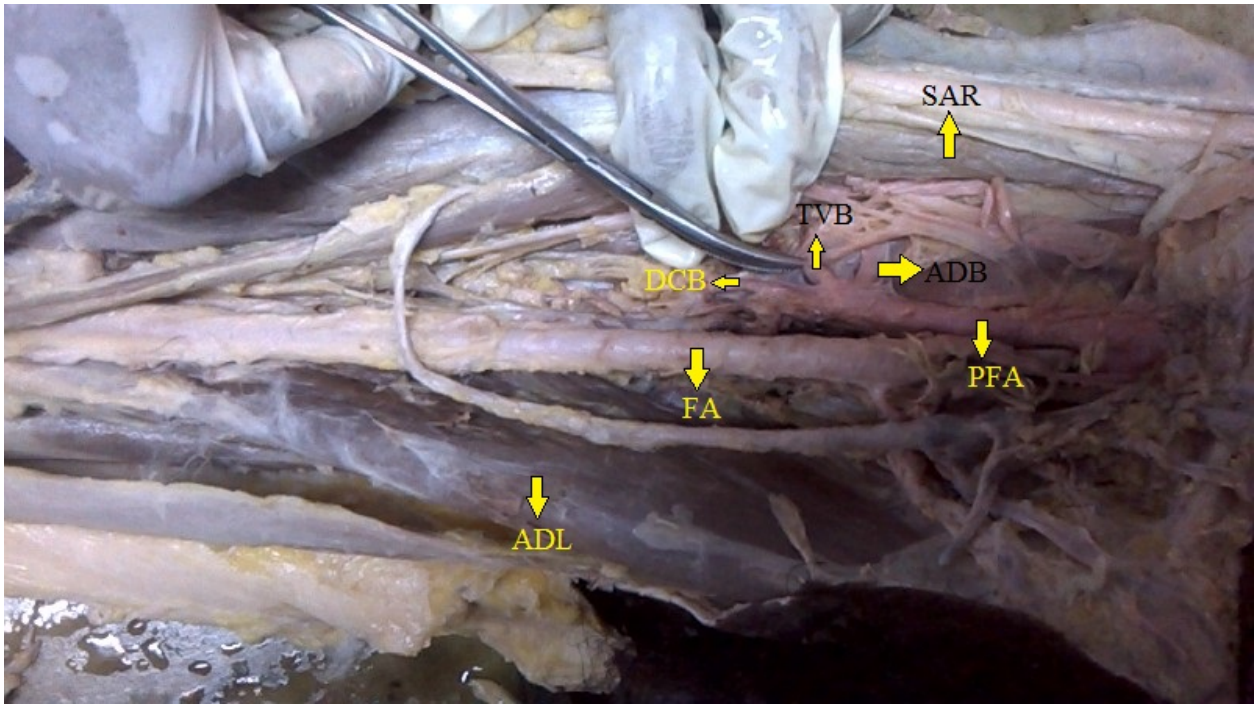


CHART 16



SPECIMEN 13 SHOWING THE ORIGIN OF BRANCHES OF LATERAL CIRCUMFLEX FEMORAL DIRECTLY FROM PROFUNDA FEMORIS ADB-ASCENDING BRANCH DCB-DESCENDING BRANCH TVB-TRANSVERSE BRANCH FA-FEMORAL ARTERY PFA PROFUNDA FEMORIS ARTERY ADL – ADDUCTOR LONGUS SAR-SARTORIUS

DISTANCE OF ORIGIN OF PROFUNDA FEMORIS ARTERY FROM MID INGUINAL POINT

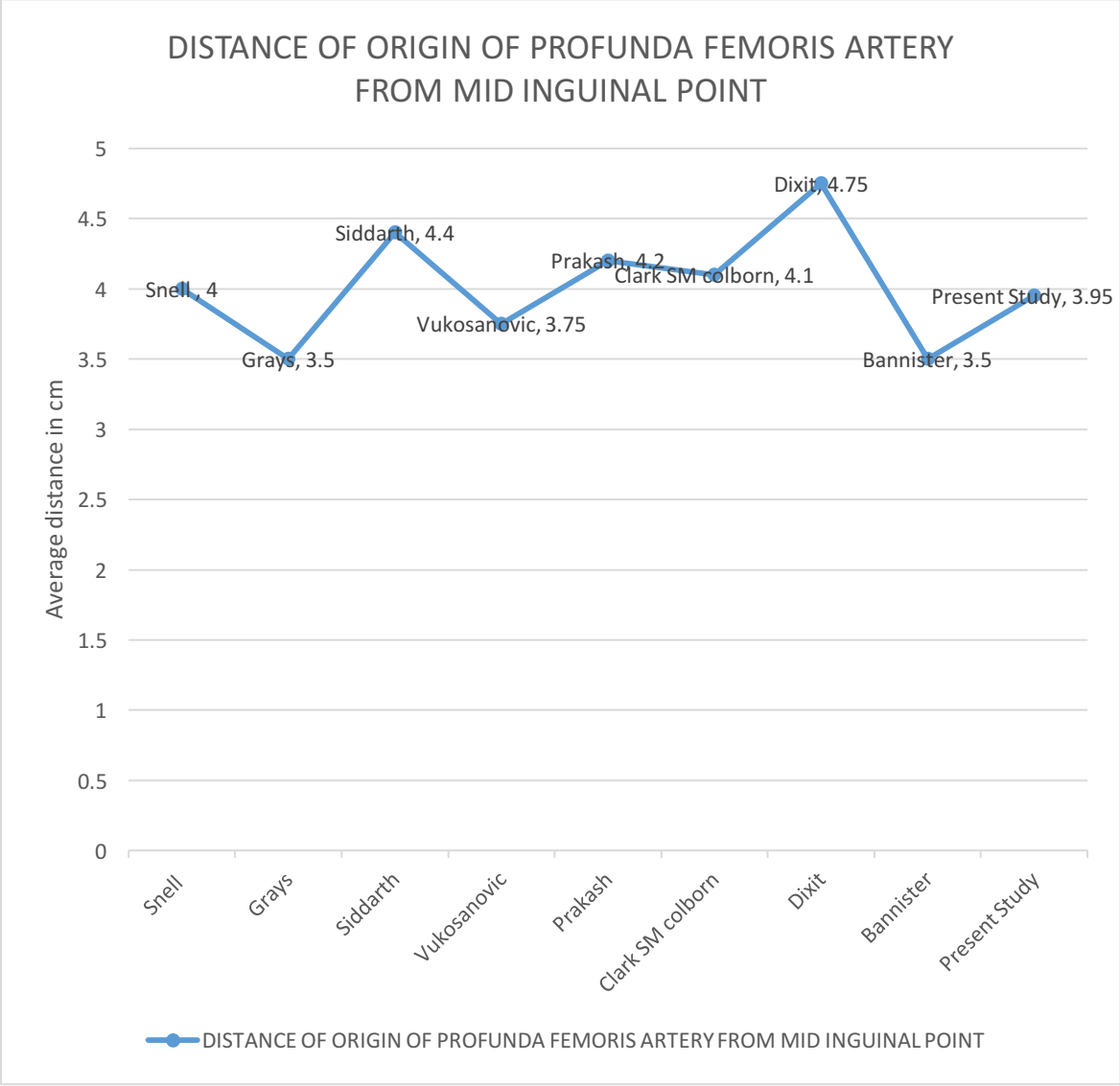


CHART 17

1. A) SITE AND DISTANCE OF ORIGIN OFLATERAL CIRCUMFLEX FEMORAL ARTERY

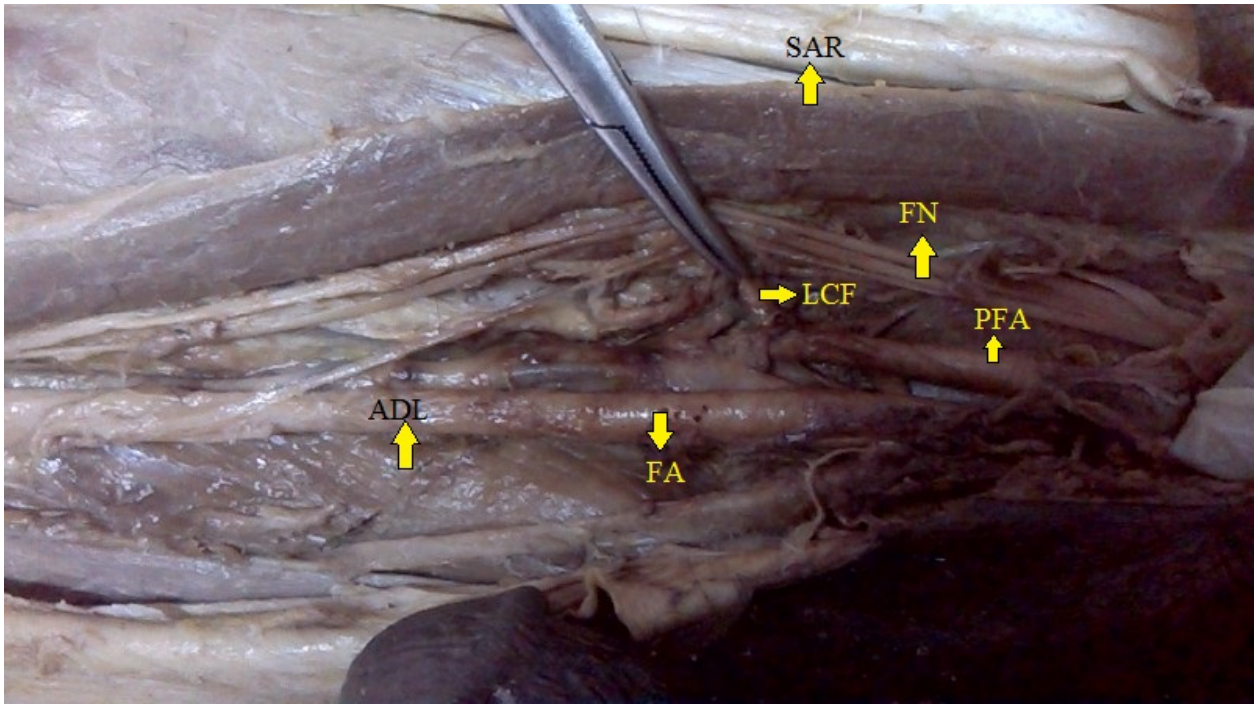
Cunningham's textbook of Anatomy (1964), **Last's Anatomy** (2011).**Gray's Anatomy** (2012) described "The lateral circumflex femoral artery arises from the lateral side of the profunda femoris artery or occasionally from the femoral artery".

Choi SN et al (2007) in his cadaveric study found the prevalence of origin of lateral circumflex femoral artery from profunda femoris artery is 86.8% and from femoral artery is 13.2%.

Prakash et al (2010) in this cadaveric study the average measurement between the origin of lateral circumflex femoral artery from profunda femoris artery to the origin of profunda femoris artery was 2.5 centimeters.

Daksha Dixit (2011) in this study profunda femoris artery and its circumflex branches, the distance of origin of lateral circumflex femoral artery from origin of profunda femoris artery was between 20-30 millimeters.

In the present study the lateral circumflex artery arose from profunda femoris artery in 36 specimens that is 90%. It arose from femoral artery in



SPECIMEN 14 SHOWING THE BRANCHES OF LATERAL CIRCUMFLEX FEMORAL PASSING THROUGH THE BRANCHES OF FEMORAL NERVE ADL-ADDUCTOR LONGUS FA-FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTERY FN-FEMORAL NERVE

two specimens that is 5% and in two specimens the branches of lateral circumflex femoral arose straight from profunda femoris artery without the stem that is 5%.

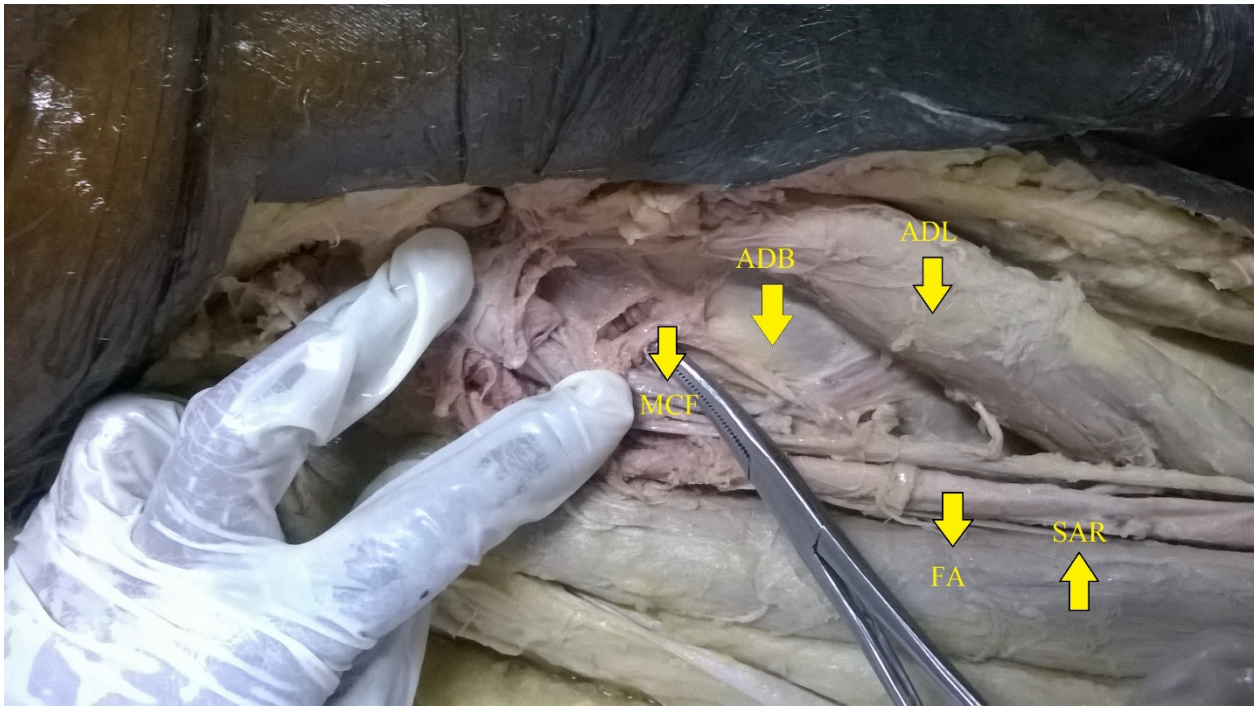
In the present study the distance of origin of lateral circumflex artery from the profunda femoris artery was between 1-3 centimeters from its origin.

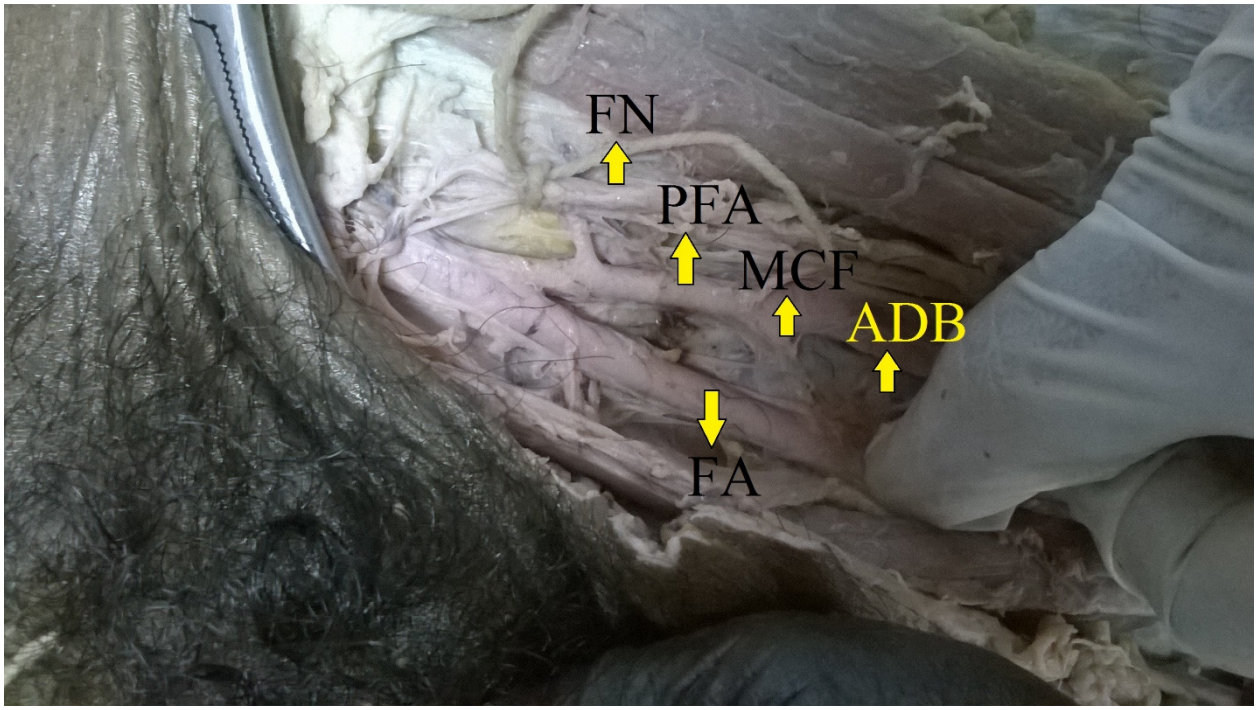
The above mentioned observations has been tabulated in **table 12 & chart 18 specimen 13.**

SITE AND DISTANCE OF ORIGIN OFLATERAL CIRCUMFLEX FEMORAL ARTERY

Name of the author	LCF arising from PFA in %	LCF arising from FA in %
Uzel M	77.3	22.3
Fukuda	78.6	21.4
Dixit DP	83.34	16.6
Choi SW	86.8	13.2
Tansatil T	56.67	43.33
Prakash	81.2	18.75
Present study	90	10

TABLE 12





SPECIMEN 15 & 16 SHOWING THE MEDIAL CIRCUMFLEX BRANCHES FROM PROFUDA FEMORIS ARTERY FA-FEMORAL ARTERY FN-FEMORAL NERVE

SITE AND DISTANCE OF ORIGIN OFLATERAL CIRCUMFLEX FEMORAL ARTERY

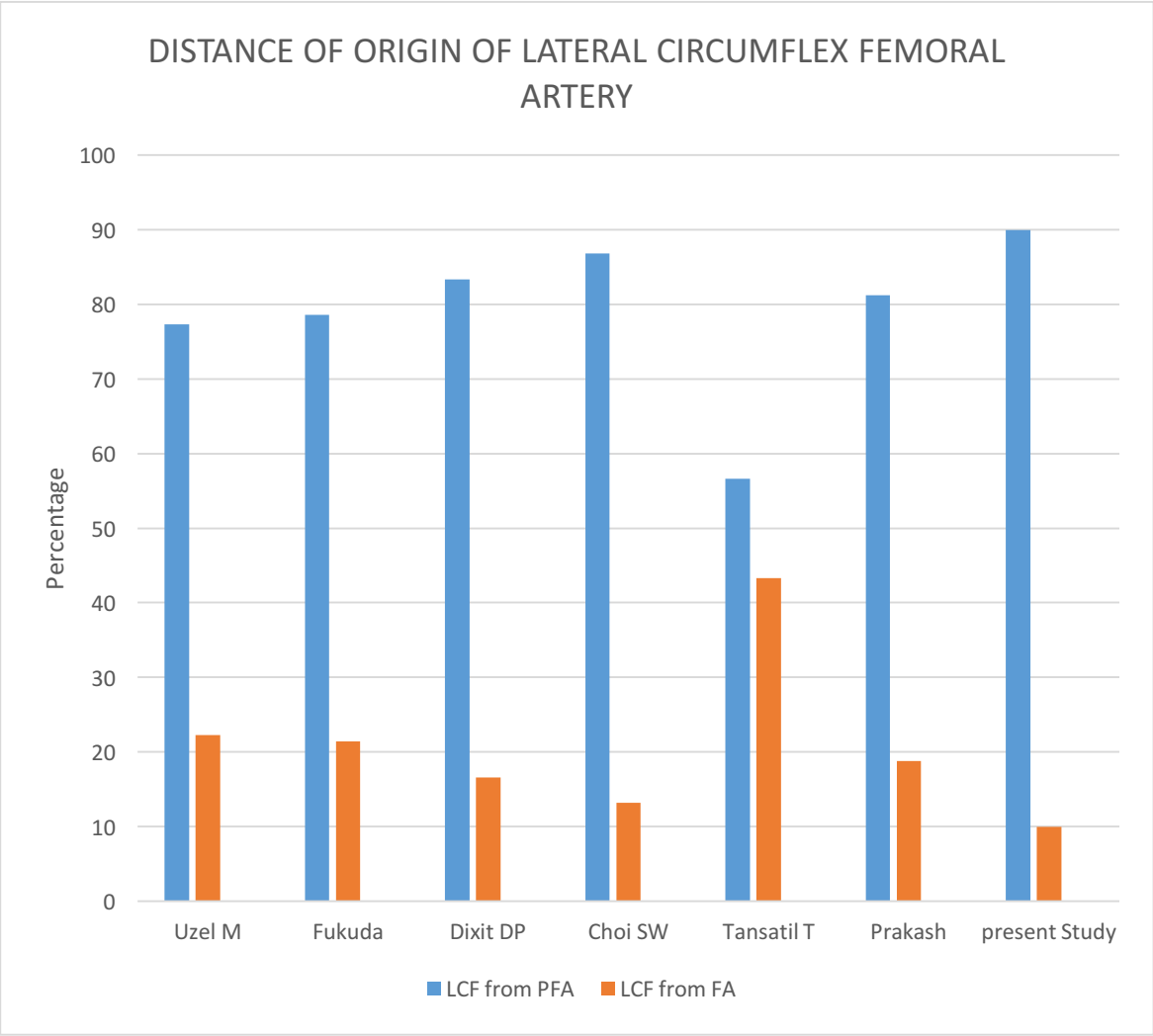


CHART 18

2. B) THE SITE AND DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

Tanyeli E et al (2006) - In this cadaveric study observed the incidence of medial circumflex femoral artery from profunda femoris artery was 79% and from femoral artery was 21 %. The medial circumflex femoral artery arose from the medial side of the profunda femoris artery or rarely from the femoral artery.

Prakash et al (2010) in this cadaveric study the measurement between the origin of medial circumflex femoral artery and the origin of profunda femoris artery was 1-2centimeters.

In this present study the medial circumflex femoral artery arose from profunda femoris artery in all the 40 specimens that is 100%.

The distance of origin of medial circumflex femoral artery from profunda femoris artery was between 1-3 centimeters. This measurement coincides with the previous studies.

The above observations has been tabulated in **table 13 and chart 19.**

THE SITE AND DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

Name of the author	Average distance in mm
Prakash et al	10 -20
Tanyeli et al	10 -30
Present Study	10 -30

TABLE 13

THE SITE AND DISTANCE OF ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY

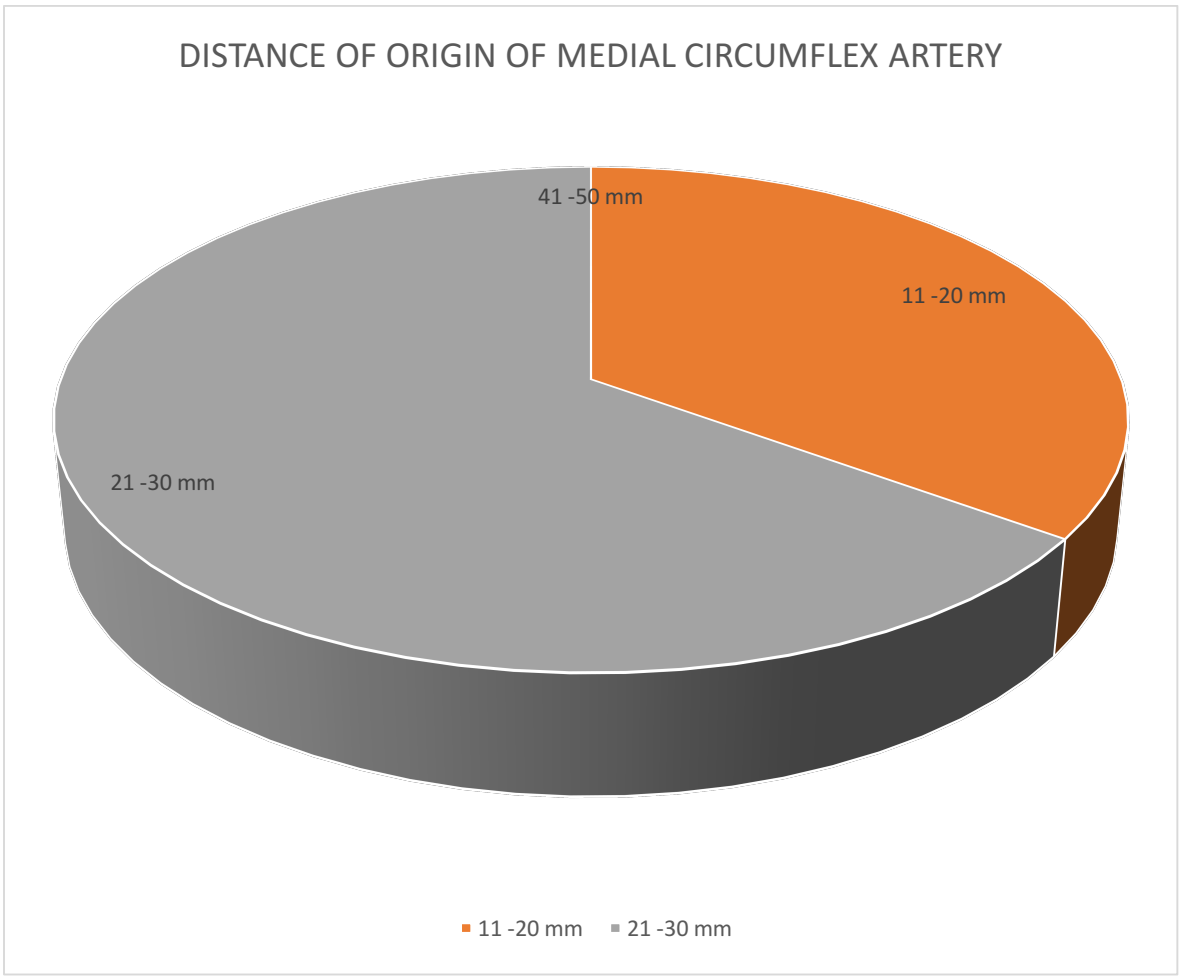


CHART 19

DIAMETER OF PROFUNDA FEMORIS ARTERY

1. A study of variations of profunda femoris artery by **D.Dixit** (2011).The diameter of profunda femoris artery in this study was 4.8 millimeters.
2. **Journal of Clinical Research volume 4 Issue I** (2013) .Anatomical variations of profunda femoris artery. The mean width of femoral artery was 10 millimeters and that of profunda femoris artery was 6 millimeters.

In this study the average diameter of profunda femoris artery was found to be 5.4 millimeters which coincides with the previous studies. The above mentioned observations has been tabulated in **table14 & Chart 20, 21.**

DIAMETER OF PROFUNDA FEMORIS ARTERY

	Name of the Author	Diameter(in mm)
1.	Dixit	4.8
2.	Journal of Clinical Research	6
3.	Present Study	5.4

TABLE 14

DIAMETER OF PROFUNDA FEMORIS ARTERY

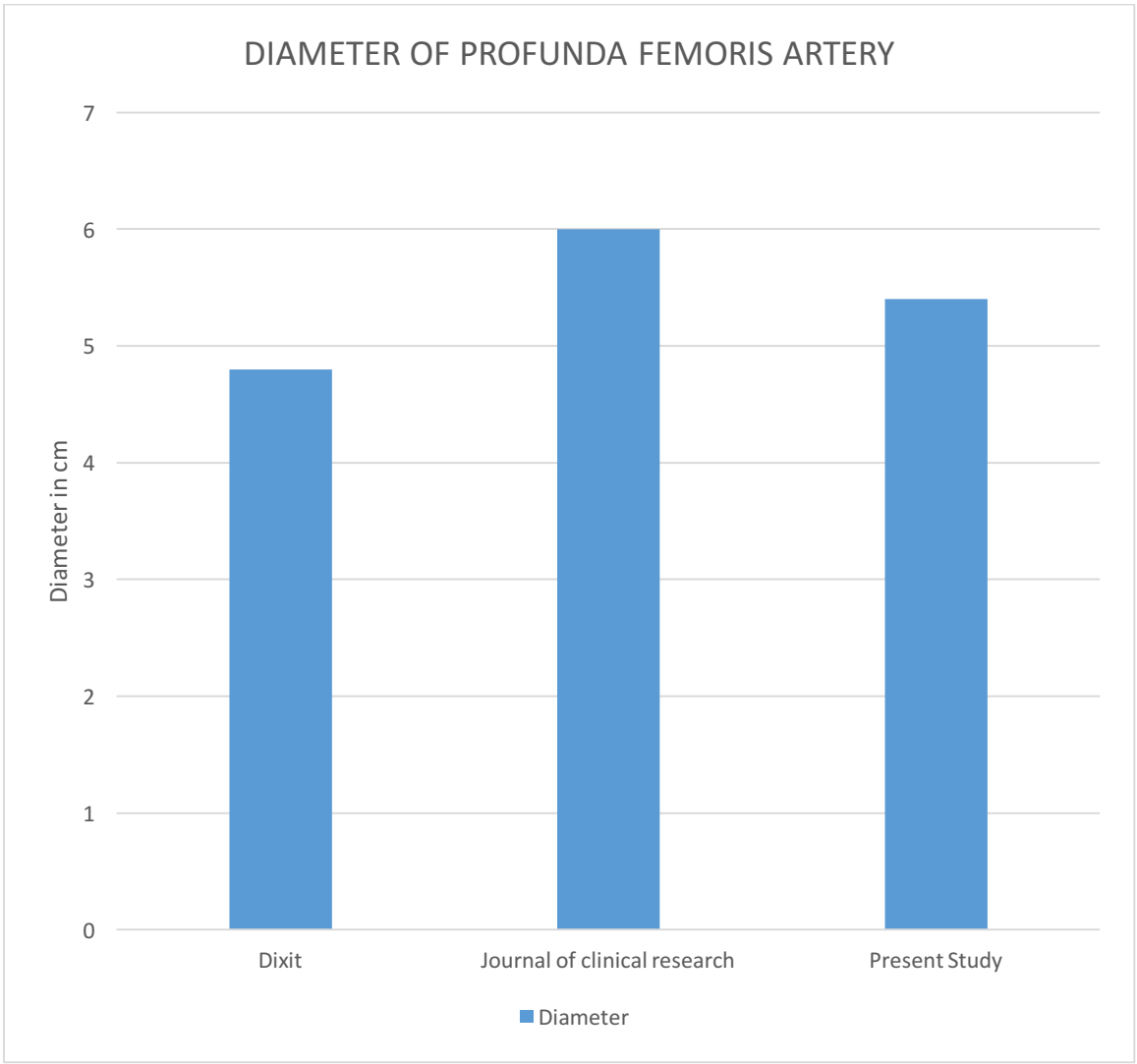


CHART 20

DIAMETER OF PROFUNDA FEMORIS ARTERY

DIAMETER OF PROFUNDA FEMORIS ARTERY

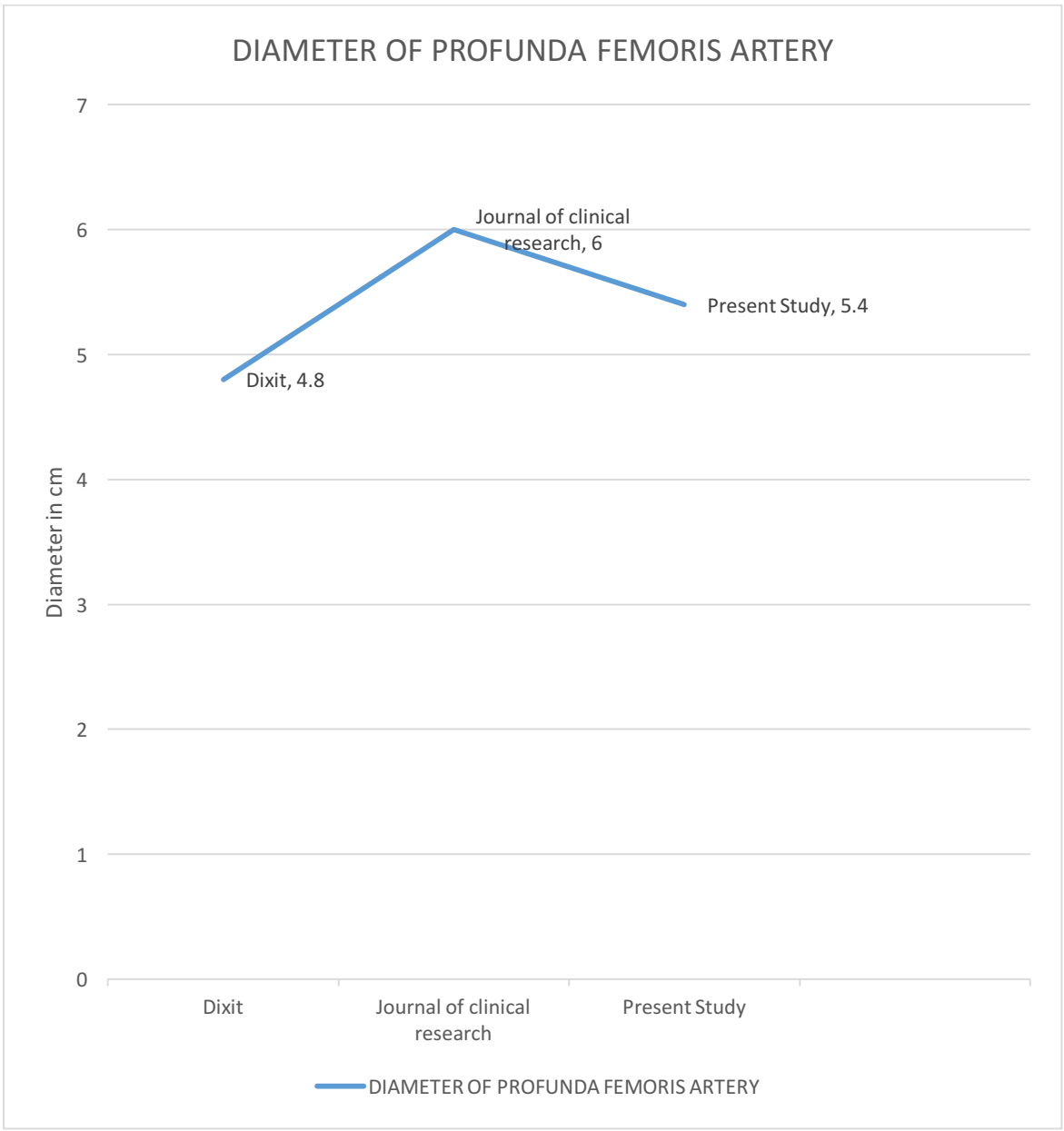
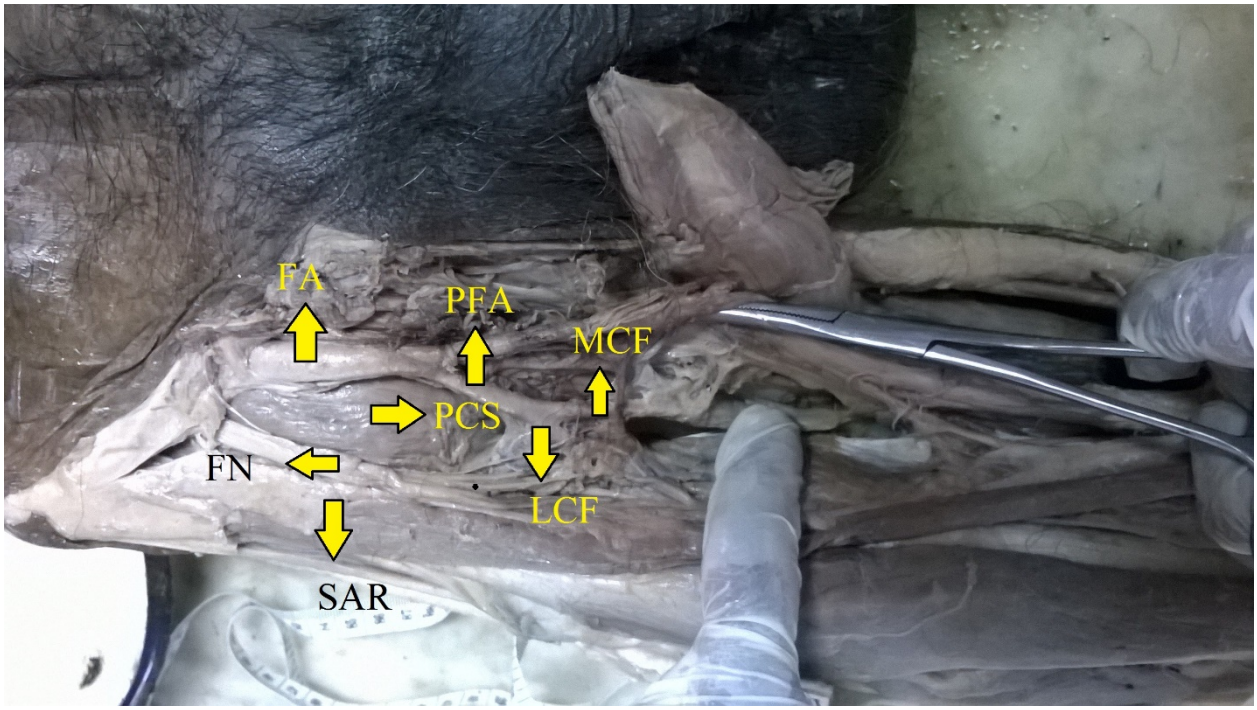
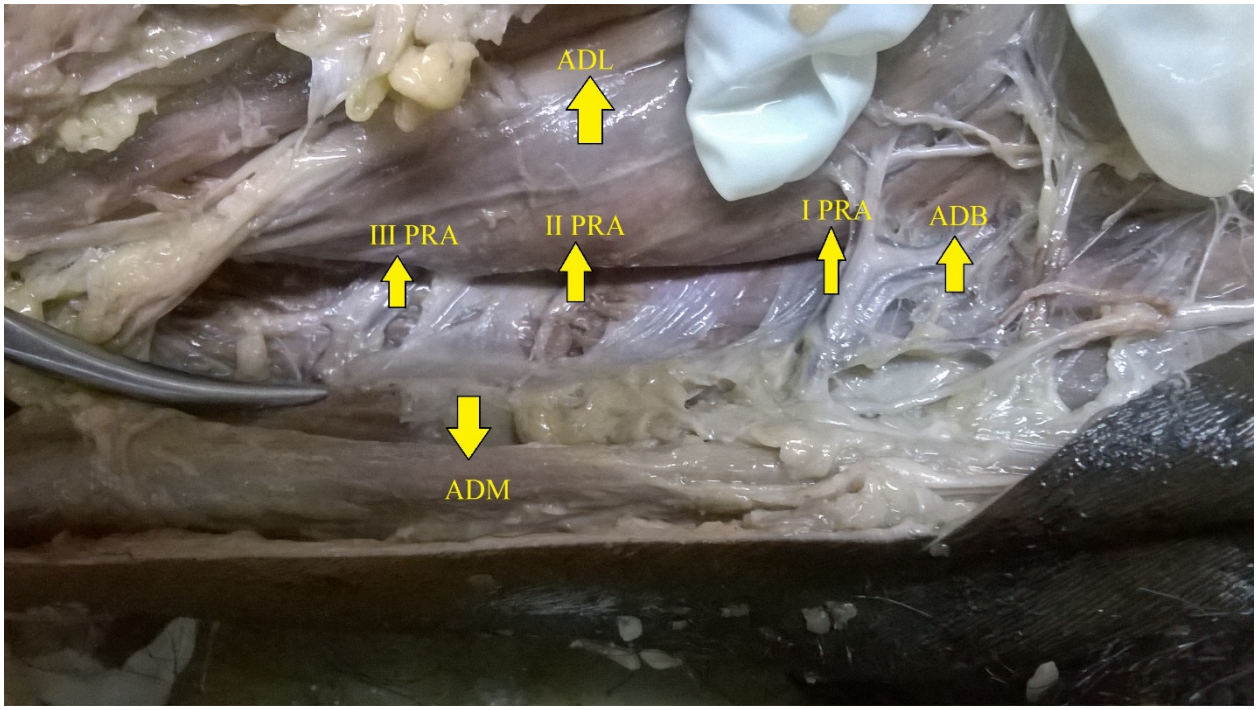


CHART 21



SPECIMEN 17 SHOWING THE PROFUNDA FEMORIS ARTERY IN FEMORAL TRAINGLE FN-FEMORAL NERVE FA-FEMORAL ARTERY PFA-PROFUNDA FEMORIS ARTERY LCF-LATERAL CIRCUMFLEX FEMORAL MCF-MEDIAL CIRCUMFLEX FEMORAL PCS-PECTINIUS SAR-SARTORIUS



SPECIMEN 18 SHOWING THE PERFORATING BRANCHES OF PROFUNDA FEMORIS ARTERY OVER THE ADDUCTOR MAGNUS MUSCLE ADM-ADDUCTOR MAGNUS ADB-ADDUCTOR BREVIS PRA-PERFORATING ARTERY

COURSE OF THE ARTERY

Cunningham's Textbook of Anatomy 1964, **Gray's Anatomy** 2012, **Last's Anatomy**2012"state that the profunda femoris artery first lateral to the femoral artery, curves downwards behind the main artery, and runs distally to the medial side of the femur. Then the artery passes between the pectineus and adductor longus, then between adductor longus and adductor magnus to finally pierce the adductor magnus and anastomose with the upper muscular branches of the popliteal artery.

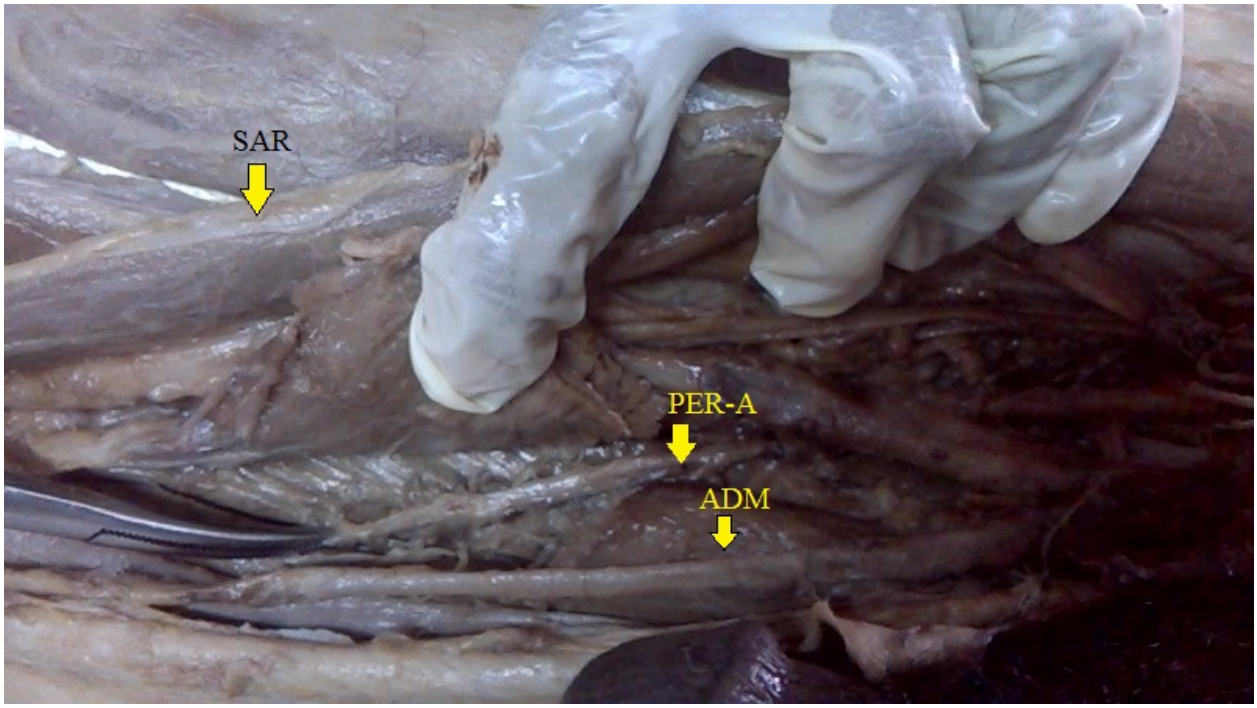
The perforating arteries are usually three, perforate the attachment at the adductor magnus to reach the thigh's flexor aspect. The first arises proximal to the adductor brevis, the second anterior and the third distal to the adductor brevis. The terminal part of the profunda femoris artery is sometimes named the fourth perforating artery".

Study done by **Mamatha Hand D Souza,** Antony Sylvia of Manipal University, published in International Journal of Current Research. A cadaveric study on the variations in the origin, course and branching pattern of the profunda femoris artery (2012): Results of the study: Higher origin of profunda femoris artery was seen in one specimen.

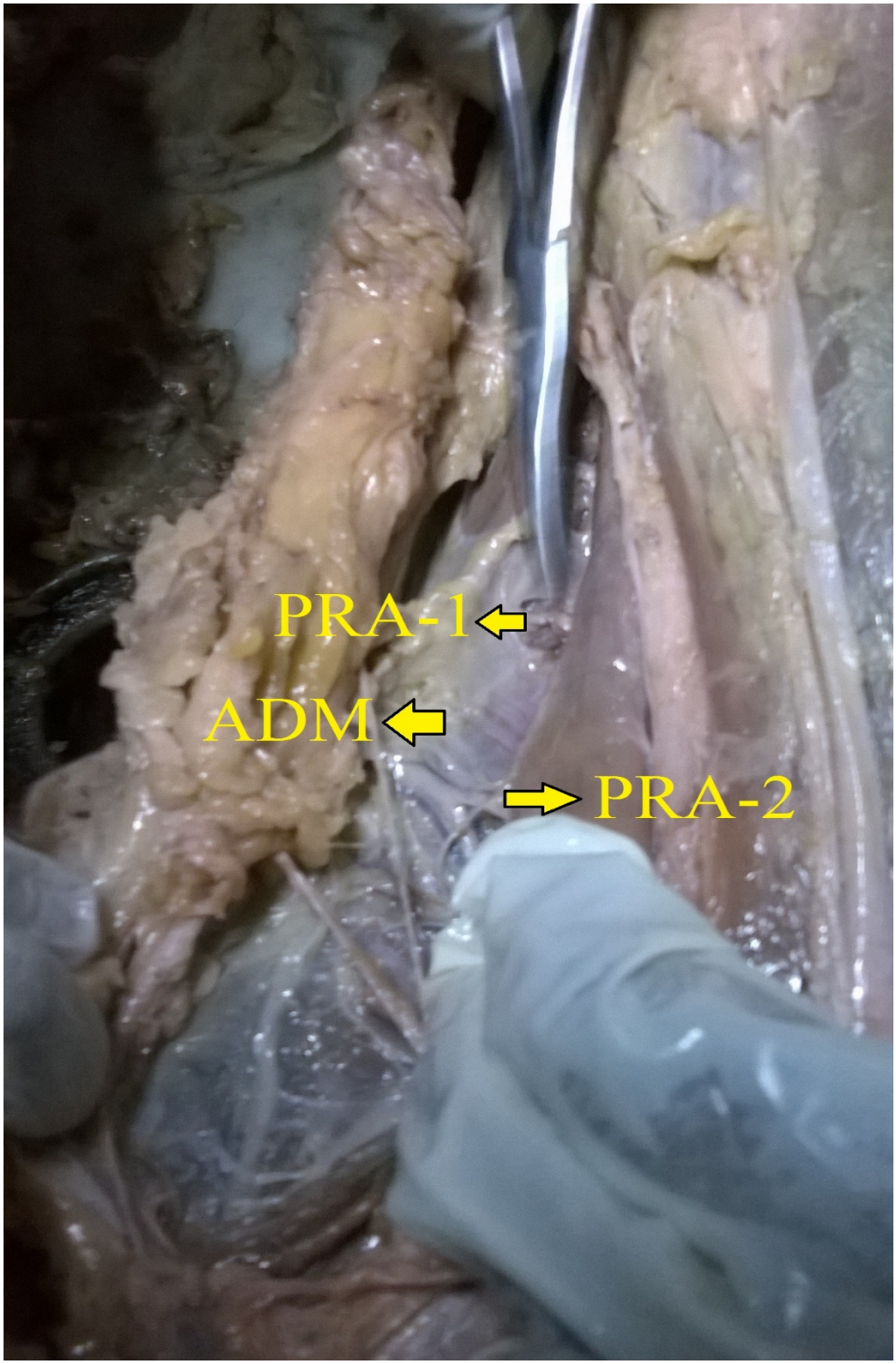
Morphological study of origin of the profunda femoris artery in Human cadavers by **Brijesh R, Agera, Sujatha,** published in International Journal of Anatomy and Research 2015/ volume 3.Out of 102 limbs that studied, high origin of profunda femoris artery(0-10) from mid inguinal point was seen in 2 limbs.

In this present study, the high origin of profunda femoris artery was seen in two specimens that is two centimeters from the mid inguinal point which is 5% and in 2 specimens 2.5 centimeters 2.5% and 2.7 centimeters 2.5% respectively. Other than this the course of the artery followed the usual pattern in all the other specimens.

The above observations are depicted in **chart 22, Specimen 4&5**



SPECIMEN 19 SHOWING THE PERFORATING BRANCHES OF PROFUNDA FEMORIS ARTERY ADM-ADDUCTOR MAGNUS SAR-SARTORIUS PER-A-PERFORATING ARTERY



SPECIMEN 20 SHOWING THE PERFORATORS OF PROFUNDA FEMORIS

COURSE OF THE ARTERY

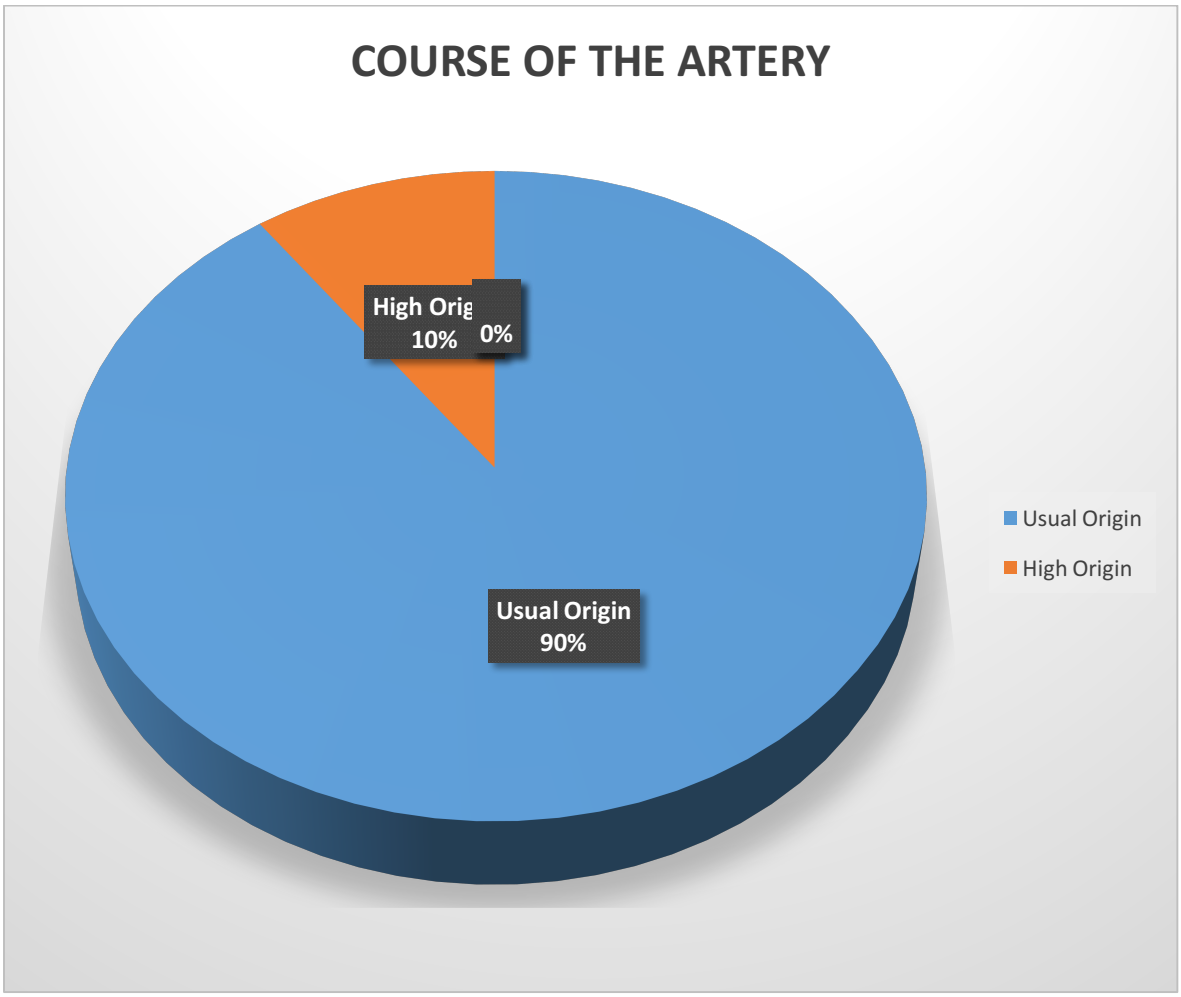


CHART 22

RELATIONS WITH THEFEMORAL ARTERY AND FEMORAL VEINS

Hollinshed1997**, Neeta Kulkarni** 2012 stated "The profunda femoris artery is given off the from the lateral side of the femoral artery in the femoral triangle and passes downward medially to the apex of the femoral triangle, where femoral artery, femoral vein and profunda femoris vein lie anterior to it".

Study of profunda femoris artery of human cadavers in Rajkot city of India. Article – International Journal of Anatomy and Research 2015(31) 813-77-Feb 2015, by Pradeep Chauhan and **Monisha A,**profunda femoris artery's relations with femoral artery, femoral vein and femoral nerve makes it important structure for Clinicians. The profunda femoris artery can originate either on the medial side off the femoral artery or on the posterior side of it. The medially originating artery crosses the femoral vein on the anterior side and passes backwards on its medial side.

In this study, the profunda femoris artery arose from the posterolateral aspect of femoral artery in all specimens that is 100% and the femoral vein femoral artery and profunda femoris vein were lying superficial to profunda femoris artery in all the specimens.

The above observations has been tabulated in **table 15.**

RELATIONS WITH THE FEMORAL ARTERY AND FEMORAL VEIN

S.no	Relation of femoral artery and vein	Total number of specimens(40)			
		Right Side (20)	%	Left Side (20)	%
1	Femoral artery and femoral vein lying superficial	20	100	20	100
2	Femoral artery and femoral vein lying deep	-	-	-	-

TABLE 15

BRANCHING PATTERNS OF MEDIAL AND LATERAL CIRCUMFLEX FEMORAL ARTERIES

Massoud and Fletcher, 1997 had studied 188 cadavers, out which 83.8% were of pattern I.9.2% were of pattern II and 6.6% were of pattern III.

This present study coincides with the above study and the branching patterns of medial and lateral circumflex femoral artery followed pattern I in 90%. In 10% of the specimens followed pattern III where the lateral circumflex femoral arose from femoral artery.

Pattern I is most commonly observed in all the studies. The prevalence of pattern I ranges from 40 to83%, pattern III from 1% to 13% in the studies of both circumflex femoral arteries.

The above mentioned observation has been depicted in **chart 23.**

BRANCHING PATTERNS OF MEDIAL AND LATERAL CIRCUMFLEX FEMORAL ARTERIES

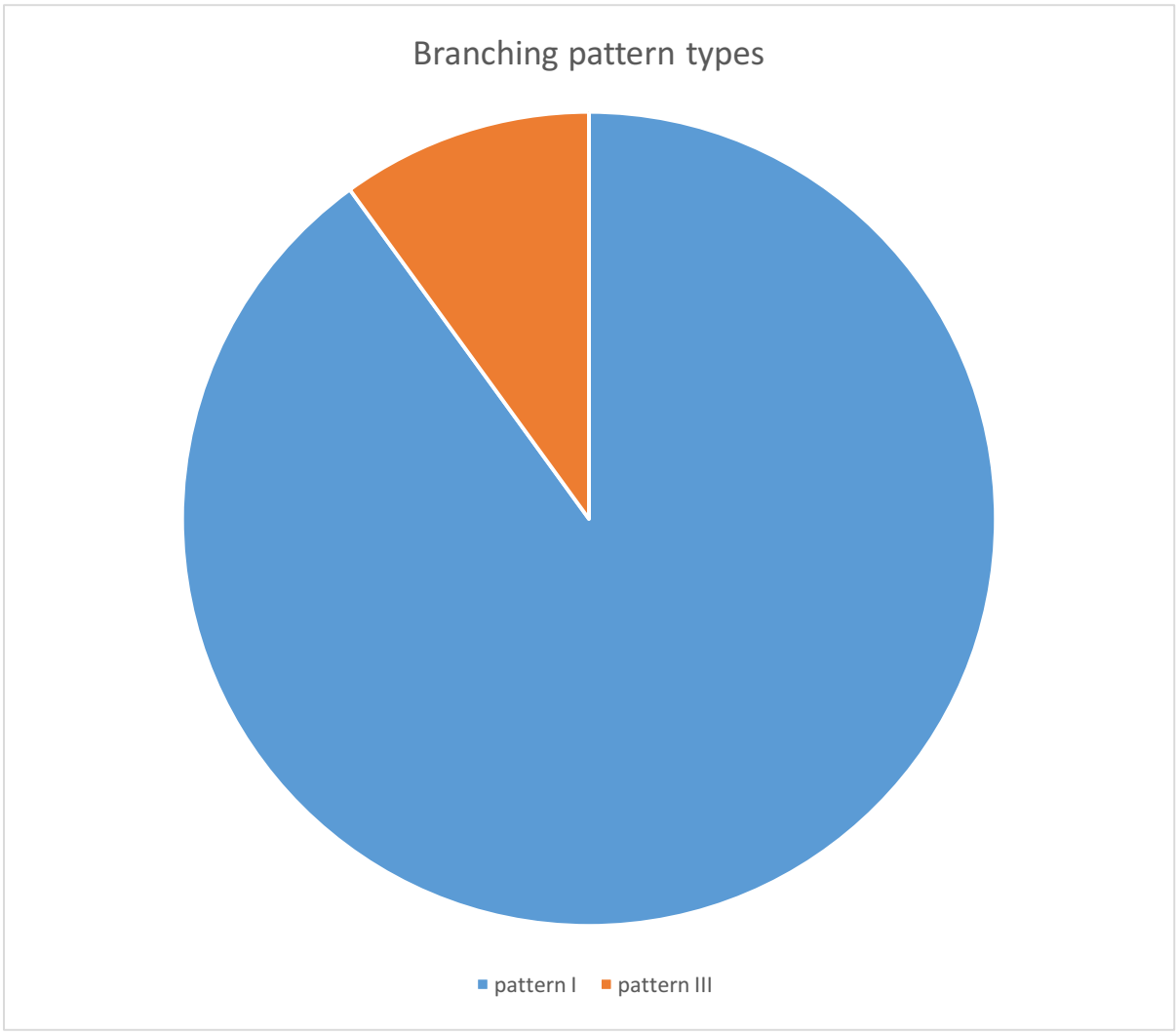


CHART 23

BRANCHING PATTERNS OF MEDIAL AND LATERAL CIRCUMFLEX FEMORAL ARTERIES

Author /year	No, of limbs	Pattern I %	Pattern II %	Pattern III %
Marcade et al 1978	100	66	14	20
Guilliot et al 1979	90	63.3	33.3	1.1
Lengua et al 1980	100	66	-	-
Siddharth et al 1985	100	70	-	-
Massoud & Fletcher 1997	188	83.8	9.2	6.6
Vazquz et al 2007	439	78.8	20.5	0.5
Present study	40	90	-	10

TABLE 16

BRANCHING PATTERNS OF MEDIAL AND LATERAL CIRCUMFLEX FEMORAL ARTERIES

A Comparative study of the branching patterns of profunda femoris artery

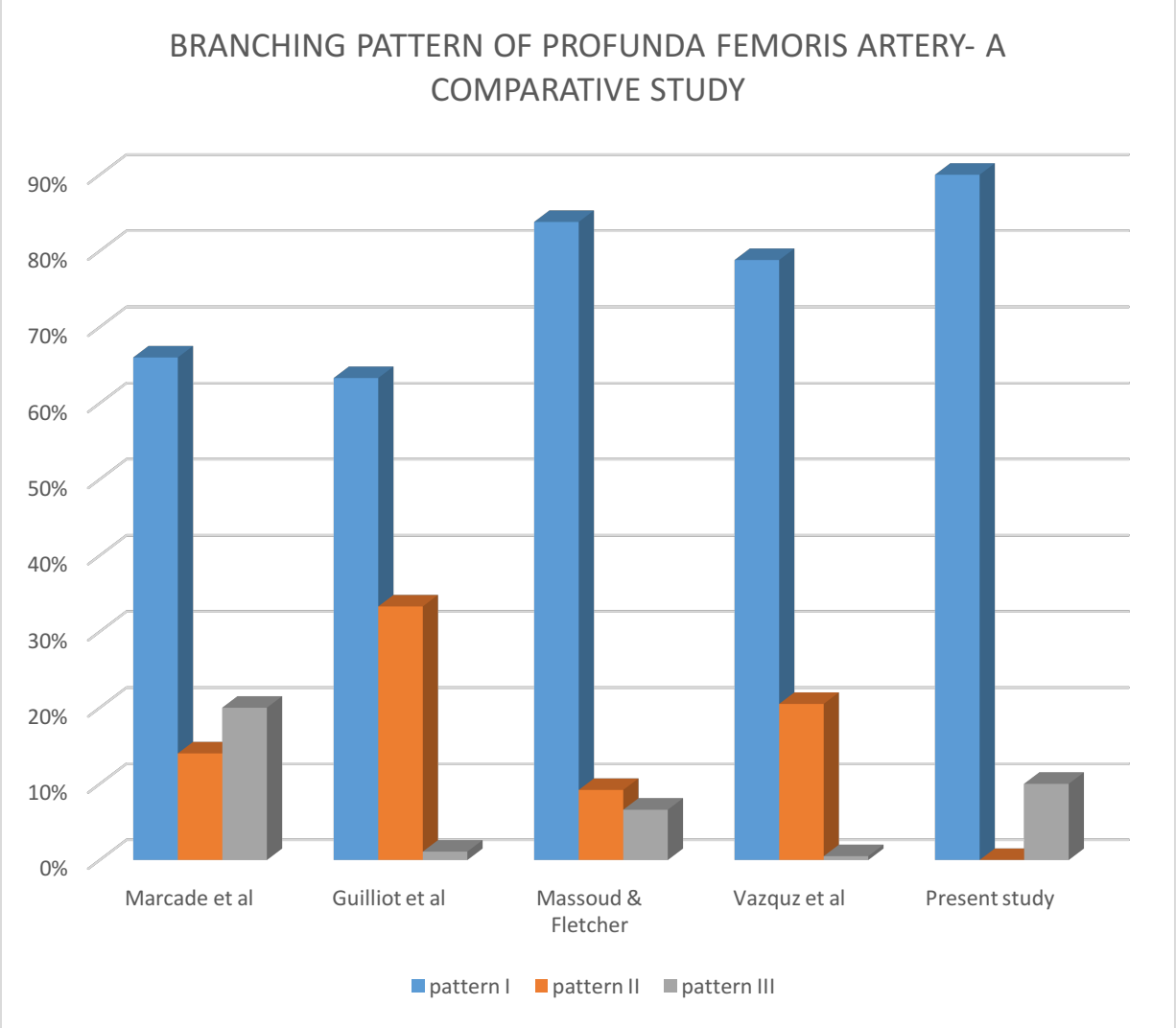


CHART 24

CONCLUSION

The present study of profunda femoris artery –its origin, origin of its both circumflex branches, diameter, length, course, its relation with femoral vein and artery and branching pattern were analyzed by several researchers in the past and present.

The methods of study were routine dissection and radiological study. The profunda femoris artery was studied in 40 adult lower limb specimens and in 10 computerized tomographic angiograms. The observatory findings in the present study were more or less coincides with that of the observations of researchers in the past.

The following findings were observed:

- ❖ High origin of profunda femoris artery in 4 specimens out of 40 specimens.
- ❖ Average distance from mid inguinal point to the origin of profunda femoris artery was 3.95 centimeters.
- ❖ Origin of lateral circumflex femoral artery from femoral artery was seen in 4 specimens.
- ❖ Origin of the branches of the lateral circumflex femoral artery directly from the profunda femoris artery was observed in 2 specimens.

- ❖ Origin of medial circumflex femoral artery from profunda femoris artery in all 40 specimens.
- ❖ Average diameter of profunda femoris artery was 5.4 centimeters.
- ❖ Average length of profunda femoris artery from its origin to the first perforator was 11.5 centimeters.
- ❖ Femoral vein and femoral artery were related superficially to the profunda femoris artery.
- ❖ Branching pattern of profunda femoris artery follow 90% of pattern I and 10% of pattern III.

A detailed knowledge of the normal anatomy and the abnormalities of the site of origin and course of the profunda femoris artery and its circumflex branches is essential. It is of importance during vascular, diagnostic, interventional procedures and surgeries but also helps in reducing the chances of intra-operative secondary haemorrhage and post-operative complications. The knowledge of various variations is very crucial during catheterization of femoral arteries and surgeries in the femoral region and therapeutic procedures on the femoral triangle. The anatomical observations of this study will definitely be useful for the Radiologists and Surgeons.