



## VARIATIONS IN THE RELATIONSHIP OF FEMORAL VEIN AND FEMORAL ARTERY .

### Surgery

**Dr.P.Ramalingam\*** Associate Professor, Dept. of Surgery, Karpagam Faculty of Medical Sciences and Research, Coimbatore, Tamil Nadu, India. \*Corresponding Author

**Dr. K.Rajeswari** Associate Professor, Dept. of Anatomy, Government Medical College and ESIC Hospital, Coimbatore, Tamil Nadu, India.

### ABSTRACT

The femoral vein assessment is important in central venous placement. The individual with duplication of the femoral vein are more prone for deep vein thrombosis. In this study we have attempted to study the variations in the relationship of femoral vein and the femoral artery by direct dissection method in human cadavers and by studying computerized tomographs. The results are discussed in the article. The sound knowledge about the anatomical variations of femoral vessels and their branches in the femoral triangle is very important for the successful outcome of surgeries in the femoral triangle. We believe that this report is of importance to the general and vascular surgeons and will enlighten them to avoid the unnecessary complications.

### KEYWORDS

femoral vein; femoral artery, relation.

#### 1.Introduction-

The femoral vein accompanies the femoral artery, beginning at the adductor opening of the popliteal vein and ending posterior to the inguinal ligament as the external iliac vein. The vein is postero lateral to the femoral artery in the distal adductor canal. More proximally, in the canal and in the distal femoral triangle, the vein lies posterior to the artery. Proximally at the base of the triangle, the vein lies medial to the artery [1]. The femoral vein is a relatively safe option for gaining central venous access when more proximal locations are less easily accessible. Ultrasound guidance helps reduce vascular bleeding by 60% when femoral vein is used for cannulation. Variations in the anatomy of lower limb veins have been studied with the use of cadavers and recently duplex ultrasound. Computerised tomographic scans has also evolved as a primary method of studying peripheral veins. The individual with duplication of femoral vein are more prone to deep vein thrombosis. Femoral vein assessment is also important in central venous placement and can be used for iliac substitution. So we have made an attempt to study the variations in the relationship of femoral vein and the femoral artery.

#### 2.Aims and objectives

The main objective of this study is to find out the variations in the relationship of femoral artery and femoral vein by direct dissection method and by studying computerized tomographs.

#### 3. Material and Methods:

##### [a]Direct dissection method:

The study material consisted of 50 adult lower limb specimens from 25 cadavers allotted for dissection to the IMBBS students in the Institute of Anatomy, Madras Medical College, Chennai. The method adopted was direct dissection method. A horizontal incision was made from the anterior superior iliac spine to the pubic tubercle. Another vertical incision was made from the pubic tubercle to the medial femoral condyle. Another horizontal incision was made at the level of tibial tuberosity. The skin and the superficial fascia were reflected. The femoral artery and the femoral vein were traced and their relationship was noted and documented.

##### [b]Adult 64 slice computerised tomographic study:

Adult 64 slice computerised tomography of 50 patients who underwent the procedure in the Barnard Institute of Radiology, Government General Hospital, Chennai were observed, collected and studied. Then the images were analysed for the relationship of the femoral vein and the femoral artery and were documented.

#### 4.Observation

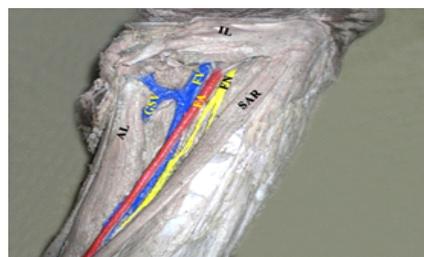
[a]By direct dissection method: In all 50 specimens at the base of the femoral triangle the femoral vein is medial to the femoral artery;[Figure-1] in the distal femoral triangle and in the proximal adductor canal, the femoral vein is posterior to the femoral artery; [Figure-2] in the distal adductor canal the femoral vein is postero lateral to the femoral artery.

[b]Relationship between femoral vein and femoral artery by 64 slice computerised tomographic scans: [Table-1]. Out of 50 limbs studied by 64 slice computerised tomographic scans, in 17 limbs (34%) there was partial overlapping of the femoral vein over the femoral artery. [Figure-3]. In remaining 33 limbs, (66%) there was no overlapping and the femoral vein was found lying medial to the femoral artery and the femoral artery and the femoral vein pairs in these cases. [Figure-4] In none of the cases complete overlapping of the femoral artery by the femoral vein noted.

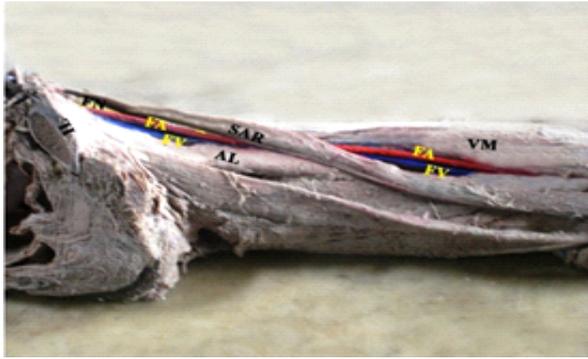
5.Discussion-[a]By direct dissection method-Henry Gray [1] quoted that the femoral vein is posterolateral to the femoral artery in the distal adductor canal, more proximally in the canal and in the distal femoral triangle the vein is posterior to the artery and proximally at the base of the femoral triangle the femoral vein is medial to the artery. Prof. A.M.Buchannan's [2] said that immediately distal to the inguinal ligament, the femoral vein lies to the medial side of the artery, it lies posterior to the artery in the distal part of the triangle. In the distal part of the sub sartorial canal, femoral vein is posterior and to the lateral side. Barry J.Anson; Chester B McVay [3] quoted that the femoral vein lies medial to the femoral artery at the inguinal ligament and from there assumes a posterior position. In the adductor canal the femoral vein is bound closely to the femoral artery by connective tissue which at first lies posterior to and then slightly to the lateral side of the artery. Keith L.Moore[4] stated that the femoral artery enters the femoral triangle, lateral to the femoral vein. As the femoral vein ascends through the adductor canal it lies posterolateral and then posterior to the artery. In the present study, in all 50 adult specimens at the base of the femoral triangle the femoral vein is medial to the femoral artery, in the distal femoral triangle and in the upper part of the adductor canal the femoral vein is posterior to the femoral artery and in the distal part of the adductor canal the femoral vein is posterolateral to the femoral artery. This finding coincided with the statement of Henry Gray, Buchannan's, Barry J.Anson and Keith L.Moore.

Barry.J.Anson, Chester B McVay [2] also mentioned that occasionally the femoral vein is found anteriorly or laterally. A.Vani and S.Saritha [5] found that in

#### Figure-1 Femoral Vein is Medial to Femoral Artery at the base of the Femoral Triangle



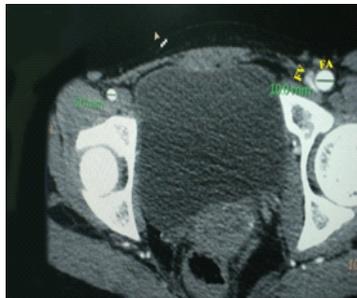
**Figure 2 -Femoral Vein is Posterior to Femoral Artery in the Distal part of the Femoral Triangle and Proximal part of Adductor Canal.**



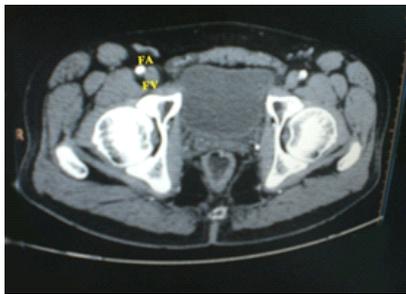
**Table-1.Overlapping of the common femoral artery by the common femoral vein**

S.no	parameters	No. noted	%
1	No overlapping of the CFA by CFV	33	66%
2	Mild overlapping of the CFA by CFV	17	34%
3	Complete overlapping of CFA by CFV	0	0

**Figure-3 . Computerized Tomography showing Partial Overlapping on both the sides**



**Figure 4- Computerised Tomographs showing No Overlapping on both the sides**



**Table-2.Overlapping of the common femoral artery by the common femoral vein by various authors**

Parameters	Philips baun	Wakentine	Present study
1 No overlapping of the CFA by CFV	22%		66%
2 Partial overlapping of the CFA by CFV	8%	4%	34%
3 Complete overlapping of CFA by CFV	65%	8%	0

a case in the upper part of the femoral triangle the femoral vein lies lateral to the femoral artery. In the present study , in none of the specimens the femoral vein is anterior or lateral to the femoral artery.

B.Sahin and S.Bilgic [6] found a rare variation of duplicated deep femoral artery in the right lower limb of a male new born cadaver. In another case deep femoral artery passing in front of the femoral vein was found in the left lower limb of a new born male cadaver. In the present study, duplicated deep femoral artery was not found. Faith

Kantari .M.B. et al [7] reported an extremely rare arterial variation, duplication of the superficial femoral artery in a 60 year old male patient with bilateral intermittent claudication. The superficial femoral vein was identified lying posterior to the duplicated femoral artery. In the present study, no such abnormality found in any of the specimens.

Chiranjit samanta et al [8] found in one male cadaver two femoral veins flanking the femoral artery. Marcucci et al [9] reported 1 case where the saphenofemoral junction and the femoral vein were located laterally to the femoral artery. Smith and Dimitri et al [10] found in 1 case the superficial femoral artery running medial to the saphenofemoral junction and common femoral vein. Leite et al [11] reported 1 case of incomplete transposition. They found the saphenofemoral junction was positioned posterolaterally to the femoral artery. Retraction of the femoral artery was required to perform adequate ligation of the saphenofemoral junction. Lekich et al [12] described a case of femoral vessel transposition due to high bifurcation of the common femoral artery. Preoperative duplex ultrasound revealed that the saphenofemoral junction and the common femoral vein were located between the superficial femoral artery and the deep femoral artery. Nabatoff et al [13] reported a case of transposition of the femoral artery and the vein in the fossa ovalis encountered during varicose vein surgery. The great saphenous vein was compressed below the transposed femoral artery. The great saphenous vein was mobilised and brought out from underneath the femoral artery during flush ligation. Bandyopadhyay et al [14] described a case of incomplete transposition of the femoral vessels. The superficial femoral artery crossed medially to the common femoral vein and the saphenofemoral junction due to high bifurcation of the femoral artery just below the inguinal ligament. Forty et al [15] reported a case where the femoral artery was positioned medial to the vein in the region of the femoral triangle. In the present study, no such abnormality noted.

[b] Relationshipship between femoral vein and femoral artery by 64 slice computerised tomographic scans:Out of 50 limbs studied by 64 slice computerised tomographic scans ,in 17 limbs (34 %) there was partial overlapping of the femoral vein over the femoral artery . In remaining 33 limbs, (66%) there was no overlapping and the femoral vein was found lying medial to the femoral artery.

The overlapping of the common femoral artery by the common femoral vein by various authors is tabulated in table 2.

Wackertine et al studied 84 patients using ultrasonography in newborns, infants and children upto 9 years. They found that the femoral vein was found to be completely overlapped by the femoral artery in 8% of the subjects and partially overlapped by the femoral artery in 4% of the subjects.

P.Hughes; C.Scott [17] quoted that in most patients there was some degree of overlap of the artery over the vein.

Phillip. A.Baun et al [18] studied 100 CT scan of pelvis and found that in 65% of the vessel pairs the common femoral artery overlapped the common femoral vein in the anteroposterior plane. Warkentine et al reported that in 8% of cases the common femoral artery overlapped the common femoral vein .In the present study , out of 50 lower limb scans of the pelvis, in none of the cases the common femoral artery was overlapping the common femoral vein. So the present study differs with the study of Baun and Warkentine et al.

According to Baun et al in more than 8% of the vessel pairs, more than 25% of the artery overlapped the vein. Warkentine et al reported in 4% of cases , there is partial overlapping of the common femoral vein by the common femoral artery. In the present study, in 34% of the cases, there were partial overlapping of the common femoral vein by the common femoral artery. So the present study differs with the findings of Baun and Warkentine.

According to Baun et al 22% of the cases, there was no overlapping of the artery and the vein in the anteroposterior plane. In the present study in 66% of the cases there was no overlapping of the artery and the vein in the anteroposterior plane. The femoral vein was found lying medial to the femoral artery and the femoral artery and the femoral vein pairs in those cases in the axial CT scan of the pelvis. So the present study differs with that of Braun.

Shahin et al [6] opined that before the catheterisation of the femoral vessels and operations in the femoral triangle, high resolution ultrasonic imaging can provide anatomic and functional information about the femoral vessels and would be of assistance in planning catheterisation.

6. Conclusion: We conclude that if the surgeon is unaware of these variations, the surgical procedure around this area can lead to disaster during therapeutic and diagnostic procedures. The sound knowledge about the anatomical variations of femoral vessels and their branches in the femoral triangle is very important for the successful outcome. We believe that this report is of importance to the general and vascular surgeons and will enlighten them to avoid the unnecessary complication. This study is also informative for the anatomists and morphologists. In addition to being of general anatomical interest to the vascular surgeon, it serves as a reminder that even the most seemingly constant of vascular landmarks can occasionally be subject to marked variability.

#### Abbreviations:

CFV-common femoral vein  
CFA-common femoral artery  
FA-femoral artery  
FV-femoral vein  
FN-femoral nerve  
IL-inguinal ligament  
AL-adductor longus  
SAR-sartorius  
GSV- great saphenous vein

Conflicts of interest: none

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