

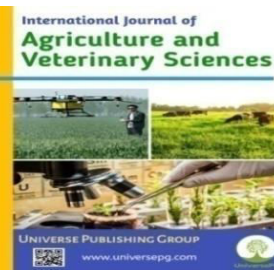


Publisher homepage: [www.universepg.com](http://www.universepg.com), ISSN: 2663-7529 (Online) & 2663-7510 (Print)

<https://doi.org/10.34104/ijavs.023.01020108>

International Journal of Agriculture and Veterinary Sciences

Journal homepage: [www.universepg.com/journal/ijavs](http://www.universepg.com/journal/ijavs)



## Saphenophemoral Junction and its Related Anatomical Variation in Black Bengal Goat

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### ABSTRACT

Blood circulation especially venous distribution is an important subject in any kind of surgical procedure. In case of the hind leg from ankle to the groin blood is supplied by saphenous vein. For venous drainage in hind limbs saphenous vein has a significant role that extends from ankle to groin. Basically median and lateral saphenous veins join together as great saphenous veins and enter into gastrocnemius muscle. Ventral to muscle layer of tensor fascia lata saphenous vein joins with femoral vein and forms a junction, which is known as saphenofemoral junction. It's also known as great saphenous vein. Between the deep and aponeurotic fascia of tensor fascia lata saphenous vein has been found. Many tributaries such as circumflex iliac vein, external pudental and deep pudental vein were examined in this case. Four cadaveric lower limbs were dissected to examine anatomical variations of these veins describe their relation to the deep fascia of the thigh. Saphenous compartment is actually a triangular structure. This triangular space is formed by adductor muscle, fascia lata and Sartorius muscle. The range of saphenous veins in the saphenous compartment ranged from 5.7-8.1 (7±1.3) cm.

**Keywords:** Anatomical variation, Black Bengal Goat, Saphenophemoral junction, and Saphenous compartment.

### INTRODUCTION:

Goats are important livestock species in developing countries. There are almost 886.1 million goats are located in the universe. Goats are hardy and well adapted to harsh climates (Aziz, 2010). Total number of livestock in Bangladesh is 3931.37 lakh. Number of cattle buffalo, sheep, and goat in Bangladesh are respectively 240.86 lakh, 14.85 lakh, 34.68 lakh, 261 lakh. Total ruminant in Bangladesh is 551.39 lakh (DLS, 2018; Hussen *et al.*, 2023).

Raising Black Bengal goat can be considered as an additional source of income for the landless farmer. Black Bengal goat has a broad chest, ears are always on top, horn may small or medium. The goat breed starts producing baby goat at their 12-15 months of age. We can get about 11 kg of consumable meat and a high quality skin from a goat weights about 20 kg. Reproductive performance in goats is an indicator of their adaption in unfavourable conditions (Hasan *et al.*, 2014). The female goat become pregnant twice a year and give birth 2-3 baby goat each time. The meat, skin

and milk of this goat have a huge demand in Bangladesh and abroad. Goat milk prevents tuberculosis and asthma. Milk contains lactose with many people with lactose intolerance can drink goat milk because of its lower amount of alpha one casein. For menopausal women goat milk provide 13% more calcium than cow milk and can be consumed comfortably (Kalayankar *et al.*, 2016).

Saphenous vein is the most important vein in hind limb of goat. The perforating veins drain flow from the great and small saphenous veins to the deep veins or muscular veins or drain flow from tributary veins that are independent from the saphenous vein system and which may play in different hemodynamic roles (Engelhorn *et al.*, 2018). Saphenous vein is the most important thing in case of goat for regional anaesthesia, endovenous laser ablation and treatment of varicosities. The great saphenous vein is a large venous blood vessel running near the inside surface of the hind leg from the ankle to the groin. It arises from the dorsal venous arch at the top of the foot (dorsum) and drains to the femoral vein (Caggiati and Bergan, 2002). Actually saphenous vein is surrounded by fascia. Toughness of fascia prevents varicosities by protecting saphenous vein from hydrostatic blood pressure. Saphenous vein remains between superficial and deep aponeurotic layer of fascia lata. At the ultrasound machine, it shows as an eye called Saphenous or Egyptian eye (Chen and Prasad, 2009).

It is originated from the dorsal venous arch of the hind leg. In front of the medial malleolus, it runs up the medial side of the leg. At the knee it runs over the posterior border of the medial epicondyle of the femur. Actually Saphenous vein passes through cribriform fascia (covering of saphenous opening) to join the femoral vein to form the circumflex femoral vein. The great saphenous vein drains into the femoral canal. This vein is the medial most structure in the femoral triangle (Raj *et al.*, 2017).

Femoral triangle is formed by lateral border is formed by medial border of Sartorius; medial border is formed by medial border of adductor longus. Inguinal canal forms the base of the femoral triangle (Raj *et al.*, 2017). Saphenous fascia acts as a type of mechanical barrier that can counteract pathologic vasodilation in

varicose vein. Tributaries of saphenous vein are posteromedial and anterolateral vein, superficial epigastric and circumflex iliac, superficial and deep external pudendal vein. These tributaries and collateral vessels emerge from this saphenous fascia. These are devoid of any fascial sheath. Fascial sheath supports saphenous vein from the hydrostatic blood pressure. So they are unprotected and thus subject to varicose dilation before the large saphenous trunks are affected (Donnelly *et al.*, 2005).

Presence of two fascial laminae surrounding the great saphenous vein enclosing within the fascial sheath microscopically. Great saphenous vein was surrounded by a fascial sleeve differentiated from adventitia. Actually three layers are present. These are tunica externa, tunica media and tunica intima (Papadopoulos *et al.*, 1981). In case of goat, the superficial vessels comprise the medial and lateral saphenous vein and their tributaries. The larger lateral saphenous vein arises from two tributaries. The cranial one ascends with the extensor tendon and the superficial peroneal nerve and crosses the hock joint on the dorsolateral aspect. The caudal one ascends with lateral planter artery from a subcutaneous origin on the lateral digit. It follows the flexor tendon under cover of the deep fascia and passes the joint plantolaterally. The medial saphenous vein ascends together with the palpable saphenous artery on the medial aspect of the leg. Above the stifle it dips between the gracilis and Sartorius muscle to join the femoral vein (Dyce *et al.*, 1995). So saphenous vein is very important for clinical purpose. But there are too little research work related saphenous vein in Bangladesh. To know about saphenous vein, some important points should be known. This study has been focused on three points related with saphenous vein; Detection of saphenofemoral junction, Detection of external pudendal artery (anatomical landmark of saphenous vein to avoid injury), and Detection of cribriform fascia (opening of Saphenous)

## **MATERIALS AND METHODS:**

### **Samples**

A total of 4 lower limbs (**Fig. 1**) from 4 cadavers (2 males and 2 females) were included in this study. Samples were collected from local market. All lower limbs were apparently normal with no apparent vari-

cosities. All cadavers were fixed in 8% formalin and preserved in 30 % ethanol. All works was performed in the laboratory of Anatomy under the Department of Anatomy and Histology in CVASU. This work was performed between April and May, 2019.

**Methodology**

At first skinning was done (Fig. 2), the fascia lata on the front of thigh was dissected to identify its layers. The number of the superficial tributaries at the saphenofemoral junction, their location in relation to the layers of fascia lata and whether they terminated into the great saphenous vein or circumflex femoral vein were recorded. The relationship between all these veins and the external pudendal artery and the cuta-

neous nerves of the front of the thigh was studied. All measurements were taken using Vernier caliper.

Seperation of skin in hind limb was done by applying incision of the surgical blade with scalpel. To observe fascia of muscle in hind limb skinning should be done. Actually fascia is white fibrous connective tissue which separates the muscle fiber from each other. After skinning, pubic symphysis of pelvic girdle was separated into two equal parts. Electrical saw was used for doing this work. At the ventral view of tensor fascia lata, mucle layer was removed with the help surgical blade. Actually saphenofemoral junction is located between fascial layers of tensor fascia lata.



**Fig. 1:** Hind limb of Black Bengal Goat.



**Fig. 2:** Process of skinning.



**Fig. 3:** Muscle with fascia in hind limb.

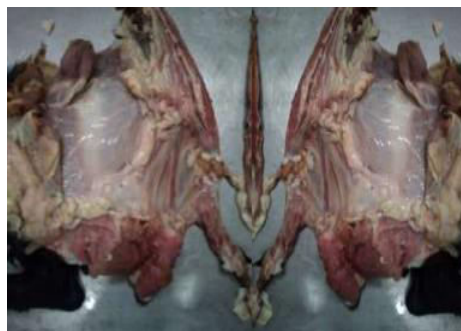
After removing muscle layer of tensor fascia lata the junction was found which was surrounded by sartorius, adductor longus and fascia lata muscle. These

three muscles are the part of triangular saphenous compartment. Median, lateral and base border of this compartment was calculated by using Vernier caliper.



Biceps Femoris  
Tensor Fascia lata

**Fig. 4:** Different muscles layer in leg.



**Fig. 5:** Equal portion of puvic symphysis

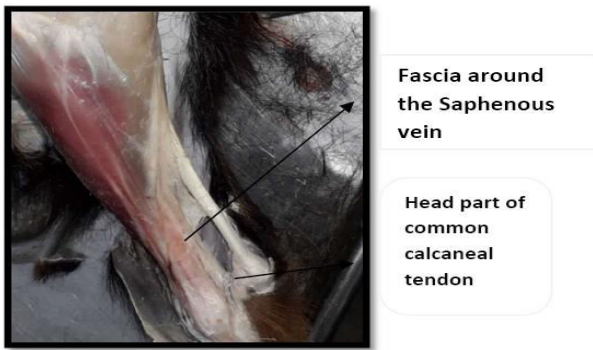
**RESULTS:**

Here the saphenofemoral junction and the common femoral vein (circumflex femoral vein) are noted. The external pudendal artery is noted taking origin from the femoral artery. It passes behind the anterolateral

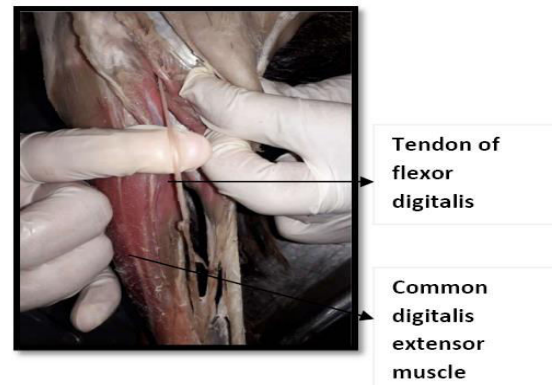
thigh vein in front of great saphenous vein below saphenofemoral junction. Adductor longus and pectineus muscles are noted. Deep femoral artery originates at the ventral margin of pelvic inlet. It divides into pudendoepigastric and medial circumflex femoral

arteries. The external pudendal artery passes out of the abdominal cavity through the inguinal canal and is distributed in the local lymph nodes. In female goat this artery continues as mammary artery. Cribriform fascia is known as saphenous opening through which saphenous vein enters into the femoral canal. (Sieve like membrane).

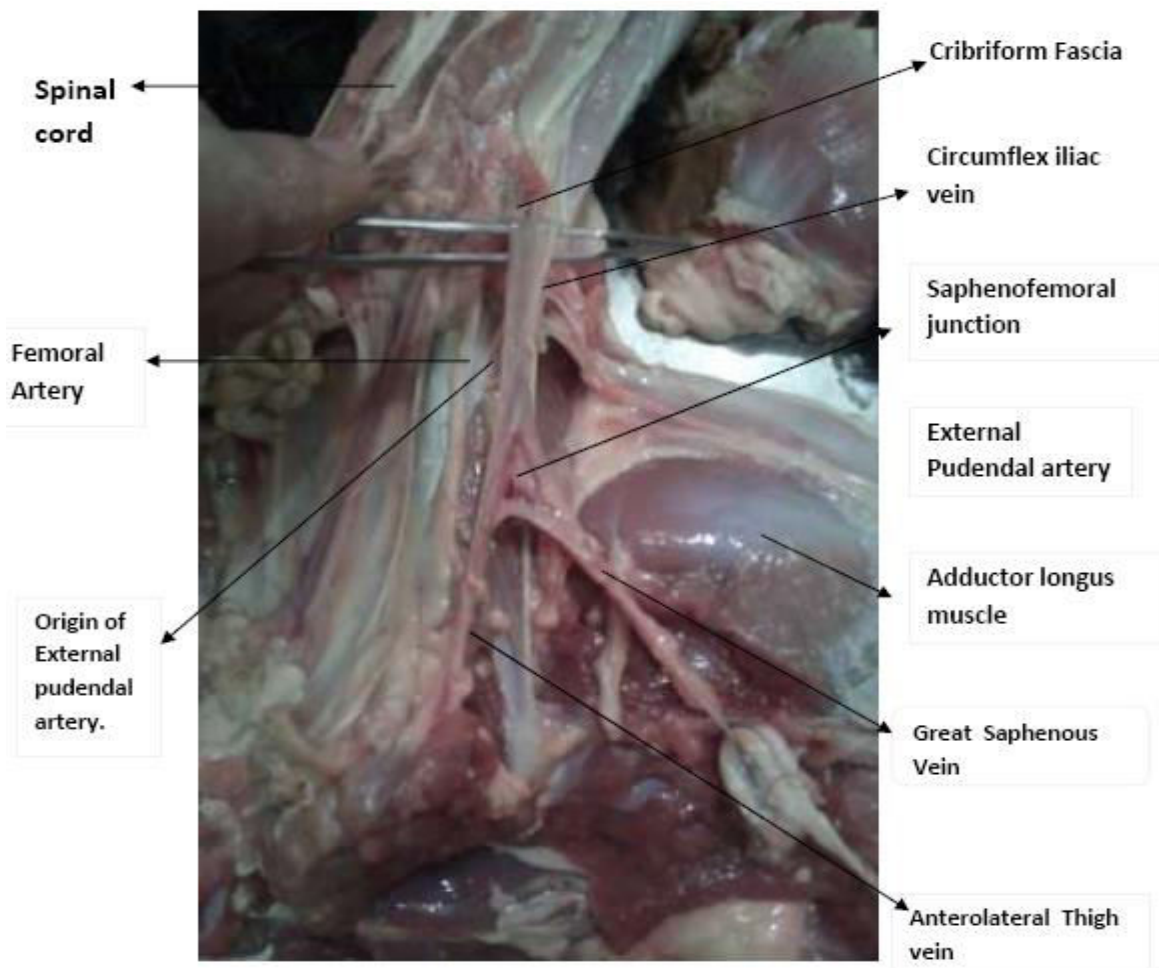
The triangular saphenous compartment is a closed fascial space except where the great saphenous vein entered near the apex (Fig. 6 &7). This triangular space consists of two lateral border, medial border and base border. Actually the fascia lata split into a superficial layer (saphenous fascia) and a deep layer (fascia lata proper) just below inguinal ligament thus creating a fascial space (saphenous compartment).



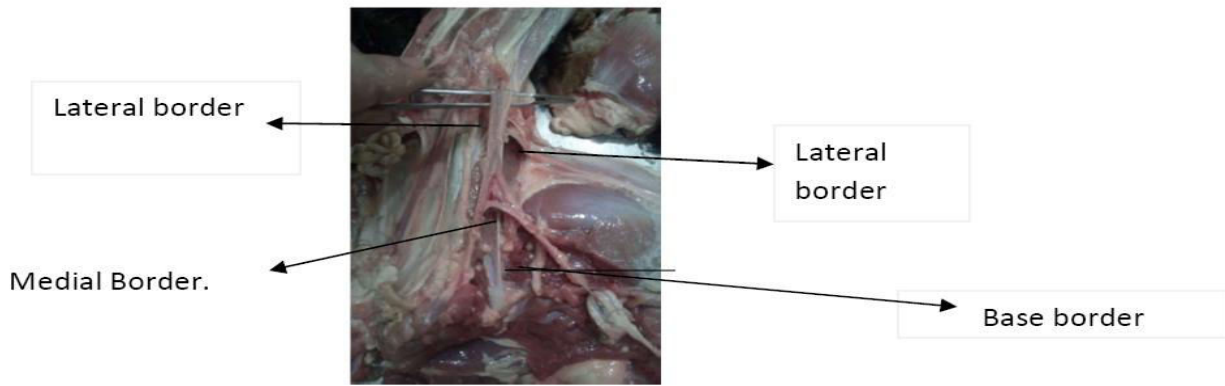
**Fig. 6:** Lateral saphenous vein with fascia.



**Fig. 7:** Tendon With lateral Saphenous Vein.



**Fig. 8:** Saphenofemoral junction and its surrounding anatomical findings.



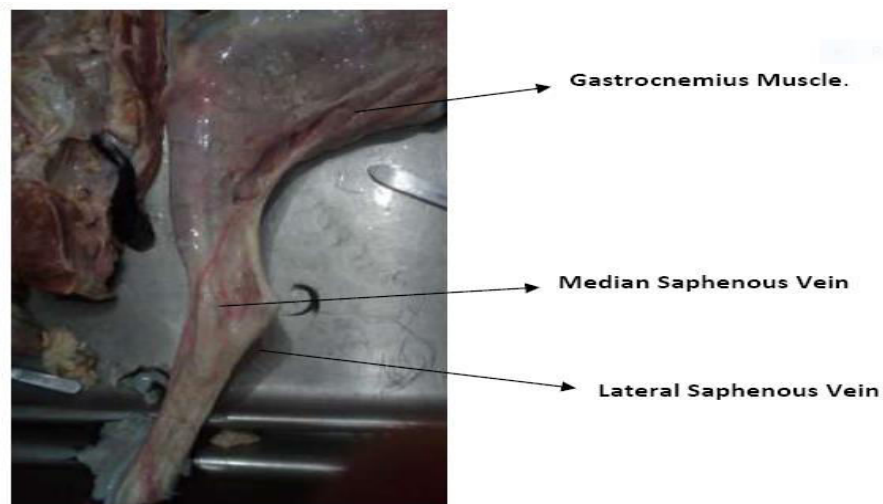
**Fig. 9:** Triangular Saphenous compartment.

**Table 1:** Dimensions of the saphenous triangle (cm = centimeter, Std = standard deviation).

Sample (no of hind limb)	Great Saphenous vein (cm)	Median Border (cm)	Base Border (cm)	Lateral Border (cm)
1.	5.7	5.5	6.2 cm	7.5 cm
2.	6.3	6.2	7.5 cm	8.3 cm
3.	7.8	5.8	7.4 cm	9.2 cm
4.	8.1	7.3	8.1 cm	10.1cm
Mean ± Std	7 ± 1.30	6.2 ±1.15	7.3 ± 0.8	8.7 ± 1.50

The fascia lata over adductor longus muscle split at the medial border of this muscle. The line of splitting formed the medial border of the saphenous triangle.

The fascia lata over Sartorius muscle split at the medial border of this muscle. This line formed the lateral border of the saphenous triangle.



**Fig. 10:** Superficial course of Saphenous Vein.

**DISCUSSION:**

Due to variable tributaries and relation to the deep fascia of the front of the thigh, Saphenofemoral junction is indeed a complex structure. The study of the anatomy of the saphenous compartment and its content can help us to a great extent to understand

pathogenesis of lower limb varicose veins and to prevent and treat them in the best way. Endovenous laser ablation can be applied in this case. Tributaries of saphenous vein are superficial epigastric, superficial circumflex iliac and superficial and deep external pudendal. These are known as saphenofemoral

junction tributaries. Presence of these tributaries outside the saphenous compartment promotes varicosities. Because in this case they drain superficial cutaneous areas. But in this result all tributaries are remained in saphenous compartment. Papadopoulos *et al.* (1995) described that two layers of fascia derived from deep fascia of thigh forming the canal. They noticed tributaries piercing superficial layer of fascia to join the great saphenous vein. External pudendal artery passes between the great saphenous vein and the saphenofemoral junction and is often positioned medial to the circumflex femoral vein. In this result it has been shown that deep femoral artery is the originating space of external pudendal artery. Accurate knowledge of the position of the external pudendal artery is important to avoid its injury.

De Maeseneer *et al.* (2007) suggested a potential benefit of closure of the cribriform fascia after Saphenofemoral junction ligation to prevent neovascularisation and reduce the incidence of recurrence. They stated that the use of fascia had better results and fewer complications when compared to the use of synthetic patches. So after this discussion it can be said that accurate anatomical knowledge related with saphenofemoral junction and its tributaries, cribriform fascia is most important to prevent neovascularisation clinically.

### CONCLUSION:

Saphenofemoral junctional structure is one of the important anatomical structures. Knowledge of variation of this is necessary for better surgery and reducing recurrence rates of neovascularization. The deep fascia on the front of the thigh should be incised and closed in layers in starting with saphenous fascia and the cribriform fascia. Finally fascia lata proper should be closed if incised to ligate circumflex femoral vein. These will help to preserve hemodynamics in the saphenous compartment and to decrease the recurrence of neovascularization after surgery.

### Limitations

As a new work it has faced a few limitations. Such as:

- 1) Insufficient number of sample (hind limb of Black Bengal Goat).
- 2) All samples were collected from local market. So animal rearing conditions was not similar.

- 3) As Saphenofemoral junction is a multi-structure, dissection and separation of muscle fasciae need very skilled hand. Here some case damage is noticed.
- 4) There is lack of sufficient information like previous study, findings related saphenous vein of goat, etc.

### ACKNOWLEDGEMENT:

I would like to express my deep sense of gratitude and thanks to Professor Dr. Md. Abdul Ahad, Dean, Faculty of Veterinary Medicine, CVASU. I am very grateful to my supervisor Dr. A.S.M. Golam Kibria, Professor, Dept. of Anatomy and Histology, CVASU, for his valuable advice, suggestions, guidance, encouragement and all kinds of help including providing freedom to work in Anatomy laboratory. I would like to thank all teachers and staffs of Anatomy and histology department for their support and providing the materials needed for the study.

### CONFLICTS OF INTEREST:

The author(s) declare no potential conflict of interest.

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**Citation:** Al Farabi A, Uddin MM, Rahman MH, Paul J, and Kibria ASMG, (2023). Saphenofemoral junction and its related anatomical variation in Black Bengal goat. *Int. J. Agric. Vet. Sci.*, **5**(4), 102-108.

<https://doi.org/10.34104/ijavs.023.01020108> 