# *Incidence of Vascular Complications Following Interventional Procedures By Doppler Color Flow Imaging*

*Thesis*

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By

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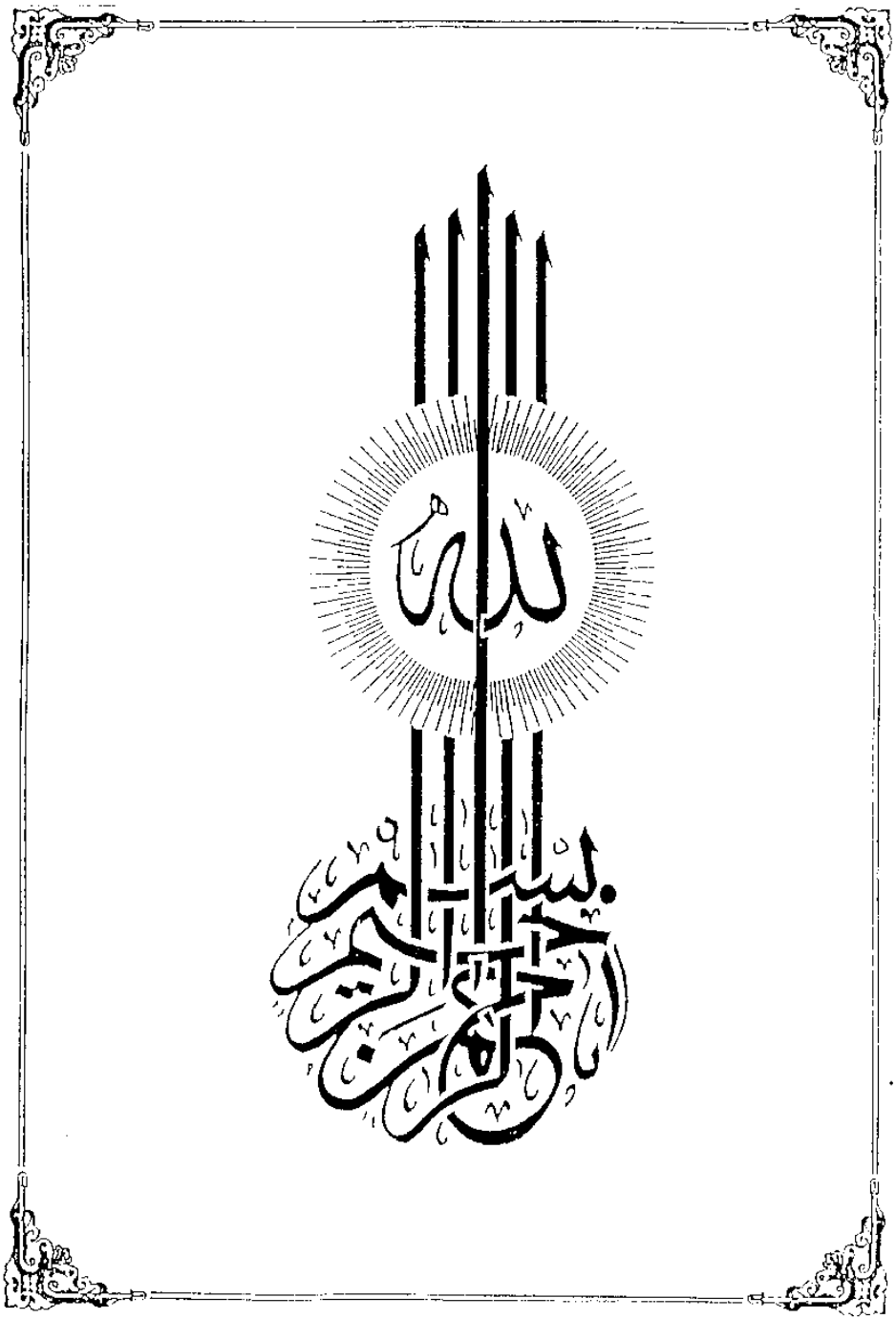

# List of Abbreviations

| | |
|---|---|
| **AF:** | Atrial fibrillation. |
| **AVF:** | Arteriovenous fistula. |
| **BMI:** | Body mass index. |
| **CCDS:** | Color coded duplex scanning. |
| **CFA:** | Common femoral artery. |
| **CFV:** | Common femoral vein. |
| **DFA:** | Deep femoral artery. |
| **PBMV:** | Percutaneous balloon mitral valvuloplasty. |
| **Ps. An.:** | Pseudo-aneurysm. |
| **PTCA:** | Percutaneous transluminal coronary angioplasty. |
| **SFA:** | Superficial femoral artery. |

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# Introduction
# &
# Aim Of The Work

# *Introduction*

Vascular complications resulting from cardiac catheterization by the femoral approach are well documented in the literature with incidence rates variously estimated to be between 0.36 % and 17.5% ***(Skillman, 1988)***.

Increased utility of complicated catheterization procedures including percutaneous transluminal coronary angioplasty, percutaneous aortic or mitral valvuloplasty and electro-physiologic testing all increases the likelihood of vascular trauma and resultant complications at the puncture site ***(Wyman, 1988)***.

Until recently, accurate diagnosis of vascular complications necessitated angiography that required further trauma, iodinated contrast injection, radiation exposure and additional cost ***(Mc Millan, 1984)***.

A new and innovative method for identification of vascular complications at the puncture site has been the development of color coded duplex scan ***(Mitchell, 1987)***.

Duplex scanning combines the diagnostic advantages of high resolution imaging (anatomical data) with pulsed-Doppler flow meter signal spectral analysis (hemodynamic data) to provide an ideal non-invasive method for evaluating blood flow ***(Bandyk, 1987)***.

## Aim of the study:

The aim of the present work is to detect the incidence of vascular complications (either arterial or venous) following interventional procedures as percutaneous mitral balloon valvuloplasty (PBMV) or percutaneous transluminal coronary angioplasty (P.T.C.A.). Also to try to find out their possible different aetiologies, and underlying risk factors.

# Review Of Literature

# Blood Vessels of The Lower Extremities

## The external iliac artery:

The external iliac arteries are the largest branches of the common iliac artery. Each runs obliquely down and laterally along the medial border of psoas major from the bifurcation of the common iliac artery to a point midway between the anterior superior iliac spine and symphysis pubis, where it enters the thigh behind the inguinal ligament to become the femoral artery. Its course may be straight (57 percent), curved (29 percent) or tortuous (14 percent). The length of the vessel is 9 cm on the right and 8.8 cm on the left side (6 to 12 cm), the diameter is 0.68 cm (0.4 to 1.0 cm) ***(Deluca and De Sorio 1962)***

### *Relations:*

Infront and medially the external iliac artery is related to parietal peritoneum and extra peritoneal tissues, which separate the right artery from the terminal ileum and frequently the vermiform appendix and the left artery from the sigmoid colon and some coils of small intestine. The beginning of the artery may be crossed by the ureter, in the females it is crossed by the ovarian vessels. The testicular vessels lie for some distance upon it near its termination and here it is crossed by the genital branch of the genitofemoral nerve, the deep circumflex iliac vein, the ductus deferens or the round ligament of the uterus.

Posteriorly it is separated from the medial border of psoas major by the iliac fascia. The external iliac vein is partly behind the upper part of the artery but is medial to its lower part.

Laterally it is related to psoas major, the iliac fascia being between them. Numerous lymph vessels and nodes lie on the front and sides of the vessel ***(Davis, 1969)***.

### *Branches:*

Besides supplying small branches to psoas major and neighbouring lymph nodes, the external iliac artery gives off inferior epigastric artery and deep circumflex iliac artery.

### *The inferior epigastric artery:*

Originates 0.5 cm above the inguinal ligament. The vessel follows a medial and then an ascending course. It runs on the dorsal surface of the rectus abdominis muscle and communicates with the terminal branches of the internal thoracic artery. Its position falls in the line of the anterior inferior iliac spine in 80 percent of the cases ***(Harsani, 1951)***. Its pubic branch runs toward the symphysis and anastomose with the pubic branch of the obturator artery. Another branch the cremasteric artery enters the inguinal canal and divides in the skin of the scrotum.

### *Variations:*

The inferior epigastric artery may arise from the femoral artery and then it ascends infront of the femoral vein to enter the abdomen. It frequently comes from the external iliac artery by a common trunk with an abnormal obturator artery, and rarely it arises from the obturator artery ***(Kiss, 1963)***.

### *The deep circumflex iliac artery:*

Describes an ascending curve along the crest of the ilium,, and communicates with the ilio-lumbar artery, then its ascending branch forms anastomosis with the lumbar arteries and the inferior epigastric artery. A bridge important for collateral circulation is thus formed between the external iliac artery and the abdominal aorta ***(Davis, 1969)***.

## *The femoral artery:*

The femoral artery is the continuation of the external iliac artery. It begins behind the inguinal ligament midway between the anterior superior iliac spine and symphysis pubis, and passes down the front and medial side of the thigh where it passes through an opening in adductor magnus to become the popliteal. Above the femoral artery is in the femoral triangle, below in the adductor (Subsartorial) canal. The length of the femoral artery is 15 to 30 cm, its diameter 0.8 to 0.9 cm ***(Paturet, 1958)***. The first 3 or 4 cm of the vessel are enclosed with the femoral vein in the femoral sheath.

### *The femoral sheath:*

This is a downward prolongation, behind the inguinal ligament, of the transversalis fascia infront of the femoral vessels and the iliac fascia is behind them. It has the form of a short funnel. The sheath is about 3 to 4 cm long, but its medial part is much shorter. The lateral wall of the sheath is vertical and perforated by the femoral branch of the genitofemoral nerve, the medial wall is directed obliquely down and laterally and is pierced by the great saphenous vein and lymphatic vessels. Two anteroposterior septa divide the femoral sheath into three compartments, the lateral contains the femoral artery, the intermediate the femoral vein while the medial and smallest compartment is named the femoral canal and contains some lymph vessels and a lymph node ***(Davis, 1969)***.

### *The femoral triangle:*

Underlies the depression immediately below the fold of the groin. Its apex is below and its limits are: laterally the medial margin of sartorius, medially, the medial margin of adductor longus, above the inguinal ligament. The roof is formed by skin, superficial fascia containing portions of the intermediate and medial cutaneous nerves of thigh. Upper part of the great saphenous vein and superficial inguinal lymph nodes and the deep fascia of the thigh. The floor is formed of adductor longus, pectineus, psoas major and iliacus muscles (from medial to lateral) The femoral vessels extend from near the middle of its base to its apex. Lateral to the femoral artery, the femoral nerve divides into branches. The triangle also contains some fat and lymph nodes ***(Davis, 1969)***.

### *The adductor (subsartorial) canal:*

Is an aponeurotic tunnel in the middle third of the thigh, from the apex of the femoral triangle to the opening in adductor magnus through which the femoral vessels pass to the popliteal fossa. It is triangular on transverse section bounded infront and laterally by vastus medialis, behind by adductor longus above and adductor magnus below. It is roofed by a strong aponeurosis which extends from these muscles across the femoral vessels to the vastus medialis. The sartorius lies anterior to the roof. The canal contains the femoral artery and vein, the saphenous nerve and the nerve to vastus medialis proximally until it enters its muscle ***(Davis, 1969)***.

### *The relations of the femoral artery:*

In the femoral triangle, the artery is covered with skin, superficial fascia, the superficial inguinal lymph nodes, the fascia lata and the femoral sheath and it is crossed by the superficial circumflex iliac vein in the superficial fascia. The femoral branch of the genitofemoral nerve travels a short distance in the lateral part of the femoral sheath, at first lateral to and then infront of the artery. Near the apex of triangle the medial cutaneous nerve of thigh crosses the artery from its lateral to its medial side.

Behind, the artery is separated by the femoral sheath from the tendon of Psoas major, pectineus and adductor longus in this order downwards. The artery is separated from the Capsule of the hip joint by

the tendon of psoas major, from pectineus by the femoral vein and profunda vessels, and from adductor longus by the femoral vein, the vessels having passed posterior to the adductor longus. The nerve to pectineus passes medially behind the upper end of the artery. Lateral to the artery is the femoral nerve. The femoral vein is medial to the artery in the upper part of the femoral triangle and posterior in the lower part.

In the adductor canal the femoral artery lies deeper covered with skin, superficial and deep fasciae, sartorius and the fibrous roof of the canal. The saphenous nerve is at first lateral and then lies infront of it and is medial below Behind, the artery is related to adductor longus above, and adductor magnus below anterolateral to it are vastus medialis and its nerve. The femoral vein lies posterior to the upper and lateral to the lower parts of the artery ***(Davis, 1969)***.

## Surface anatomy:

The artery corresponds to the upper two thirds of a line joining a point midway between the anterior superior iliac spine and pubic symphysis to the adductor tubercle when the thigh is semiflexed, abducted and laterally rotated ***(Passler, 1963)***.

*Variations:* (Fig. 1)

The femoral artery is rarely absent being replaced by the inferior gluteal artery, which accompanies the sciatic nerve to the popliteal fossa, the external iliac artery is small and ends as the profunda femoris artery