

# Femoral vein duplication: incidence and potential significance

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## Abstract

**Objective:** The purpose of this study was to determine the prevalence of femoral vein duplication and the incidence of bilateral anomalies in a normal cohort of patients presenting with varicose veins.

**Methods:** Two hundred and forty patients underwent bilateral lower limb deep venous ultrasound examination with particular attention to the femoropopliteal segment.

**Results:** The incidence of femoral vein duplication was 41%. Of the 140 people with femoral vein duplications, 60 (42%) were bilateral and 80 (57%) were unilateral.

**Conclusion:** Femoral vein duplication is a common anatomical variant of the lower limb deep venous system. Ultrasound in skilled and experienced hands with the latest ultrasound units can readily demonstrate this venous anomaly on a consistent basis.

**Keywords:** femoral vein duplication; deep vein thrombosis; duplex ultrasound

## Introduction

Accurate diagnosis of clinically suspected deep vein thrombosis (DVT) is essential in the management of patients with thrombo-embolic disease and is also becoming increasingly important in post-sclerotherapy and post-endovenous laser ablation screening. Although contrast venography has been the gold standard study for the diagnosis of DVT in the past, it is now rarely used. Instead, duplex ultrasonography is becoming the imaging technique of choice because it is non-invasive and has a comparable true-positive rate as compared with venography in the evaluation of the femoropopliteal segment.<sup>1</sup> In the past, several studies have documented several potential pitfalls with ultrasound including a failure to identify thrombus within a duplicated femoral vein.<sup>2</sup> In fact, Liu *et al.*<sup>3</sup> was able to demonstrate a substantial increase in the prevalence of DVT in the presence of multiple femoral veins. DVT in these

cases was also more frequently asymptomatic than in patients with a single femoral vein. Thorough and routine sonographic examination for the presence of a duplicated femoral vein is therefore extremely important and should be a mandatory component of the DVT investigation protocol. Only a limited number of studies utilizing ultrasound to detect this common anatomical anomaly have been performed.<sup>4,5</sup> As such, the primary purpose of this study was to determine the incidence of femoral vein duplication with colour duplex imaging in patients presenting to our varicose vein clinic.

## Methods

Over a six-month period, all patients presenting to our clinic for lower limb venous incompetence studies were examined for underlying DVT and duplication of the femoral vein. A total of 240 patients were scanned. All scans were by a vascular sonographer using an XV Aplio scanner, with a 7-4 MHz linear array probe and a 5-2 MHz curved array probe. For consistency, all patients were placed in the supine position on the examination couch, with the thigh to be examined externally rotated and the contralateral hip raised and supported with a foam pad. Using B-mode imaging,

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the common femoral vein, femoral vein, deep femoral vein and other thigh muscle tributaries and the popliteal vein were scanned in transverse plane (Figures 1a and b). Intermittent compression along the length of the veins was used to confirm full compressibility and the absence of any thrombus. Colour Doppler imaging in the transverse and longitudinal plane was adjunctively used to confirm the presence of filling of the vessel lumen (Figures 1c and d).

For the purpose of this study, femoral vein duplications were classified into *short segment* duplications occurring above the popliteal vein and confined to the femoral triangle and/or adductor's canal and *long segment* duplications which extend into the popliteal vein.

Preconsent was obtained from the patient and included a verbal discussion relating to the aim of the ultrasound investigation and the possible outcomes of the study, including the finding of DVT and the proposed implications and management course.

## Results

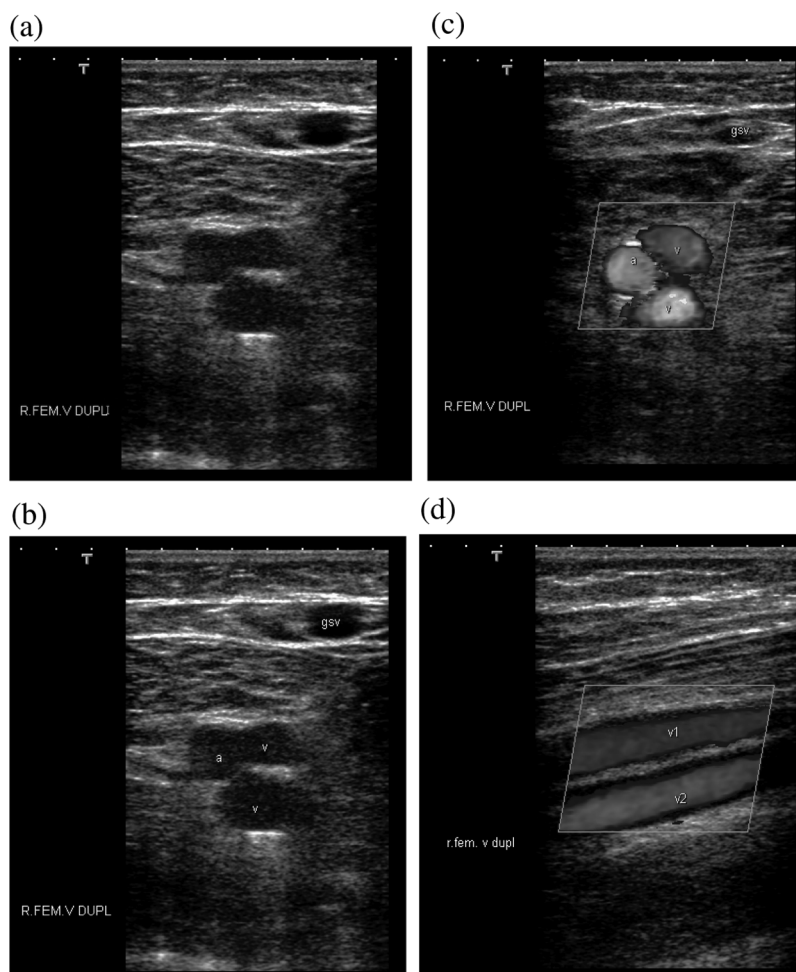
A total of 480 limb ultrasound scans from 240 patients were reviewed. The mean age of the patients was 45 (range: 21–60). There were 200 women with a total of 400 limbs, and 40 men with a total of 80 limbs. Duplications were present in 200 (41%) of these limbs and 140 of the patients. Of the 140 people with femoral vein duplications, 60 (42%) were bilateral and 80 (57%) were unilateral. Seventy percent (140 of 200 limbs) of the duplications were classed as 'short segment duplications' and 30% (60 of 200 limbs) were classed as long segment duplications

No DVTs were identified.

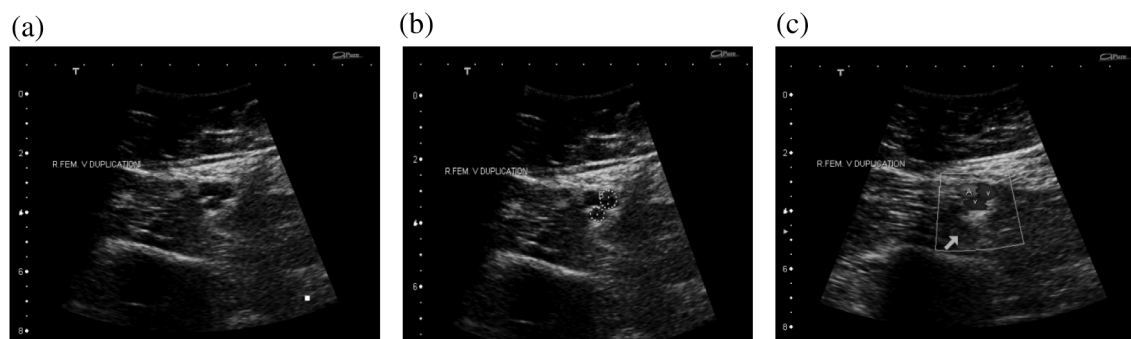
## Discussion

### Incidence of femoral vein duplication

As demonstrated in this study, duplicated femoral veins are common. Prevalence published in the



**Figure 1** B-mode images (a and b) and colour duplex images in transverse (c) and longitudinal (d) of right femoral vein duplicates in the right lower limb of a 46-year-old man



**Figure 2** (a) Transverse image of duplicated femoral veins in the right lower limb of an obese patient, utilizing a 5-2 MHz curved array probe; (b) the circumference of each vessel is outlined; and (c) colour duplex image of the same vessels in blue and the femoral artery in red

contrast venographic literature during the 1990s range from 18%<sup>6</sup> to 46%.<sup>2</sup> In comparison, the ultrasound studies performed during that time have reported much lower duplication incidences ranging from 15.7%<sup>5</sup> to 25%.<sup>4</sup> The fact that previous ultrasound studies have demonstrated lower frequency rates as compared with venography studies may highlight an important difference in the sensitivity and specificity of these two examination techniques.<sup>7</sup> It may also be attributed to the use of older ultrasound machines with lower contrast and resolution specifications, technical difficulties of the ultrasound examination particularly in obese patients (Figure 2), and also to a lack of experience of the performing sonographer.

During the course of the study, emphasis was placed on answering two important questions.

(1) Does femoral duplication in one limb predict duplication in the other?

To date several of the published studies have shown that duplication of the femoral vein in one limb strongly correlated with the incidence of venous anomalies in the other limb. Fifty-seven percent of the duplications in one of the studies,<sup>7</sup> for example, were bilateral, and although this was a significant number, duplication in one limb may still be a poor predictor of duplication in the other. We have found an incidence of bilateral duplication of 60%. It may be advisable to scan both legs if one leg is found to have duplication.

(2) What is the significance of diagnosing duplication of the femoral vein?

The significance of diagnosing duplicated femoral veins is the potential for missing an asymptomatic DVT in one of the duplicates. A substantial increase in the prevalence of thrombus in the presence of duplicated femoral veins has been observed.<sup>1,4,8,9</sup> In addition, thrombus within one of the duplicate veins may be more frequently asymptomatic than in patients presenting with

DVT within a single, non-duplicated femoral vein.<sup>10,11</sup>

Although duplicated femoral veins can be frequently demonstrated sonographically when patent, thrombus in one limb of a duplex femoral vein, with a patent adjacent limb, may result in false-negative ultrasound studies.<sup>4</sup> The operator may identify a patent femoral vein but fail to appreciate an adjacent clot-filled vessel. Screatton's study<sup>2</sup> of 410 contrast venograms where the femoropopliteal veins were previously deemed thrombus-free sonographically showed that 43% of patients had duplication of the femoral vein and of the 20 patients who were found to have had a false-negative ultrasound result, six (30%) cases resulted from missed thrombus in a duplicated femoral vein.

## Conclusion

This study has shown an incidence of ultrasound detected femoral duplication of 40%, which is similar to the venographic prevalences reported by Quinlan *et al.*<sup>7</sup> (43%) and Screatton *et al.*<sup>2</sup> (46%). The frequency of this anatomical variant and the possible serious consequences if confined thrombus is not observed emphasize that a careful search should be made for it in every case. Duplex ultrasound appears to be as sensitive as venography for the detection of duplication. However, a formal study directly comparing these two imaging modalities is required along with the potential errors in ultrasound<sup>12</sup> and venography.

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