Anatomical Variation at the Sapheno-Femoral Junction

Kimihiro Igari, MD,¹ Masayuki Hirokawa, MD, PhD,² Hidetoshi Uchiyama, MD,¹
Takahiro Toyofuku, MD, PhD,¹ Toshifumi Kudo, MD, PhD,¹ Masatoshi Jibiki, MD, PhD,¹
Nobuhisa Kurihara, MD, PhD,² and Yoshinori Inoue, MD, PhD¹

Objective: The aim of this study was to assess the anatomical variations of the sapheno-femoral junction (SFJ) and the incidence of these variations.

Materials and Methods: Between April 2005 and March 2010, 2552 limbs of 1563 patients with complaints of varicose veins underwent ultrasonography. Ultrasonography was used to identify the anatomical variations of the SFJ, especially the relationship to the femoral artery.

Results: Variations were seen in six limbs (0.24%) at the SFJ. The most common anatomical variation was the great saphenous vein crossing posterior to the common femoral artery, which was present in three limbs.

Conclusion: It is important to investigate the anomalies of the SFJ using preoperative duplex ultrasound, although the incidence of such anomalies is lower than that of the sapheno-popliteal junction. An anomaly of the SFJ always should be taken into consideration in order to minimize surgical complications of varicose veins. (*English translation of Jpn J Phlebol 2012; 23: 25-29)

Keywords: sapheno-femoral junction, variation, great saphenous vein, endovenous laser ablation

INTRODUCTION

Anatomical variations of the sapheno-femoral junction (SFJ) are rare, although variations of the sapheno-popliteal junction (SPJ) have been widely reported.¹⁾ In Japan, we can perform endovenous laser ablation (EVLA) for the treatment of varicose veins (VV), and this procedure has been covered by the national insurance system since 2011. Currently, there is a trend toward performing EVLA for VV and away from performing open surgery, such as stripping. Therefore, preoperative evaluation and

recognition of the SFJ anatomy are helpful to ensure the safe treatment of VV by EVLA.

This study was undertaken to evaluate the SFJ anatomy, anomalies of which have rarely been documented. Furthermore, we discuss the problems associated with EVLA treatment for VV with an SFJ anomaly.

MATERIALS AND METHODS

This study was approved by the Institutional Review Board, and the data were obtained retrospectively through an extensive review of all medical records. Between April 2005 and March 2010, duplex ultrasound investigations were performed for patients who consulted our clinic with VV-related complaints, such as pain, edema, and skin changes. A total of 2552 limbs in 1563 patients were investigated for anatomical changes at the SFJ, including those affecting the femoral vein (FV), great saphenous vein (GSV), common femoral artery (CFA), superficial femoral artery (SFA), and profunda femoris artery (PFA), by duplex ultrasound sonography (DUS).

¹Division of Vascular and Endovascular Surgery, Department of Surgery, Tokyo Medical and Dental University, Tokyo, Japan

²Ochanomizu Vascular & Vein Clinic, Tokyo, Japan

Received: September 16, 2013; Accepted: September 22, 2013

Corresponding author: Kimihiro Igari, MD. Division of Vascular and Endovascular Surgery, Department of Surgery, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8519, Japan

Tel: +81-3-5803-5255, Fax: +81-3-3817-4126

E-mail: igari.srg1@tmd.ac.jp

*This article is English translation of Jpn J Phlebol 2012; 23: 25-29.

Fig. 1 Variation at the sapheno-femoral junction (SFJ). (1) GSV crossing posterior to the CFA. (2) GSV passing through between profunda femoris artery and SFA. (3) GSV running lateral, along the SFA. (4) Inversion of femoral artery and vein. (5) Duplication of the SFJ. GSV: great saphenous vein; CFA: common femoral artery; PFA: profunda femoris artery; SFA: superficial femoral artery; FV: femoral vein.

We categorized the SFJ variations into five patterns: (1) The GSV crosses posteriorly to the CFA, (2) the GSV passes between the PFA and the SFA, (3) the GSV runs laterally along the SFA, (4) the CFA and FV are completely transposed, and (5) two GSVs are confluent to the FV, which means that there is duplication of the SFJ (**Fig. 1**). DUS was performed by two sonographic specialists at our institute, and we evaluated the anatomy of the SFJ using a color DUS system (Xario™ XG, Toshiba, Tokyo, Japan) equipped with a linear array probe (frequency, 7.5 MHz).

RESULTS

We performed DUS examinations for a total of 2552 limbs in 1563 patients. There were 548 male patients and 1015 female patients, and the mean age was 61 years (range: 19–92 years). In the 2552 limbs, we detected six limbs with SFJ variations (0.24%), which included two male limbs and four female limbs. The variation of the GSV crossing posterior to the CFA was noted in three limbs, the variation of the GSV passing between the PFA and SFA was noted in two limbs, and the variation of the GSV running lateral along the SFA was found in one limb.

Fig. 2 Technique of endovenous laser ablation for a limb with anatomical variation of the sapheno-femoral junction (sagittal view). (A) The GSV into the femoral vein between the SFA and profunda femoris artery. The fiber tip should be positioned distal to crossing over the SFA. (B) Postoperative duplex scan shows successful ablation of the GSV. GSV: great saphenous vein; PFA: profunda femoris artery; SFA: superficial femoral artery; FV: femoral vein.

CASE PRESENTATION

A 66-year-old female was admitted with primary symptomatic VV of the right leg. DUS showed incompetent SFJ and widened GSV, with reflux that extended to a level

below the knee. We recognized that there was a variation of the SFJ, in which the GSV passed between the PFA and the SFA (**Fig. 2A**). We treated this case with EVLA. Venous access was obtained by puncturing the vein at a level below the knee with an 18 Fr needle under ultrasound guidance. After entrance to the VV was established, a 0.035 inch guidewire was passed through the hollow needle into the vein up through the SFJ. The needle was then removed, and an introducer sheath was passed over the guidewire, after which the guidewire was withdrawn. Perivenous tumescent local anesthesia²⁾ was administered under ultrasound guidance, especially around the GSV attached to the SFA and PFA. A 980 nm diode laser fiber was introduced, and the fiber tip was positioned just distal to the point crossing over the SFA. Withdrawal of the laser fiber was performed with continuous ablation. Postoperative DUS showed obliteration of the GSV without arterial injury and endovenous heat-induced thrombosis (**Fig. 2B**).

DISCUSSION

Compared with the anomalies of the SPJ,³⁾ variations of the SFJ are rare, with an incidence in the literature of 0.02%. Nabatoff¹⁾ reported that, during 5050 stripping operations for VV, noticeable deviations from the normal anatomy were encountered. In 2 patients (0.04%), the GSV entered the FV completely separate from its branches, which joined to form a common trunk before emptying into the FV. In 1 patient (0.02%), the FV and femoral artery were transposed in the region of the fossa ovalis. In 1 patient (0.02%), the GSV was encountered, and arose from the femoral artery just proximal to the origin of the PFA and accompanied the GSV along the medial aspect of the upper thigh.

When scanning the anatomy of the SFJ, clinicians should use a transverse view to identify the GSV and FV, both of which lie medial to the CFA. This viewing is called the “Mickey Mouse” sign, and should be confirmed during normal viewing (**Fig. 3**).⁴⁾ In this study, we defined the cases without this “Mickey Mouse” sign as having a variation of the SFJ. Besides our present findings, some other variations of the SFJ have been reported (**Fig. 1**).⁵⁾ In our study, we observed three kinds of variation of the SFJ, but it is likely that other kinds of variation would be observed in a larger number of cases.

The standard treatment of VV was previously high ligation of the SFJ and stripping of the GSV. In the last decade, minimally invasive techniques have been developed to treat an incompetent GSV, such as foam sclero-

Fig. 3 Normal anatomy at the sapheno-femoral junction (transverse view). It is called “Mickey mouse sign”. GSV: great saphenous vein; CFA: common femoral artery; FV: femoral vein.

Fig. 4 Technique of endovenous laser ablation. The fiber should be withdrawn below the great saphenous vein close to the artery. GSV: great saphenous vein; CFA: common femoral artery; PFA: profunda femoris artery; SFA: superficial femoral artery; FV: femoral vein.

therapy, radiofrequency ablation, and EVLA.⁶⁾ When a stripping procedure for VV with variations of the SFJ is performed, there is a risk of misunderstanding the relationship between the FV and the femoral artery, which might lead to damage to these vessels. Therefore, in such variant cases, the variations of the SFJ should be confirmed preoperatively by DUS. Furthermore, during the operations, the stripper should be inserted into the GSV from an area below the knee to the inguinal area, and the GSV should be identified by relying on the inserted stripper. In the case of EVLA, the use of a laser might cause perforation of the vein wall with concomitant arterial injury to an adjacent vessel. When there are variations of the GSV, this risk could increase when the tumescent anesthesia fails to separate the vein from the artery, and the laser fiber is close to the artery.⁷⁾ Therefore, the EVLA should be performed with sufficient tumescent anesthesia at the variant SFJ site, and the laser

fiber should be withdrawn below the GSV close to the artery. In the present cases, we safely and effectively performed EVLA in 6 patients with variations in the SFJ using this cautious method, and no postoperative complications were observed (**Fig. 4**).

CONCLUSION

We evaluated the variations of the SFJ, which were relatively rare (occurring in 0.24% of patients); however, for the treatment of VV, it is necessary to consider the variations of the SFJ in order to ensure that the procedure can be performed safely. In cases with variations of the SFJ, the surgical procedures should be performed in a way that will prevent the risk of concomitant injuries. In addition, when VV are treated with EVLA, the administration of tumescent anesthesia and the ablation area of the vein should be considered because they can decrease the surgical risks.

DISCLOSURE STATEMENT

Igari and the other co-authors have no conflicts of interest to declare.

REFERENCES

- 1) Nabatoff RA. Anomalies encountered during varicose vein surgery. *Arch Surg* 1978; **113**: 586-8.
- 2) Klein JA. Anesthesia for liposuction in dermatologic surgery. *J Dermatol Surg Oncol* 1988; **14**: 1124-32.
- 3) Vasdekis SN, Clarke GH, Hobbs JT, et al. Evaluation of non-invasive and invasive methods in the assessment of short saphenous vein termination. *Br J Surg* 1989; **76**: 929-32.
- 4) Coleridge-Smith P, Labropoulos N, Partsch H, et al. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs—UIP consensus document. Part I. Basic principles. *Eur J Vasc Endovasc Surg* 2006; **31**: 83-92.
- 5) Marcucci G, Antonelli R, Accrocca F, et al. A rare anomaly of the femoral vessels: complete transposition of the femoral artery and vein. *Interact Cardiovasc Thorac Surg* 2010; **11**: 838-9.
- 6) Pronk P, Gauw SA, Mooij MC, et al. Randomised controlled trial comparing sapheno-femoral ligation and stripping of the great saphenous vein with endovenous laser ablation (980 nm) using local tumescent anaesthesia: one year results. *Eur J Vasc Endovasc Surg* 2010; **40**: 649-56.
- 7) Theivacumar NS, Gough MJ. Arterio-venous fistula following endovenous laser ablation for varicose veins. *Eur J Vasc Endovasc Surg* 2009; **38**: 234-6.