Radiofrequency ablation with concomitant stab phlebectomy increases risk of endovenous heat-induced thrombosis

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ABSTRACT

Objective: Endovenous heat-induced thrombosis (EHIT) is a well-documented phenomenon that follows endovenous ablation, but the treatment, surveillance, and risk factors for EHIT have yet to be comprehensively elucidated. We sought to identify characteristics that may put patients at higher risk for development of EHIT after radiofrequency ablation (RFA) for the treatment of symptomatic superficial venous insufficiency.

Methods: A retrospective review was performed of all consecutive patients undergoing treatment with RFA to the great saphenous vein by a single surgeon from July 2013 through October 2015. On postprocedural day 2, a surveillance venous duplex ultrasound examination was obtained and the presence of EHIT was recorded. Demographics of the patients, venous thromboembolism (VTE) risk factors, and procedural details were compared between patients with EHIT and those with no EHIT using multivariable logistic regression for risk adjustment. As a sensitivity analysis, propensity score matching on the basis of 18 demographic and perioperative variables was then used to confirm significant findings.

Results: There were 299 patients who underwent RFA for symptomatic chronic venous insufficiency (median age, 55 years; 65% female; 46% right lower extremity). Concomitant stab phlebectomy was performed in 71%. EHIT occurred in 12% (n = 35) of patients (class 1, 5%; class 2, 4%; class 3, 1%; class 4, 2%). The incidence of EHIT was significantly higher after RFA with concomitant stab phlebectomy vs RFA alone (14% vs 6%; $P = .04$). There were also nonsignificant trends toward a higher incidence of EHIT in patients with a history of VTE (20% vs 10%; $P = .06$), worsening venous disease (Clinical, Etiology, Anatomy, Pathophysiology [CEAP] class >2, 37% vs 26%; $P = .13$), and history of tobacco use (43% vs 31%; $P = .18$). On multivariable analysis, RFA with concomitant stab phlebectomy (odds ratio, 3.46; 95% confidence interval, 1.36-10.8) and history of VTE (odds ratio, 3.48; 95% confidence interval, 1.22-9.25) were independently associated with EHIT ($P \leq .02$). After propensity matching of 60 pairs of similar patients, RFA with concomitant stab phlebectomy had a persistently higher incidence of EHIT compared with RFA alone (23% vs 7%; relative risk, 3.48; $P = .01$).

Conclusions: Concomitant stab phlebectomy and the patient's history of VTE are independent risk factors for EHIT after endovenous ablation with RFA. History of tobacco use and advanced stages of venous disease may also play a role. For patients with these high-risk features, care should be taken to prevent, identify, and treat EHIT early. (J Vasc Surg: Venous and Lym Dis 2017;5:200-9.)

During the past decade, therapy for symptomatic superficial venous insufficiency has been revolutionized by endovenous ablation techniques. Many advantages of these treatment modalities include minimal invasiveness, the ability of the procedure to be performed without systemic anesthesia, and rapid return to regular activities. Extensive supporting data have been published in the venous literature to support these advantages. However, there are associated risks with these procedures, namely, the phenomenon of endovenous heat-induced thrombus.

The treatment objective of endovenous ablation therapy is to apply heat intravenously to produce endothelial damage and subsequent venous sclerosis, thereby occluding flow through the pathologic vein. However, proximal propagation into the deep system can occur, which has been termed endovenous heat-induced thrombosis (EHIT).[1] Because of growing concerns about the incidence and treatment of these endothermally produced thrombotic events, Kabnick et al[2] coined the term EHIT and devised a classification system that provides recommended treatment according to the level of thrombus extension (Table I). Early

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investigators reported an EHIT rate of 16% after endovenous ablation; however, with advances in technology and a better awareness and understanding of EHIT, more recent reports have demonstrated much lower rates of this complication.[3] In a study of 2470 patients undergoing radiofrequency ablation (RFA) for chronic venous insufficiency, Marsh et al[4] reported a 0.7% rate of EHIT. Other smaller studies support this downtrend in EHIT rates.[5,6]

Despite improvements in the incidence of EHIT, the phenomenon remains an uncommon yet persistent presence in postprocedural endovenous ablation. Many unanswered questions persist, including the identification of risk factors associated with this complication. The main objective of this study was to identify possible factors that may increase the risk of EHIT in a population treated with RFA.

ARTICLE HIGHLIGHTS

- **Significance:** This study investigates the role of concomitant phlebectomy in increasing the risk of endovenous heat-induced thrombosis in patients undergoing great saphenous vein (GSV) ablation to treat chronic venous disease.
- **Type of Research:** Retrospective cohort study
- **Take Home Message:** In 299 patients undergoing radiofrequency ablation of the GSV, concomitant phlebectomy increased the risk of endovenous heat-induced thrombosis from 6% to 14% ($P = .04$).
- **Recommendation:** The authors suggest prophylactic anticoagulation if phlebectomy is performed at the time of radiofrequency ablation for GSV incompetence.
- **Strength of Recommendation:** 2. Weak
- **Level of Evidence:** C. Low or very low

METHODS

Study design. This was a retrospective review of all patients undergoing treatment with RFA for symptomatic superficial venous insufficiency by a single surgeon from July 2013 through October 2015. The Institutional Review Board approved this study before data collection. No patient consents were obtained as this was a retrospective review.

Patients who underwent RFA to the great saphenous vein (GSV) with or without concomitant stab phlebectomy at the time of RFA were included. Patients were excluded if they underwent RFA to the small saphenous vein (n = 16), stab phlebectomy without RFA (n = 78), chemical ablation (n = 2), or foam sclerotherapy with or without RFA (n = 5) to reduce potential heterogeneity of the treated cohort. Patients were selected for RFA with concomitant stab phlebectomy if they had numerous varicosities of a large enough caliber based on clinical assessment that the surgeon did not think they would achieve significant resolution with RFA alone.

RFA technique. RFA was performed by a single surgeon (J.A.H.) for all patients. Our analysis was limited to the experience of a single surgeon to reduce the potential bias that different techniques may introduce to the procedure. Patients were treated with perioperative deep venous thrombosis (DVT) prophylaxis (heparin, 5000 mg subcutaneously) empirically on the basis of their perceived individual risk for development of a postoperative DVT. High-risk factors included obesity, oral contraceptive use, tobacco use, thrombophilia, and personal or family history of venous thromboembolism (VTE) events. As part of standard procedure, all procedures were performed by the operating surgeon in combination with a registered vascular technologist from our institution's Intersocietal Commission for the Accreditation of Vascular Laboratories-accredited noninvasive vascular laboratory.

To perform RFA, treatment location site was confirmed with periprocedural ultrasound interrogation of the GSV. Access was achieved using a modified Seldinger technique with a 7F catheter. With the patient in the Trendelenburg position, the tip of a ClosureFast (Medtronic, Santa Rosa, Calif) catheter was then placed at least 2 cm distal to the takeoff of the deep system at the saphenofemoral junction. Tumescent anesthesia was administered along the course of the vein to be treated and checked for completeness with ultrasound. A drop in temperature was confirmed after tumescent infiltration. RFA was then performed along the treated vein with the proximal segment undergoing a double treatment cycle. At the completion of RFA, the ultrasound probe was used to confirm patency of the saphenofemoral junction and retrograde flow in the epigastric vein.

For patients who underwent RFA with concomitant stab phlebectomy, the locations of the varicose veins to be treated with phlebectomy were marked while the patient was standing before the procedure was started. RFA was then performed. After completion of RFA and duplex ultrasound confirmation, a conventional stab phlebectomy by standard techniques was performed.

In both groups, the treated extremity was wrapped in a multilayered compression dressing at the completion of the procedure. Patients ambulated within 1 hour of the procedure. Postprocedural instructions included walking a minimum of 5 minutes hourly until bed. Patients were encouraged to resume normal activity the next day.

Primary outcome. The primary outcome was the incidence of a postprocedural EHIT. All EHIT classes (1 through 4; Table I) were combined as a single outcome variable because of a small number of events within each individual EHIT class. Phlebectomy-related DVTs, defined as isolated calf DVTs in patients who