doi: 10.13241/j.cnki.pmb.2023.10.022

超声引导下射频消融治疗联合泡沫硬化治疗对下肢静脉曲张疼痛应激反应、血流动力学及凝血功能的影响 *

高 明 胡海燕 张峰伟 张 荣 李梅梅△

（西安医学院第二附属医院超声科 陕西 西安 710038）

摘要 目的：探讨与分析超声引导下射频消融联合泡沫硬化治疗对下肢静脉曲张疼痛应激反应、血流动力学及凝血功能的影响。**方法：**2021 年 8 月到 2022 年 5 月选择在本院诊治的下肢静脉曲张 60 例作为研究对象，根据简单分配原则把患者分为联合组与泡沫硬化组各 30 例。联合组给予超声引导下泡沫硬化联合射频消融治疗，泡沫硬化组给予超声引导下泡沫硬化治疗，观察与记录患者疼痛应激反应、血流动力学及凝血功能变化情况。**结果：**两组术后 1 d 的疼痛 VAS 评分都显著低于术前 1 d（*P*<0.05），联合组也显著低于泡沫硬化组（*P*<0.05）。两组术后 1 d 的血清缓激肽（BK）、P 物质（SP）含量都显著低于术前 1 d（*P*<0.05），联合组也显著低于泡沫硬化组（*P*<0.05）。两组术后 1 周的血浆纤维蛋白原（Fib）、纤溶酶原激活物抑制物（PAI-1）都低于术前 1 d（*P*<0.05），联合组也显著低于泡沫硬化组（*P*<0.05）。联合组术后 1 个月的总有效率为 100.0 %，明显高于泡沫硬化组的 86.7 %（*P*<0.05）。**结论：**相对于泡沫硬化，超声引导下射频消融联合泡沫硬化治疗下肢静脉曲张能改善患者的凝血功能，还能有效缓解疼痛，改善患者的血流动力学状况，提高总体治疗效果。

关键词：超声；射频消融；泡沫硬化；下肢静脉曲张

中图分类号：R543.6 **文献标识码：**A **文章编号：**1673-6273（2023）10-1920-04

Effects of Ultrasound-guided Radiofrequency Ablation Combined with Foam Sclerotherapy on Pain Stress Response, Hemodynamics and Coagulation Function of Lower Extremity Varicose Veins*

GAO Ming, HU Hai-yan, ZHANG Feng-wei, ZHANG Rong, LI Mei-mei△

(Department of ultrasonography lab, The Second Affiliated Hospital of Xi 'an Medical university, Xi'an, Shaanxi, 710038, China)

ABSTRACT Objective: To explore and analyze the effect of ultrasound-guided radiofrequency ablation combined with foam sclerosis treatment on the lower limb varicose vein pain stress response, hemodynamics and coagulation function. **Methods:** From August 2021 to May 2022, 60 cases of lower extremity varicose veins diagnosed and treated in our hospital were selected as the research objects, and the patients were divided into Joint group and foam sclerosis group with 30 cases in each group according to the simple allocation principle. The ultrasound-guided foam sclerosis combined with radiofrequency ablation therapy, and the foam sclerosis group gave ultrasound-guided foam sclerosis therapy, and the changes of pain stress response, hemodynamics and coagulation function were observed and recorded. The pain stress response, hemodynamics and coagulation function changes were observed and recorded. **Results:** The VAS scores of pain in the two groups at 1 d after operation were lower than those at 1d before operation (*P*<0.05), and the Joint group were also lower than that in the foam sclerosis group(*P*<0.05). The serum levels of bradykinin (BK) and Substance P (SP) in the two groups were lower than those in the preoperative day 1 (*P*<0.05), and the joint group were also lower than the foam sclerosis group group (*P*<0.05). Plasma fibrinogen (Fib) and plasminogen activator inhibitor (PAI-1) in both groups at 1 week after operation were lower than those at 1 day before operation(*P*<0.05). Compared with the foam sclerosis group group, the joint group also decreased (*P*<0.05). The total effective rate 1 month after surgery in the joint group were 100.0 %, which were higher than that in the foam sclerosis group (86.7 %) (*P*<0.05). **Conclusion:** Compared with foam sclerosis, ultrasound-guided radiofrequency ablation combined with foam sclerosis for lower limb varicose veins can improve the coagulation function, effectively relieve pain, improve the hemodynamic condition of patients, and improve the overall treatment effect.

Key words: Ultrasound; Radiofrequency ablation; Foam sclerosis; Varicose veins

Chinese Library Classification(CLC): R543.6 Document code: A

Article ID: 1673-6273(2023)10-1920-04

* 基金项目：国家自然科学基金项目（81870172）

作者简介：高明（1985-），女，本科，主治医师，研究方向：超声相关，E-mail：djefy_1985@163.com

△ 通讯作者：李梅梅（1986-），女，本科，主治医师，研究方向：超声相关，E-mail：djefy_1985@163.com

（收稿日期：2022-07-28 接受日期：2022-08-23）

前言

下肢静脉曲张是由于下肢静脉血液回流异常所导致的疾病，在临床上主要表现为下肢浅静脉变粗，呈团块状或蚯蚓状突出皮肤表面，该疾病多发生于怀孕妇女、久立或久坐的工作人员[1-3]。下肢静脉曲张的具体发生机制还不明确，但发现其多由静脉瓣膜关闭不全引起，引起大隐静脉曲张的主要原因之一是静脉内压升高、静脉瓣膜缺陷[4]。由于下肢静脉存在邻近腓肠神经、解剖结构变异大、隐腘交界位置深等不足，传统的高位结扎剥脱术、经皮透光旋切术等手术存在恢复慢、腓肠神经易损伤、解剖暴露困难、创伤大等不足，手术效果一直较差[5,6]。超声引导下射频消融是治疗单纯性静脉曲张的一大进步，其创伤小、疗效佳等特征很快得到业界认可。其可损害内皮细胞和内膜层，诱导炎症反应，继而纤维化，最终达管腔非血栓性闭合[7]。随着医学技术的发展，超声引导下聚桂醇泡沫硬化治疗也得到了广泛应用，可降低复发风险，有效减少术后并发症的发生，但其作用机制还有待明确[8,9]。本文具体分析了超声引导下射频消融和泡沫硬化治疗对下肢静脉曲张疼痛应激反应等的影响，并分析了相关机制，以促进射频消融治疗的应用。

1 资料与方法

1.1 研究对象

2021 年 8 月到 2022 年 5 月选择在本院诊治的下肢静脉曲张 60 例作为研究对象。本研究经医学伦理委员会批准。

纳入标准：符合下肢静脉曲张的指征（超声证实）；患者及家属知情；年龄 20-80 岁；单侧发病；择期手术；病情稳定。

排除标准：存在精神障碍者；合并深静脉及大隐静脉主干内血栓形成者；入组前有射频消融史或硬化剂注射史；长期卧床或者行动不便患者；合并先天性心血管发育畸形。

根据简单分配原则把患者分为联合组与泡沫硬化组各 30 例，两组患者一般资料对比无差异（P>0.05）。见表 1。

表 1 一般资料对比

Table 1 Comparison of general data

Groups	n	Body mass index (kg/m^2)	Gender (male / female)	Disease location (left / right side)	Age (year)	Elcosis (n)	Chromatosis (n)
Joint group	30	22.58± 1.11	16/14	17/13	54.33± 1.86	8(26.7%)	9(30.0%)
Foam hardening group	30	22.50± 0.87	15/15	16/14	54.76± 2.00	10(33.0%)	9(30.0%)

1.2 治疗方法

泡沫硬化组：给予超声引导下泡沫硬化治疗，具体措施如下：（1）依据血管内径差异选取 1 %-3 %浓度的聚多卡醇注射液 2-4 mL，大隐静脉主干直径超过 5 mm 时选择 3 %浓度，根据气液比 =4:1，利用两支 10 mL空针及三通器配制泡沫硬化剂 10-20 mL。（2）患者取侧卧或俯卧位，超声观察静脉曲张的程度，在超声引导下穿刺隐静脉主干，回抽见静脉血后可匀速注射泡沫硬化剂，超声下观察硬化剂的弥散情况，在泡沫硬化剂快弥散至隐腘交界处及时停止推注药物，可辅助按照加速硬化剂向周围分支曲张静脉蔓延，患肢注射泡沫剂总量不得超过 20 mL。所有患者术后用绷带加压包扎后更换医用弹力袜，鼓励患者适当运动，循序渐进进行功能锻炼。

联合组：在泡沫硬化组基础上，给予超声引导下射频消融治疗，于体表标记曲张静脉走行，患者采取头高脚低位，在超声条件下引导下穿刺大隐静脉，局部麻醉后引入血管鞘，送入一次性微波消融导管。射频消融参数：作用时间 6 s，大隐静脉功率 55 W。在超声引导下沿大隐静脉走行，使用微波治疗段静脉周围组织并后撤导管，对大隐静脉主干全程进行消融。

1.3 观察指标

（1）在术前 1 d 与术后 1 d 采用疼痛 VAS 量表评定患者的疼痛状况，分数越高，疼痛越严重。

（2）所有患者在术前 1 d 与术后 1 d 抽取患者的静脉血 2 mL 左右，分离血清后，采用 ELISA 法检测血清缓激肽（Bradykinin, BK）、P 物质（Substance P, SP）含量，进而评估血流动力学状况。

（3）在术前 1 d 与术后 1 周抽取患者的血液后，采用全自动血凝分析仪测定患者的凝血功能指标，包括纤维蛋白原（Fibrinogen, Fib）、纤溶酶原激活物抑制物（Plasminogen activator inhibitor-1, PAI-1）等。

（4）所有患者在术后 1 个月进行总体疗效评定，治愈：超声诊断无血液反流，下肢静脉曲张、患肢酸胀等症状消失；有效：超声诊断有轻微血液反流，下肢存在较小曲张静脉且肉眼可见，患肢酸胀等症状缓解；无效：超声诊断有血液反流，下肢静脉曲张恶化，患肢酸胀等症状加剧；治疗总有效率 =（治愈例数 + 有效例数）/ 总例数× 100.0 %。

1.4 统计方法

本次研究统计学软件为 SPSS25.00，计数资料用[例(%)]表示，两两对比为卡方 x^2 检验等，计量数据以均数± 标准差表示，两两对比采用 t 检验分析，P<0.05 为差异有统计学意义。

2 结果

2.1 疼痛 VAS 评分变化对比

两组术后 1 d 的疼痛 VAS 评分都显著低于术前 1 d，联合组也显著低于泡沫硬化组（P<0.05）。见表 2。

2.2 血清 BK 与 SP 含量变化对比

两组术后 1 d 的血清 BK 与 SP 含量都显著低于术前 1 d，联合组也显著低于泡沫硬化组（P<0.05）。见表 3。

2.3 凝血功能变化对比

两组术后 1 周的血浆 PAI-1 与 Fib 值都显著低于术前 1 d，联合组也显著低于泡沫硬化组（P<0.05）。见表 4。

2.4 总有效率对比

联合组术后 1 个月的总有效率为 100.0 %，明显高于泡沫硬化组的 86.7 %（P<0.05）。见表 5。

表 2 手术前后疼痛 VAS 评分变化对比(分,均数± 标准差)

Table 2 Comparison of pain VAS scores before and after surgery (score, mean ± standard deviation)

Groups	n	1 d before surgery	1 d after surgery
Joint group	30	5.78± 0.32	2.20± 0.25*#
Foam hardening group	30	5.81± 0.28	4.11± 0.36*

Note: Compared with the foam hardening group, #P<0.05; Compared with the 1 d before surgery, *P<0.05, the same below.

表 3 两组手术前后血清 BK 与 SP 含量变化对比(均数± 标准差)

Table 3 Comparison of serum BK and SP content before and after surgery in both groups (mean ± standard deviation)

Groups	n	BK(μg/L)		SP(μg/mL)	
		1 d before surgery	1 d after surgery	1 d before surgery	1 d after surgery
Joint group	30	9.35± 0.36	5.35± 0.24*#	9.12± 0.24	5.41± 0.46*#
Foam hardening group	30	9.32± 0.27	7.22± 0.28*	9.14± 0.32	6.75± 0.28*

表 4 两组手术前后凝血功能变化对比(均数± 标准差)

Table 4 Comparison of coagulation function changes before and after surgery (mean ± standard deviation)

Groups	n	PAI-1(ng/L)		Fib(g/L)	
		1 d before surgery	1 d after surgery	1 d before surgery	1 d after surgery
Joint group	30	47.57± 5.37	36.50± 4.42*#	3.65± 0.24	3.09± 0.24*#
Foam hardening group	30	47.49± 5.11	41.58± 5.01*	3.67± 0.33	3.33± 0.18*

表 5 两组术后 1 个月的总有效率对比(n)

Table 5 Comparison of 1 month between the two groups (n)

Groups	n	Cure	Valid	Invalid	Total effective rate
Joint group	30	28	2	0	30(100.0 %)#
Foam hardening group	30	22	4	4	26(86.7 %)

3 讨论

下肢静脉曲张为临床上比较常见的常见,多表现为静脉主干或分支局限性、节段性囊状或柱状扩张,还可出现瘙痒、色素沉着、肿胀、疼痛等症状,如果不及时治疗,可导致患者出现曲张破裂出血等并发症,严重影响患者的身心健康[10,11]。现代研究表明下肢静脉曲张的发生与吸烟、血管弹性差、血管压力高、静脉高压、血管壁缺氧等多种因素有关,也是系统性炎性反应的结果[12,13]。

高位结扎加剥脱术虽有创伤大、恢复慢,瘢痕明显等不足,但实施简便、价格低廉、疗效确切,深受认可[14]。目前其改良术式高位结扎大隐静脉联合点式剥脱术仍在临床广泛应用,此外高位结扎能减少血栓上行及血流再通的问题,降低并发症和远期复发率,常与腔内治疗联合应用。但是上述手术对于患者的创伤比较大,在临床上的应用受到一定的限制[15,16]。本研究显示两组术后 1 d 的疼痛 VAS 评分都显著低于术前 1 d,联合组也显著低于泡沫硬化组; 两组术后 1 d 的血清 BK 与 SP 含量都显著低于术前 1 d,联合组也显著低于泡沫硬化组,表明超声引导下联合使用射频消融、泡沫硬化治疗下肢静脉曲张能缓解疼痛,改善血流动力学。分析可知,超声引导泡沫硬化治疗对患者血流动力学稳定性影响较小,可减轻手术创伤,减少手术应激,欧洲泡沫硬化剂疗法协调会议建议泡沫硬化剂安全剂量为 6~8 mL,应用 40 mL 以内一般不会发生严重并发症,但超过 40 mL 可出现胸闷、过性黑矇和休克等症状[17,18]。射频消融可通过热能使静脉壁挛缩,引起胶原纤维收缩,破坏大隐静脉内膜结构,导致静脉壁增厚,管腔收缩,形成纤维条索。与此同时进行加压包扎可加速静脉粘连过程, 并经阻塞静脉阻滞血液回流,基于此,可使得静脉壁闭合[19,20]。此外,超声引导下射频消融是在病变静脉植入射频消融导管,将热能传导至静脉壁,激发静脉壁收缩闭塞以改变下肢血液流向的治疗方法,利用超声引导后,稳定作用大隐静脉,可确保治疗精确性[21,22]。

大隐静脉高位结扎联合静脉剥脱术虽然可消除浅静脉反流,但对血管损伤较大,术后患者具有较长的恢复时间[23]。本研究显示两组术后 1 周的血浆 PAI-1 与 Fib 值都显著低于术前 1 d,联合组也显著低于泡沫硬化组;联合组术后 1 个月的总有效率为 100.0 %,明显高于泡沫硬化组的 86.7 %,表明超声引导下联合使用射频消融、泡沫硬化治疗下肢静脉曲张能改善凝血功能,提高总体治疗效果。可知分析,射频消融术是静脉曲张治疗的确切选择之一,泡沫硬化剂与血管内壁接触多,因此较少剂量可取得理想治疗效[24,25]。泡沫拥有独特的致密性和黏附性,进入管腔后产生充盈效应, 排空管腔内血液形成局部断流,不被血液稀释且保持恒定浓度, 因此粘附在管壁上的时间延长,更大限度的损伤内皮细胞,易引起皮下淤血、皮肤灼伤以及隐神经损伤等并发症[26,27]。射频消融通过射频热能使静脉壁损伤、肿胀,在高达 80~120℃的温度下发生炎症反应、纤维细胞增殖以及弹力纤维重构,进而血管壁结构崩解,发生塌陷、管腔缩

小。此外,在术后自我修复过程中,通过弹力纤维重构及成纤维细胞增殖,进而使静脉闭锁[28-30]。不过本研究由于人力资源投入太少,分析的指标也比较少,没有进行多时间点分析,将在后续进行深入探究。

总之,相对于泡沫硬化,超声引导下射频消融联合泡沫硬化治疗下肢静脉曲张能改善患者的凝血功能,还能有效缓解疼痛,改善患者的血流动力学状况,提高总体治疗效果。

参 考 文 献(References)

[1] Youn YJ, Lee J. Chronic venous insufficiency and varicose veins of the lower extremities[J]. Korean J Intern Med, 2019, 34(2): 269-283

[2] Shadrina AS, Sharapov SZ, Shashkova TI, et al. Varicose veins of lower extremities: Insights from the first large-scale genetic study[J]. PLoS Genet, 2019, 15(4): e1008110

[3] Li C, Fan W, Pan Z, et al. Efficacy and safety of Buyang Huanwu decoction in the treatment of varicose veins of the lower extremities: A protocol of randomized controlled trial [J]. Medicine (Baltimore), 2021, 100(8): e24663

[4] Rusinovich Y, Rusinovich V. Respiratory changes in biometry of suprarenal inferior vena cava in patients with varicose veins of lower extremities[J]. Phlebology, 2021, 36(4): 313-321

[5] Li ZL, Wang M, Wu RD, et al. Efficacy of endovenous microwave ablation in treating primary varicose veins of the lower extremities[J]. Natl Med J China, 2021, 101(39): 3232-3237

[6] Li N, Li J, Huang M, et al. Efficacy and safety of polidocanol in the treatment of varicose veins of lower extremities: A protocol for systematic review and meta-analysis[J]. Medicine (Baltimore), 2021, 100(8): e24500

[7] Larsen KD, Håkansson K, Papesch M, et al. Ultrasound-guided radiofrequency ablation of benign symptomatic thyroid nodules [J]. Ugeskr Laeger, 2020, 182(43): V06200485

[8] Joyce DP, De Freitas S, Woo EY, et al. Ultrasound-guided foam sclerotherapy as a therapeutic modality in venous ulceration [J]. Surgeon, 2021, S1479-666X(21): 141-144

[9] Wu Z, Ma Y. Ultrasound-guided foam sclerotherapy for primary small saphenous vein insufficiency[J]. ANZ J Surg, 2021, 91(1-2): 158-161

[10] Kurginyan KM, Raskin VV. Éndovaskuliarnoe lechenie ostrogo tromboflebita ven nizhnikh konechnosteĭ u patsientov s varikoznoĭ bolezn'iu [Endovascular treatment of acute thrombophlebitis of the lower extremities in patients with varicose veins] [J]. Khirurgiia (Mosk), 2019, 18(10): 50-54

[11] Li X, Zhang H, Niu L, et al. Clinical outcomes of radiofrequency ablation for patients with varicose veins of the lower extremities combined with grade II iliac vein compression [J]. J Vasc Surg Venous Lymphat Disord, 2021, 9(3): 676-682.e2

[12] Rusinovich Y, Rusinovich V. Cardiac Doppler in patients with primary varicose veins of lower extremities [J]. Phlebology, 2020, 35 (1): 62-66

[13] Tamura K, Maruyama T, Sakurai S. Effectiveness of Endovenous Radiofrequency Ablation for Elderly Patients with Varicose Veins of Lower Extremities[J]. Ann Vasc Dis, 2019, 12(2): 200-204

[14] Hartmann K. Endovenous (minimally invasive) procedures for treatment of varicose veins: The gentle and effective alternative to high ligation and stripping operations[J]. Hautarzt, 2020, 71(Suppl 2): 67-73

[15] Guo Z, Li X, Wang T, et al. Effectiveness of iliac vein stenting combined with high ligation/endovenous laser treatment of the great saphenous veins in patients with Clinical, Etiology, Anatomy, Pathophysiology class 4 to 6 chronic venous disease [J]. J Vasc Surg Venous Lymphat Disord, 2020, 8(1): 74-83

[16] Kong J, Liu Z, Fu G, et al. Outcomes of Fluoroscopy-Guided Percutaneous High Ligation of the Great Saphenous Vein Combined With Foam Sclerotherapy for Symptomatic Great Saphenous Veins [J]. J Vasc Interv Radiol, 2022, 33(4): 445-450

[17] de-Abreu GCG, Camargo O Júnior, de-Abreu MFM, et al. Ultrasound-guided foam sclerotherapy for severe chronic venous insufficiency[J]. Rev Col Bras Cir, 2017, 44(5): 511-520

[18] Cartee TV, Wirth P, Greene A, et al. Ultrasound-guided foam sclerotherapy is safe and effective in the management of superficial venous insufficiency of the lower extremity [J]. J Vasc Surg Venous Lymphat Disord, 2021, 9(4): 1031-1040

[19] Cheng Z, Liang P. Advances in ultrasound-guided thermal ablation for symptomatic benign thyroid nodules[J]. Adv Clin Exp Med, 2020, 29(9): 1123-1129

[20] O'Neal D, Cohen T, Peterson C, et al. Contrast-Enhanced Ultrasound-Guided Radiofrequency Ablation of Renal Tumors [J]. J Kidney Cancer VHL, 2018, 5(1): 7-14

[21] Shah R, Ahmad M, Hanu-Cernat D, et al. Ultrasound-guided radiofrequency ablation for treatment of Morton's neuroma: initial experience[J]. Clin Radiol, 2019, 74(10): 815.e9-815.e13

[22] Lash D, Frantz E, Hurdle MF. Ultrasound-guided cooled radiofrequency ablation of the genicular nerves: a technique paper[J]. Pain Manag, 2020, 10(3): 147-157

[23] Rass K, Frings N, Glowacki P, et al. Same Site Recurrence is More Frequent After Endovenous Laser Ablation Compared with High Ligation and Stripping of the Great Saphenous Vein: 5 year Results of a Randomized Clinical Trial (RELACS Study) [J]. Eur J Vasc Endovasc Surg, 2015, 50(5): 648-656

[24] Kahraman N, Özsin KK. Ultrasound-guided catheter-directed foam sclerotherapy can be safely applied for the treatment of great saphenous varicose veins in elderly patients[J]. Vascular, 2020, 28(5): 597-603

[25] de Abreu GCG, de Camargo O Jr, de Abreu MFM, et al. Ultrasound-guided foam sclerotherapy for chronic venous disease with ulcer. A prospective multiple outcome cohort study [J]. J Vasc Bras, 2020, 19(8): e20180108

[26] Lim SY, Tan JX, D'Cruz RT, et al. Catheter-directed foam sclerotherapy, an alternative to ultrasound-guided foam sclerotherapy for varicose vein treatment: A systematic review and meta-analysis[J]. Phlebology, 2020, 35(6): 369-383

[27] Kumar S, Bhavana K, Kumar S, et al. Ultrasound-guided polidocanol foam sclerotherapy for treating venous malformations [J]. J Clin Ultrasound, 2018, 46(1): 23-31

[28] Maeshima S, Ida Y, Shimizu R, et al. Endoscopic ultrasound-guided radiofrequency ablation of porcine liver [J]. J Med Ultrason (2001), 2020, 47(3): 435-443

[29] Bittencourt AH, Dallanora DV, Bacega NR, et al. Cerebrovascular ischemia following ultrasound-guided foam sclerotherapy [J]. J Vasc Bras, 2018, 17(4): 333-336

[30] Polimanti AC, Pereira LA, Carmine TM, et al. Influence of polidocanol ultrasound-guided foam sclerotherapy on quality of life in lower extremity chronic venous disease: initial results[J]. J Vasc Bras, 2019, 18(7): e20190049