



**Characteristics of Varicose Vein Patients Underwent Endovenous Laser Ablation (EVLA) in Vascular and Endovascular Surgery Sub-Division of Dr. Mohammad Hoesin General Hospital Palembang between January 2019 - December 2019**

Deo Valendra<sup>1</sup>, Kemas M Dahlan<sup>2\*</sup>

<sup>1</sup> Residence of Surgical, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

<sup>2</sup> General Surgeon Consultant Vascular Surgery of Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia

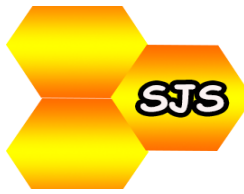
\*Corresponding Author Email: [dokterdahlanspb@gmail.com](mailto:dokterdahlanspb@gmail.com)

**Abstract**

**Background:** Chronic venous disease is often overlooked by health care providers because it has mild symptoms and low mortality. The most common manifestations of chronic venous disease are varicose veins. Risk factors for varicose veins are multifactorial. We aim to determine the characteristics of varicose vein patients who underwent endovenous laser ablation (EVLA).

**Methods:** This research is a retrospective descriptive study and was conducted in January 2019 - December 2019 at the Vascular and Endovascular Surgery Sub-division of the General Hospital dr. Mohammad Hoesin Palembang. The samples were all of varicose vein patients who underwent EVLA and was collected with total sampling. The variables used include age, gender, level of severity/grading, and management. The data obtained were processed descriptively and were presented in tabular and narration.

**Results:** There were 24 subjects meeting research criteria. The highest age group for varicose veins was in the age group 55 to 74 years as many as 11 people (45.8%). The most varicose vein patients were found in male as many as 14 people (58.3%). Based on the grading of severity, most were in grade C5, namely 14 people (58.3%). In varicose vein patients based on the type of intervention, the most cases occurred with EVLA and phlebotomy as many as 22 people (91.7%). Most subjects did not experience postoperative recanalization, namely 22 people (91.7%).



**Conclusion:** Male patients aged 55 to 74 years old, with severity grade of C5, treated with EVLA and phlebectomy, and without post-operative complication of recanalization are all the most common characteristics of varicose veins patients in dr Mohammad Hoesin General Hospital Palembang.

**Keyword:** Varicose vein, EVLA, characteristics, descriptive

## 1. Introduction

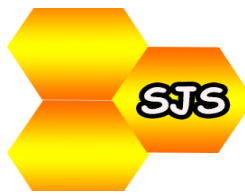
Chronic venous disease is often overlooked by health care providers because it is considered to have mild disorders and low mortality. The importance of studying chronic venous disease is associated with the number of sufferers and the socio-economic impact on already severe clinical conditions. Chronic venous disease is very common, with varicose veins affecting more than 25 million adults in the United States and more than 6 million adults with more advanced venous disease. The most common manifestations of chronic venous disease are telangiectasis, reticular veins, and varicose veins.<sup>1</sup>

Chronic venous insufficiency describes a condition that affects the venous system in the lower extremities and can cause symptoms of pain, edema, discoloration of the skin, and ulceration. Chronic venous insufficiency often indicates a more advanced form of venous disorder, including hyperpigmentation, venous eczema, lipodermatosclerosis, atrophic Blanche, and active or healed ulcers.<sup>1</sup>

Varicose veins of the lower extremities refer to an abnormal leg condition, which is characterized by dilated veins due to valve dysfunction in the large saphenous veins, small saphenous veins, perforator vein arteries, and subcutaneous veins in the legs. This situation often occurs in people who stand for a long time, have high intensity of physical activity, or sit for a long time.

Varicose veins are one of the most common chronic venous diseases, having a prevalence of about 1% to 73% in women, higher than 2% to 56% in men in Western countries. In Brazil, the prevalence of this disease reaches 50%.<sup>2</sup> The incidence rate of this disease among adults is generally 20-40%. About a third of men and women aged 18 to 64 years have varicose veins.<sup>3</sup>

Varicose veins are more common in women and other adults, where about 22 million women and 11 million men between the ages of 40 and 80 have varicose veins.<sup>4</sup> Of these, it is estimated that about 2 million men and women will develop symptoms of chronic venous insufficiency, including venous ulceration. The high prevalence of varicose veins and the high costs involved in treating complications such as chronic venous ulcers will burden health care funding resources. Chronic



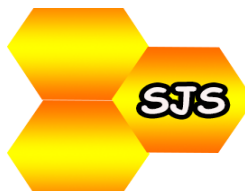
venous ulceration results in a loss of 2 million working days and costs about \$ 3 billion per year in treatment in the United States. Whereas in London, about 2% of national health care funds are spent on varicose veins treatment.<sup>5</sup>

Nowadays varicose veins are starting to get public attention because they can cause cosmetic problems that interfere with the appearance.<sup>6</sup> In addition, patients also show complaints or disturbing symptoms ranging from heaviness in the legs, pain/burning sensation, calf muscle spasms, and mild swelling in feet. In severe cases, permanent leg edema may occur with pigmentation, ulceration, and recurrent cellulitis. This situation causes discomfort to many sufferers and has a socio-economic impact due to a decrease in the productivity of the suffering individual.<sup>5</sup>

The diagnostic criteria used for varicose veins include; dilated, palpable subcutaneous vein greater than 4 mm. Risk factors for varicose veins are obesity, female gender, lack of activity, and family history. Varicose veins can be classified as primary or secondary. Primary varicose veins result from intrinsic vein wall abnormalities, whereas secondary varicoses are associated with deep and/or superficial venous insufficiency. Heredity, and endocrine, and activity are still being investigated as risk factors for varicose veins. Hereditary factors include valve dysfunction and venous wall weakness, or increased superficial venous pressure due to manual labor, chronic cough, constipation, pregnancy, and the like. It's easier for women to be affected than men. Therefore, currently, pressure therapy can be used to treat primary varicose veins of the lower extremities, including medical elastic stockings therapy, elastic bandage therapy, and intermittent compression therapy. However, this therapy is only temporary in relieving pain. In the long term, the pressure treatment method for patients with varicose veins of the lower extremities is considered ineffective because it is temporary.<sup>6,7</sup> The purpose of this study is to determine the characteristics of varicose vein patients who underwent endovenous laser ablation (EVLA) in the vascular and endovascular surgery department, RSUP dr. Muhammad Hoesin Palembang period January 2019 - December 2019.

## 2. Method

This research is a retrospective descriptive study. The research was conducted in January 2019 - December 2019 at the Medical Record Installation of the General Hospital dr. Mohammad Hoesin Palembang. The population in this study were all of varicose vein patients who underwent endovenous laser ablation (EVLA) in the department of vascular and endovascular surgery of General Hospital dr. Mohammad Hoesin Palembang during the study period. The exclusion criteria in this study were patients with a final diagnosis of varicose veins with incomplete study variables.



The variables used in this study include age, gender, level of severity/grading, and management. The data collected was secondary data of medical record with total sampling. The data obtained in this study were processed descriptively based on the amount of data obtained following the variables studied. The research results are presented in tabular form which is further explained in narrative form.

### 3. Results

**Between the study period, there are 24 varicose vein patient data obtained and included to the research.**

The age group was divided into 5 groups, namely less than 15 years, 15 to 34 years, 35 to 54 years, 55 to 74 years, and  $\geq 75$  years. Based on the study, 0 patients had varicose veins at the age of fewer than 15 years (0%), 9 patients at the age of 15 to 34 years (37.5%), 4 patients at the age of 35 to 54 years (16.67%), 11 patients at 55 to 74 years (45.83%), and 0 patients at  $\geq 75$  years (0%). The age distribution of the patients is presented in Table 1.

**Table 1.** Distribution of varicose veins by age

Age	N	%
<15 y.o.	0	0
15-34 y.o.	9	37.5
35-54 y.o.	4	16.67
55-74 y.o.	11	45.83
$\geq 75$ y.o.	0	0
<b>Total</b>	<b>24</b>	<b>100</b>

Sex is divided into male and female groups. Of the 24 samples, 14 patients with varicose veins were male (58.33%), while 10 patients were female (41.67%). The sex distribution of the patients is presented in Table 2.

**Table 2.** Distribution of varicose veins by gender

Gender	N	%
Male	14	58.33
Female	10	41.67
<b>Total</b>	<b>24</b>	<b>100</b>



The grading of varicose veins is divided into C1-C6. The results showed that 14 patients had varicose vein grade C5 (58.33%). and 10 patients had varicose vein grade C6 (41.67%). The distribution of severity is presented in Table 3.

**Table 3.** Distribution of varicose veins by grading severity

<b>Grading</b>	<b>N</b>	<b>%</b>
C2	0	0
C3	0	0
C4	0	0
C5	14	58.33
C6	10	41.67
<b>Total</b>	<b>24</b>	<b>100%</b>

Types of interventions are divided into EVLA, EVLA, and sclerotherapy, EVLA, and phlebectomy. The results revealed that out of 24 varicose vein patients, 1 varicose vein patient was treated with the EVLA technique (4.17%), 1 patient used EVLA and sclerotherapy (4.17%), and 22 patients were operated on with EVLA and phlebectomy (91.66%). The distribution of action types is presented in Table 4.

**Table 4.** Distribution of varicose veins based on types of interventions

<b>Type of interventions</b>	<b>N</b>	<b>%</b>
EVLA	1	4.17
EVLA and sclerotherapy	1	4.17
EVLA and phlebectomy	22	91.66
<b>Total</b>	<b>24</b>	<b>100</b>

Recanalization is divided into recanalization and without recanalization. The results showed that from 24 varicose vein patients, 2 patients experienced recanalization (8.3%) and 22 patients (91.7%) did not experience recanalization. The distribution of the patient's greater saphenous vein recanalization is presented in Table 5.

**Table 5.** Distribution of varicose veins by presence of recanalization

<b>Presence of recanalization</b>	<b>N</b>	<b>%</b>
Yes	2	8.3
No	22	91.7
<b>Total</b>	<b>24</b>	<b>100</b>

#### 4. Discussion

The results showed that the age group that experienced the most varicose veins was the 55 to 74 years age group, followed by the 15–34-year group in the second place, with an overall mean of 43.8 years. The mean age value of 43.8 patients who were excluded in the 55–74 age class interval as the largest group was suspected because routine health checks were more often performed in the productive age group.<sup>8</sup> Younger varicose vein patients were also associated with genetic factors that play a role in determining the incidence of congenital abnormalities related to the production of pro-inflammatory cytokines, collagen structure, and other connective tissues from the blood vessels.<sup>9</sup> The geriatric health screening program has not been implemented evenly and effectively in every health care facility, particularly regarding screening for varicose vein risk factors.<sup>10</sup> In fact, aging is known to be able to alter the structure and function of the venous lumen.<sup>11</sup> The structure of aging veins has decreased levels of elastin protein.<sup>12</sup> The reduced elasticity of the venous walls will change the laminar hemodynamics of the popliteal veins into turbulent flow.<sup>13</sup> Turbulence of venous blood flow will result in increased pressure on the lumen vein wall causing cell lesions and inflammatory response in the lining of the tunica intima.<sup>14</sup> Increasing the number of pro-inflammatory cytokines in intraluminal veins will reduce the intraluminal diameter of the veins, increase levels of CO<sub>2</sub> transported through blood vessels so that there is a fulmination of hypoxia in the popliteal veins, thus exacerbating the risk of varicose vein obstruction.<sup>15</sup> The mean age of 43.8 years of varicose vein patients in this study is in accordance with the results of a study in India which showed that 31.2% of varicose vein patients were 41–50 years old.<sup>16</sup> The much older population is also more at risk of developing varicose veins, according to several epidemiological studies in the UK.<sup>17</sup>

The sex with the most varicose veins is male. These data are consistent with the conclusion of the study in India which claimed that 74.7% were experienced by males.<sup>16</sup> Male veins are less elastic than female veins due to a lack of male estrogen receptors.<sup>17</sup> Estrogen receptors allow easier venous relaxation to occur so that the risk of varicose veins can be lower.<sup>18</sup> Estrogen also plays a role in



aging by the transcription mechanism of the telomerase enzyme which triggers the pro-inflammatory cytokines that cause varicose veins.<sup>19</sup> Contrastly, research in England shows that varicose veins are more prevalent in 50-55% of women.<sup>72</sup> The etiology of varicose veins in women is associated with the compression mechanism of the vena cava by the gravid uterus, resulting in leg edema and an increased risk of varicose veins.

In this study, we found that the degree of severity of varicose veins that were followed up was at grade C5 and C6 and the most at grade C5. This is not much different from the main complaint of varicose vein patients in India, where 57.6% only went to a doctor after experiencing lower leg ulcers.<sup>16</sup> Varicose vein degrees of telangiectasis were not followed up entirely because they did not entirely cause pain complaints.<sup>21</sup> Visual disturbance factors in old age as a The main population of varicose veins makes telangiectasis often unnoticed.<sup>22</sup> The invisible telangiectasis by presbyopia sufferers makes early diagnosis and management of varicose veins.<sup>23</sup> A lazy lifestyle also makes varicose vein sufferers not immediately consult the telangiectasis complaint to the clinic, assuming they are not familiar with the telemedicine method.<sup>24</sup>

The results of this study indicate that the most commonly performed types of surgery are EVLA and Phlebectomy. A study in Japan also revealed that the majority of varicose vein patients were treated with EVLA and phlebectomy.<sup>84</sup> These results were different from studies in India where 23.5% of the surgical procedures selected were saphenous vein stripping.<sup>16</sup> The choice of EVLA by doctors was according to the degree of varicose vein severity. experienced by the majority of patients.<sup>3</sup> The effectiveness of conservative therapy was doubtful for degrees C5 and C6 which were listed as the highest severity levels in the sample of this study.<sup>13</sup> Cost efficiency and duration of cure were considered in the selection of EVLA.<sup>25</sup> Geriatric age as the age of the majority of varicose vein patients was associated with increased risk. anxiety before surgery as a basis for making decisions about the type of surgery that the patient will choose.<sup>26</sup> The condition of the varicose vein patient's premorbid disease is also the basis for choosing EVLA as the most commonly performed surgical procedure.<sup>27</sup> The patient's economic condition also determines the type of varicose vein surgery performed.<sup>28</sup> The availability of operating room facilities, intensive care rooms, the skills of radiologists in the diagnostic process, the experience of surgeons in the use of intraoperative support devices, the anesthesiologist's ability to assess the type of anesthesia affects the choice of varicose vein surgery that will be offered to the patient.<sup>29</sup>

Recanalization is divided into recanalization and non-recanalization. The results showed that from 24 varicose vein patients, 2 patients experienced recanalization (8.3%) and 22 patients (91.7%) did not experience recanalization. A European study using embolization also showed that



recanalization occurred in 92.9% of patients.<sup>30</sup> Recanalization also occurred in a Turkish study using radiofrequency ablation of 6.8%, but none of the patients experienced recanalization after undergoing EVLA.<sup>31</sup> Varicose patients Veins undergoing radiofrequency ablation were also reported to have episodic recanalization as much as 65% in a study in Korea.<sup>32</sup> Recanalization of the saphenous vein is the opening of a vein segment with varicose veins > 5 cm long after being treated surgically or medically.<sup>33</sup> Histologically, the veins experiencing recanalization experienced incomplete formation of blood vessel walls, decreased components of the elastin connective tissue, venous valves, and innervation of the recanalized veins.<sup>34</sup> Recanalization was determined by the diameter of the greater saphenous vein, not by the type of varicose vein treatment chosen.<sup>35</sup> League The exposed saphenofemoral or EVLA has the same level of safety.<sup>36</sup> EVLA and radiofrequency ablation also have minimal side effects after 12 months post-procedure.<sup>37</sup>

## 5. Conclusion

The highest age group for varicose veins was in the age group 55 to 74 years as many as 11 people (45.8%). The most varicose vein patients were found in male as many as 14 people (58.3%). Based on the grading of severity, most were in grade C5, namely 14 people (58.3%). In varicose vein patients based on the type of intervention, the most cases occurred with EVLA and phlebectomy as many as 22 people (91.7%). Most subjects did not experience postoperative recanalization, namely 22 people (91.7%).

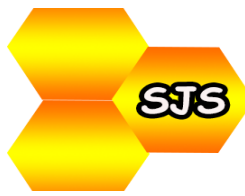
## 6. References

1. Eberhardt RT, Raffetto JD. Chronic venous insufficiency. *Circulation*. 2014. p. 333–346. PMID: 25047584
2. Millan SB, Gan R, Townsend PE. Venous ulcers: Diagnosis and treatment. *Am Fam Physician*. 2019;100(5):298–305. PMID: 31478635
3. Murad MH, Coto-Yglesias F, Zumaeta-Garcia M, Elamin MB, Duggirala MK, Erwin PJ, Montori VM, Gloviczki P. A systematic review and meta-analysis of the treatments of varicose veins. *Journal of Vascular Surgery*. 2011. p. 49S-65S.
4. Oliveira R de Á, Mazzucca ACP, Pachito DV, Riera R, Baptista-Silva JC da C. Evidence for varicose vein treatment: An overview of systematic reviews. *Sao Paulo Med J*. 2018;136(4):324–332. PMID: 30020324
5. Piazza G. Varicose veins. *Circulation*. 2014;130(7):582–587. PMID: 25114187

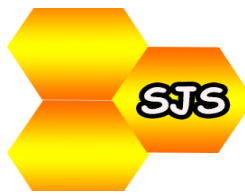




6. Ding J, Mu XF, Yuan Y, Tang LY, Wei KX, Zhao XY, Qing LN, Liu C. Therapies of varicose veins: Protocol for the reporting and methodological quality of pairwise meta-analyses. *Medicine (Baltimore)*. 2019;98(25):e16042. PMID: 31232937
7. Senn N. Principles of Surgery. *The Journal of Nervous and Mental Disease*. 1896. PMID: 15712569
8. Tamers SL, Chosewood LC, Childress A, Hudson H, Nigam J, Chang CC. Total worker health@ 2014–2018: The novel approach to worker safety, health, and well-being evolves. *Int J Environ Res Public Health*. 2019;16(3). PMID: 30682773
9. Fukaya E, Flores AM, Lindholm D, Gustafsson S, Zanetti D, Ingelsson E, Leeper NJ. Clinical and genetic determinants of varicose veins: Prospective, community-based study of  $\approx 500\,000$  individuals. *Circulation*. 2018;138(25):2869–2880. PMID: 30566020
10. Kannegaard PN, Vinding KL, Hare-Bruun H. National database of geriatrics. *Clinical Epidemiology*. 2016. p. 731–735.
11. Jeong GA, Choi ET, Chang JH. Octamer-Binding Transcription Factor-1 Gene Is Upregulated in Primary Varicose Veins. *Ann Vasc Surg*. 2008;
12. Chen Y, Peng W, Raffetto JD, Khalil RA. Matrix Metalloproteinases in Remodeling of Lower Extremity Veins and Chronic Venous Disease. *Prog Mol Biol Transl Sci*. 2017. p. 267–299. PMID: 28413031
13. Rohan CPY, Badel P, Lun B, Rastel D, Avril S. Biomechanical response of varicose veins to elastic compression: A numerical study. *J Biomech*. 2013;46(3):599–603. PMID: 23178041
14. Lattimer CR, Kalodiki E, Geroulakos G, Hoppensteadt D, Fareed J. Are Inflammatory Biomarkers Increased in Varicose Vein Blood? *Clin Appl Thromb*. 2016;22(7):656–664. PMID: 27103338
15. Jacob T, Hingorani A, Ascher E. Overexpression of transforming growth factor- $\beta 1$  correlates with increased synthesis of nitric oxide synthase in varicose veins. *J Vasc Surg*. 2005;41(3):523–530. PMID: 15838489
16. Joseph N, B A, Faizan Thouseef M, Devi M U, Abna A, Juneja I. A multicenter review of epidemiology and management of varicose veins for national guidance. *Ann Med Surg*. 2016;8:21–27.
17. Raffetto JD, Qiao X, Beaugard KG, Khalil RA. Estrogen receptor-mediated enhancement of venous relaxation in female rat: Implications in sex-related differences in varicose veins. *J Vasc Surg*. 2010;51(4):972–981. PMID: 20347696



18. Zhao MY, Zhao T, Meng QY, Zhao L, Li XC. Estrogen and estrogen receptor affects MMP2 and MMP9 expression through classical ER pathway and promotes migration of lower venous vascular smooth muscle cells. *Eur Rev Med Pharmacol Sci.* 2020;24(3):1460–1467. PMID: 32096196
19. Grasselli A, Nanni S, Colussi C, Aiello A, Benvenuti V, Ragone G, Moretti F, Sacchi A, Bacchetti S, Gaetano C, Capogrossi MC, Pontecorvi A, Farsetti A. Estrogen receptor- $\alpha$  and endothelial nitric oxide synthase nuclear complex regulates transcription of human telomerase. *Circ Res.* 2008;103(1):34–42. PMID: 18519947
20. Callam MJ. Epidemiology of varicose veins. *British Journal of Surgery.* 1994. p. 167–173. PMID: 8156326
21. Passman MA, McLafferty RB, Lentz MF, Nagre SB, Iafrati MD, Bohannon WT, Moore CM, Heller JA, Schneider JR, Lohr JM, Caprini JA. Validation of Venous Clinical Severity Score (VCSS) with other venous severity assessment tools from the American Venous Forum, National Venous Screening Program. *J Vasc Surg.* 2011;54(6 SUPPL.):2S-9S.
22. Kidd Man RE, Fenwick EK, Sabanayagam C, Li LJ, Gupta P, Tham YC, Wong TY, Cheng CY, Lamoureux EL. Prevalence, Correlates, and Impact of Uncorrected Presbyopia in a Multiethnic Asian Population. *Am J Ophthalmol.* 2016;168:191–200. PMID: 27246256
23. Mai ELC, Lin C cheng, Lian I, Liao R, Chen M, Chang C. Population-based study on the epidemiology of dry eye disease and its association with presbyopia and other risk factors. *Int Ophthalmol.* 2019;39(12):2731–2739. PMID: 31359236
24. Copeland JL, Ashe MC, Biddle SJ, Brown WJ, Buman MP, Chastin S, Gardiner PA, Inoue S, Jefferis BJ, Oka K, Owen N, Sardinha LB, Skelton DA, Sugiyama T, Dogra S. Sedentary time in older adults: A critical review of measurement, associations with health, and interventions. *British Journal of Sports Medicine.* 2017. PMID: 28724714
25. Brittenden J, Cotton SC, Elders A, Tassie E, Scotland G, Ramsay CR, Norrie J, Burr J, Francis J, Wileman S, Campbell B, Bachoo P, Chetter I, Gough M, Earnshaw J, Lees T, Scott J, Baker SA, MacLennan G, Prior M, Bolsover D, Campbell MK. Clinical effectiveness and cost-effectiveness of foam sclerotherapy, endovenous laser ablation and surgery for varicose veins: Results from the comparison of LAser, Surgery and foam Sclerotherapy (CLASS) randomised controlled trial. *Health Technol Assess (Rockv).* 2015;19(27):1–341. PMID: 25858333
26. Yu J, Rawtaer I, Fam J, Jiang MJ, Feng L, Kua EH, Mahendran R. Sleep correlates of depression and anxiety in an elderly Asian population. *Psychogeriatrics.* 2016;16(3):191–195. PMID: 26179204



27. Izumi M, Ikeda Y, Yamashita H, Asaoka Y, Fujishiro M, Shin M, Abo Y. Safety and effectiveness of endovenous laser ablation combined with ligation for severe Saphenous varicose veins in Japanese patients. *Int Heart J*. 2016;57(1):87–90. PMID: 26742879
28. Arora M. Management of varicose veins. *JK Sci*. 2017;19(1):30–32.
29. Lim CS, Gohel MS, Shepherd AC, Davies AH. Secondary care treatment of patients with varicose veins in National Health Service England: At least how it appeared on a National Health Service website. *Phlebology*. 2010;25(4):184–189. PMID: 20656956
30. Proebstle TM, Alm J, Dimitri S, Rasmussen L, Whiteley M, Lawson J, Cher D, Davies A. The European multicenter cohort study on cyanoacrylate embolization of refluxing great saphenous veins. *J Vasc Surg Venous Lymphat Disord*. 2015;3(1):2–7. PMID: 26993674
31. Bozoglan O, Mese B, Eroglu E, Erdogan MB, Erdem K, Ekerbicer HC, Yasim A. Comparison of Endovenous Laser and Radiofrequency Ablation in Treating Varicose Veins in the Same Patient. *Vasc Endovascular Surg*. 2016;50(1):47–51. PMID: 26767802
32. Jin HY, Ohe HJ, Hwang JK, Kim SD, Kim JY, Park SC, Kim J Il, Won YS, Yun SS, Moon IS. Radiofrequency ablation of varicose veins improves venous clinical severity score despite failure of complete closure of the saphenous vein after 1 year. *Asian J Surg*. 2017;40(1):48–54. PMID: 27378121
33. Tekin Aİ, Tuncer ON, Memetoğlu ME, Arslan Ü, Öztekin A, Yağmur B, Biçer M, Özmen R. Nonthermal, Nontumescent Endovenous Treatment of Varicose Veins. *Ann Vasc Surg*. 2016;36:231–235. PMID: 27421205
34. Brake M, Lim CS, Shepherd AC, Shalhoub J, Davies AH. Pathogenesis and etiology of recurrent varicose veins. *J Vasc Surg*. 2013;57(3):860–868. PMID: 23343668
35. Kemaloğlu C. Saphenous vein diameter is a single risk factor for early recanalization after endothermal ablation of incompetent great saphenous vein. *Vascular*. 2019;27(5):537–541. PMID: 30880609
36. Leopardi M, Salerno A, Dante A, Cofini V, Necozone S, Ventura M. Endovenous Laser Ablation with 1,470-nm Diode with Tumescence Anesthesia and Saphenofemoral Ligation: Propensity Score Match Comparison. *Ann Vasc Surg*. 2019;58:302–308. PMID: 30769060
37. Volkov AS, Dibirov MD, Shimanko AI, Gadzhimuradov RU, Tsuranov S V., Shvydko VS, Tyurin DS, Magdiev AK, Parfentyev EA. Comparison of endovasal laser and radiofrequency ablation of great saphenous vein in the complex treatment of lower limb varicose vein disease. *Flebologiya*. 2020;14(2):91–98.