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The Impact of Age on the Outcomes Following High Ligation and Stripping for Lower Extremity Venous Insufficiency: A Cohort Study

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Rezumat

Impactul vârstei asupra rezultatelor postoperatorii după ligatură înaltă și strippingul venelor varicoase

Introducere: Boala varicoasă reprezintă o patologie cu un număr frecvent de cazuri care necesită tratament chirurgical. Ligatura înaltă a safenei şi strippingul reprezintă încă o intervenție chirurgicală fezabilă în cazuri selecționate. Studiul de față are ca scop identificarea vârstei ca factor prognostic după ligatura înaltă şi strippingul safenei.
Material şi Metodă: Au fost analizate prospectiv cazurile pacienților internați în perioada 2016-2023 cu patologie varicoasă pentru care s-a practicat ligatura înaltă şi strippingul safenei. 167 de pacienți au întrunit criteriile de includere şi de excludere, fiind divizați în două grupuri: Grupul I – 114 pacienți cu vârsta sub 60 de ani şi Grupul II – 53 pacienți cu vârsta de peste 60 de ani. Pacienții au fost urmăriți în perioada postoperatorie la 1 lună şi respectiv 6 luni, iar datele au fost colectate utilizând mai multe chestionare: CEAP, VAS, VCSS şi AVVQ.
Rezultate: Clasa 4, conform clasificării CEAP a fost cel mai frecvent implicată indiferent de categoria de vârstă (Grupul I: 49,12%, Grupul II: 49,06%), urmată de clasa 2 (Grupul I: 41,22%, Grupul II: 35,85. În perioada preoperatorie au existat diferențe statistic semnificative între cele două grupuri în ceea ce priveşte VAS (p = 0,041) şi AVVQ (Grupul I: 12,51 ± 6,11, Grupul II: 11,11 ± 7,19, p = 0,036). Nu au existat diferențe semnificativ statistice între cele două grupuri (p = 0,744) privind chestionarul

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VCSS efectuat preoperator. La 6 luni după intervenția chirurgicală, îmbunătățirea VCSS şi AVVQ a fost independentă de vârstă.
Concluzii: Intervenția chirurgicală de ligatura înaltă şi stripping al safenei este o operație sigură şi fezabilă ce se poate efectua în cazuri selecționate care nu este influențată de vârsta pacienților.

Cuvinte cheie: vârsta, chirurgie, ligatură înaltă a safenei, stripping, varice

Abstract
Background: Varicose veins represent a pathology with a frequent number of cases that require surgical treatment. High saphenous ligation and stripping is still a feasible surgical intervention in selected cases. The present study aims to identify age as a prognostic factor after high saphenous ligation and stripping.
Material and Methods: The cases of patients admitted between 2016 and 2023 with varicose disease for which high ligation and stripping were performed were prospectively analyzed; 167 patients met the inclusion and exclusion criteria and were divided into two groups: Group I – 114 patients under 60 years of age and Group II – 53 patients over 60 years of age. Patients were followed in the postoperative period at 1 month and 6 months, respectively, and data were collected using several questionnaires: CEAP, VAS, VCSS and AVVQ.
Results: Class 4, according to the CEAP classification, was the most frequently involved regardless of age category (Group I: 49.12%, Group II: 49.06%), followed by class 2 (Group I: 41.22%, Group II: 35.85%). In the preoperative period, there were statistically significant differences between the two groups regarding VAS ($p = 0.041$) and AVVQ (Group I: 12.51 ± 6.11, Group II: 11.11 ± 7.19, $p = 0.036$). There were no significant statistical differences between the two groups ($p = 0.744$) regarding the preoperative VCSS questionnaire. At 6 months after surgery, the improvement in VCSS and AVVQ was independent of age.
Conclusions: The surgical intervention of high ligation and stripping of the saphenous vein is a safe and feasible operation that can be performed in selected cases and is not influenced by the age of the patients.

Key words: age, surgery, high ligation and stripping, varicose veins

Introduction

Varicose vein disease is among the most common pathologies in the field of vascular surgery, in which approximately a quarter of patients are affected and require treatment (1,2). In this sense, over the years, along with the revolutionary development of diagnostic methods and implicitly of medicinal and minimally invasive operative and non-operative treatments, the treatment of varicose diseases has undergone a significant improvement, highlighted by an increase in the patients' quality of life (3,4).

Non-surgical types of treatment require a longer duration of treatment, which has repercussions on the high costs of this type of treatment (5,6). Unfortunately, the evolution of diagnostic tools has not influenced the percentage of patients who reach a stage that requires surgical intervention (7).

High Ligation and Stripping (HLS) for lower varicose veins (LVV) represents the classical treatment for this condition, with well-known advantages: fast postoperative recovery, reduced hospitalization, reduced costs (8). This technique is feasible and frequently used in developing regions at the

global level, where the addressability of patients to medical services is deficient (9).

In this context, considering the greater addressability to medical services of patients ≥ 60 years old, the current study aims to identify the effects of age on early and late clinical and postoperative results of patients who underwent HLS.

Material and Methods

Study Group

From January 2016 to December 2023, a prospective cohort study was performed on patients who underwent surgery for LVV, by the same surgical team. Inclusion criteria: 1) patients diagnosed with varicose veins by ultrasound; 2) CEAP 2-4 classes of venous disease; 3) patients who underwent HLS for one or both limbs; 4) patients willing to sign an informed consent. Exclusion criteria: 1) previous surgical intervention for varicose veins; 2) another type of surgery for varicose veins; 3) patients who did not respond to the postoperative follow-up.

Out of 288 patients prospectively admitted to Surgery Department, only 167 patients met the inclusion and exclusion criteria and were enrolled in the study. Patients who met the inclusion criteria, were divided into two groups, Group I: patients < 60 years old (114 patients, Group II: patients ≥ 60 years old (53 patients); the two groups were compared in terms of clinical and biological characteristics, regarding early and long-term postoperative results.

Patients are routinely examined in the standing position and reverse flow of greater than 0.5 m/s following a compression of the calf or Valsalva maneuver is considered pathological reflux. All patients received the same preoperative management and postoperative treatment. Patient data were collected before surgery and after surgery at 1 month and 6 months, respectively. Data were collected using different severity scores: CEAP classification, Visual Analogue Score (VAS), Venous Clinical Severity Score (VCSS), and Aberdeen Varicose Veins Questionnaire (AVVQ).

The CEAP (Clinical-Etiology-Anatomy-Pathophysiology) classification is an internationally accepted standard for describing patients with chronic venous disorders and it has been used for reporting clinical research findings in scientific journals (10). The VAS measures the intensity of pain and consists of a measurement on a scale from 0 ("no pain") to 10 ("pain as bad as it could be") that is completed according to the patient's report regarding the current level of pain (11).

The VCSS was developed from elements of the CEAP classification and was subsequently developed as an evaluative instrument that would be responsive to changes in disease severity over time and in response to treatment, the score includes 10 clinical parameters (pain, varicose veins, venous edema, skin hyperpigmentation, inflammation, induration, number of ulcers, durations of ulcers, size of ulcers, and compliance with compression therapy) (12).

The AVVQs were scored using the method described and validated by Andrew Garratt, being a score comprising 13 questions, with answers ranging from 0 to 100 points, with 0 points indicating the best possible quality of life (13).

Follow-up methods included outpatient visits, interviews by telephone or email.

Study Endpoints

Primary Endpoint

The primary endpoint is to determine the improvement in CEAP, VAS, VCSS and AVVQ after surgery, correlated with patient age.

Secondary Endpoint

Evaluation of clinical and biological characteristics of patients.

Ethical Approval

The study was carried out in accordance with the Declaration of Helsinki on experimentation with human subjects and was approved by the Local Ethics Commission for the Approval of

Clinical and Research Developmental Studies (No 9/2015). Informed consent was obtained from all patients, at the time of enrolment.

Statistical Analysis

For statistical analysis, SPSS version 28 (IBM Corp.; Armonk, NY, USA) was used. Results are presented as mean ± standard deviation or medians with range. The categorical variables were expressed as count (percentage), and chi-square tests were used to compare demographic factors, as well as clinical-pathological parameters. Statistical significance was evaluated using Fisher's exact tests and Mann-Whitney U tests to compare proportions and continuous variables between the groups. A multivariate logistic regression analysis was performed to detect the improvement of VCSS and AVVQ at 1 month and 6 months after surgery. A p value of < 0.05 was considered an indicator of statistical significance.

Results

A total of 167 HLS procedures were performed from January 2016 to December 2023 by the same surgical team, with 114 patients in Group I (<60 years), and 53 patients in Group II (≥60 years). Baseline parameters of the two groups are shown in *Table 1*. The mean age of the patients from Group I was 47.81±11.22 years (range: 29-59), and from Group II was 66.25±7.11 years (range: 60-74). In both study groups, most patients were non-smokers (Group I: 62.28%, Group II: 62.26%) and non-drinkers (Group I: 97.36%, Group II: 96.23%), the procedures predominantly performed on females (Group I: 69.29%, Group II: 67.92%).

One of the most important comorbidities of the patients in both groups was obesity, better represented by those in Group I (42.11% versus 37.73%). In addition, hypertension was more common in the ≥ 60 years old group (32.07% vs 9.64%, p = 0.044). Unilateral limb

Table 1. Comparisons of clinical and demographic characteristics of patients with HLS

Feature	HLS		p-value
	< 60 years (n=114)	≥ 60 years (n=53)	
Age*(y)	47.81±11.22 (29-59)	66.25±7.11 (60-74)	0.007
Area of provenience			0.037
Urban	65 (57.01)	21 (39.62)	
Rural	49 (42.99)	32 (60.38)	
Gender			0.781
Male	35 (30.71)	36 (32.08)	
Female	79 (69.29)	17 (67.92)	
Behavior			
Tobacco			
•Never smoker	71 (62.28)	33 (62.26)	
•Former smoker	17 (14.91)	4 (7.55)	
•Current smoker	26 (22.80)	16 (30.19)	
Alcohol			
•Never consumer	111 (97.36)	51 (96.23)	
•Moderate consumption	3 (2.64)	2 (3.77)	
•Binge drinking	0	0	
•Heavy alcohol use	0	0	
BMI*	29.1±6.2 (22-41.7)	30.9±4.1 (21.4-49.3)	0.118
≥ Obesity I	48 (42.11)	20 (37.73)	
Overweight	26 (22.80)	19 (35.84)	
Normal	39 (34.21)	12 (22.64)	
Underweight	1 (0.87)	2 (3.77)	
Hypertension	11 (9.64)	17 (32.07)	0.044
Limbs			0.322
Unilateral	71 (62.71)	29 (54.72)	
Bilateral	43 (37.71)	24 (25.28)	

Y, years; BMI, Body Mass Index. With percentages in parentheses unless indicated otherwise,
*Values are mean (standard deviation) (range).

involvement was found more frequently in both groups (Group I: 62.71%, Group II: 54.72). Bilateral limb involvement was found more frequently in the young group of patients (37.71%) compared to the ≥ 60 years old group (25.28%). There were significant statistical differences between the two groups regarding the area of origin (p = 0.037) and the existence of previous hypertension (p = 0.044).

In the CEAP classification, the most frequently involved class in both groups was class 4 (Group I: 49.12%, Group II: 49.06%), followed by class 2 (Group I: 41.22%, Group II: 35.85%) (*Table 2*). There were significant statistical differences between the two groups regarding the preoperative VAS (p = 0.041) and preoperative AVVQ (Group I: 12.51 ± 6.11, Group II: 11.11 ± 7.19, p = 0.036). Regarding the preoperative VCSS severity score, there were no statistically significant differences between the two groups (p = 0.744).

A multivariate analysis for VCSS and AVVQ improvement was performed (*Table 3*). The improvement of VCSS at 1 month after surgery was negatively associated with age, with an odds ratio of -0.2 (95% CI -1.1 – 0.1, p = 0.007), and at 6 months after surgery the improvement of VCSS was independent of age. At 1 month after surgery, the age was not related to the improvement of AVVQ with an odds ratio of 0.7 (95% CI -1.4 – -2.8, p = 0.077) and at 6 months after surgery, the improvement AVVQ were independent of age (95% CI -1.8 – 0.09, p = 0.122).

Discussions

Varicose veins affect both young and older adults, the gender distribution being roughly similar (14). The morbidity caused by this disease is not at all negligible, its prevalence increases with age and the impact on the quality of life of these patients has already been

Table 2. Comparison of preoperative data between the two groups of patients

Variables	GROUP I (n=114)	GROUP II (n=53)	p-value
Preoperative CEAP classification			0.161
2	47 (41.22)	19 (35.85)	
3	11 (9.64)	8 (15.09)	
4	56 (49.12)	26 (49.06)	
Preoperative VAS			0.041
0	10 (8.77)	4 (7.54)	
1	49 (42.98)	21 (39.62)	
2	39 (34.21)	23 (43.39)	
3	9 (7.89)	3 (5.66)	
4	4 (3.50)	2 (3.77)	
5	3 (2.63)	0	
Preoperative VCSS			0.744
1	2 (1.75)	1 (1.88)	
2	9 (7.89)	4 (7.54)	
3	17 (14.91)	3 (5.66)	
4	11 (9.64)	9 (16.98)	
5	29 (25.43)	11 (20.75)	
6	18 (15.78)	13 (24.52)	
7	12 (10.52)	2 (3.77)	
8	1 (0.87)	0	
9	2 (1.75)	1 (1.88)	
10	0	2 (3.77)	
11	1 (0.87)	3 (5.66)	
12	3 (2.63)	0	
13	4 (3.50)	0	
14	0	1 (1.88)	
15	3 (2.63)	2 (3.77)	
16	2 (1.75)	1 (1.88)	
Preoperative AVVQ*	12.51±6.11	11.11±7.19	0.036

CEAP: clinical, etiology, anatomy, and pathophysiology; VAS: visual analogue score; VCSS: venous clinical severity score; AVVQ: Aberdeen varicose veins questionnaire. With percentages in parentheses.

Table 3. Multivariate logistic regression for risk factors associated with the improvement of VCSS and AVVQ at 1 month and 6 months after surgery.

Feature	VCSS improvement		AVVQ improvement	
	1 Month OR [95% CI] p-value	6 Months OR [95% CI] p-value	1 Month β [95% CI] p-value	6 Months β [95% CI] p-value
Age				
< 60 years	0	0	0	0
≥ 60 years	-0.2 [-1.1 – 0.1] 0.007	0.1 [-0.04 – 0.8] 0.378	0.7 [-1.4 – 2.8] 0.077	-0.6 [-1.8 – 0.09] 0.122
Preoperative CEAP Classification				
2-3	0	0	0	0
4	0.1 [-0.3 – 0.4] 0.377	0.0 [0.7 – 0.8] 0.391	-0.9 [-1.4 – 2.7] 0.421	-0.6 [-2.4 – 1.1] 0.241
Limbs				
Unilateral	0	0	0	0
Bilateral	0.0 [-0.7 – 0.9] 0.077	0.4 [-0.1 – 0.7] 0.511	-0.9 [-1.7 – 1.2] 0.183	-0.4 [-2.1 – 0.1] 0.061

VCSS: Venous Clinical Severity Score; AVVQ: Aberdeen Varicose Veins Questionnaire; CEAP: Clinical, Etiology, Anatomy, and Pathophysiology; OR: odds ratio; CI: confidence interval; β: beta coefficient.

demonstrated (15,16) Because of its frequency, varicose disease is significantly associated with a low socioeconomic status (17,18).

In our study, the gender distribution was predominantly female, regardless of age category, and with regard to socioeconomic status, patients from rural areas were associated with a more precarious status. The majority of young adults were from the urban area, and the older adults were in a higher percentage from the rural area.

The increased weight of patients with varicose disease influences the disease itself, but also the perioperative status (19). The susceptibility of overweight and obese patients to develop varicose veins is higher than in the general population (20). In the current study, patients from both age groups had an average body mass index of over 29 kg/m^2, respectively over 30 kg/m^2.

Despite the advancement of minimally invasive techniques on a large scale worldwide, classical surgery continues to have an important role in the treatment of varicose pathology, according to studies in the literature still being the most common vascular procedure in Europe (21,22). The studies in the literature analyzed the probability of the existence of a relationship between age and HLS performed in an outpatient setting, for LVV, age not having an effect on these patients in the immediate postoperative period and on the mid-term prognosis (23,24).

HLS can be performed safely in older patients with varicose disease, being effective and with similar results in patients before and after the 6th decade of age (24,25). In the current study, the association of age with HLS prognosis was evaluated, and the finding was that age was an independent variable in relation to VCSS at 6 months postoperatively. After multivariable risk adjustment for potential confounding factors at one month postoperatively, age was found to be related to improvement of VCSS. Regarding the improvement of AVVQ in the immediate or late postoperative period, no correlation with age was identified. The data of this study are similar to the existing data in the literature (26,27). The patients in the study did not suffer major postoperative complications, what they presented were classified as minor complications, namely: ecchymoses, hematomas, seromas, which were treated conservatively.

The limitation of this study is related to the limited number of cases and the short follow-up period. Further studies are needed to validate our findings.

Conclusions

High Ligation and Stripping is a safe and feasible procedure for patients with lower varicose veins, and the age of the patients does not have a significant effect on the medium-term prognosis.

Author's Contributions

Conceptualization, M.P, N.L., R.C.P.; methodology, M.P., N.L., R.C.P.; software, N.L.; validation, M.P., N.L., R.C.P., D.B., I.C., D.I., A.C.; formal analysis, N.L.; investigation, M.P., N.L., R.C.P., D.B., I.C., D.I., A.C.; resources, M.P., N.L., R.C.P., D.B.; data curation, M.P., N.L.; writing - original draft preparation, N.L.; writing - review and editing, M.P., N.L., R.C.P.; visualization, M.P., N.L., R.C.P., D.B., I.C., D.I., A.C.; supervision, M.P., N.L., R.C.P.; administration, M.P., N.L., R.C.P. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interests: None to declaire.

Ethical Statement

The study was carried out in accordance with the Declaration of Helsinki on experimentation with human subjects and was approved by the Local Ethics Commission for the Approval of Clinical and Research Developmental Studies (No. 9/2015). Informed consent was obtained from all patients, at the time of enrolment.

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