

Comparison Between Records of Varicose Vein Surgery and Ultrasound-Guided Foam Sclerotherapy: Is This the End of Conventional Surgical Treatment for Varicose Veins of The Lower Limbs?

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Abstract

Introduction: Varicose veins of the lower limbs are a common manifestation of chronic venous disease (CVD), the most frequent pathology of the circulatory system, and are treated by various techniques, mainly through ablation of the affected veins. Classic surgery, called “high ligation and stripping” (HL&S), and ultrasound-guided dense foam sclerotherapy (EEED) are two of the main methods. **Materials and methods:** observational, retrospective, aggregate, and descriptive documentary research based on secondary data extracted from the Brazilian Hospital Information System between 2017 and 2024 according to the ICD-10 chapter: I83 **Results:** 469,780 surgical procedures and 1,334,563 sclerotherapy sessions for varicose veins were performed, with respective growth rates of 5,604.5% and 20.5%. Procedures associated with ulcers totaled 119,409, most of which were performed on an emergency basis (87%). Total costs were USD 67.6 million for surgeries and USD 84.3 million for sclerotherapy, with average costs of USD 143.95 and USD 63.19 per procedure, respectively. Most interventions occurred in patients aged between 50 and 59 years, while surgeries associated with ulcers predominated in patients aged ≥80 years. Women accounted for approximately 80% of surgeries, and brown patients had a higher prevalence in cases associated with ulcers, reversing the pattern observed in conventional treatments. These data reveal the reconfiguration of the care pattern, with the increasing adoption of the sclerosing technique for the treatment of varicose veins, in parallel with conventional surgical treatment.

Keywords: varicose veins, sclerotherapy; foam

Introduction

The condition known as varicose veins of the lower limbs is a common manifestation of chronic venous disease (CVD), the most frequent pathology of the circulatory system. They present as dilated, elongated, and tortuous veins that mainly affect the superficial topography of the lower limbs. They are usually secondary to weakness in the vessel wall or valve incompetence, associated with venous hypertension, which leads to blood stasis and venous reflux. [1,2]

This condition mainly affects the superficial venous system (great saphenous vein and/or small saphenous vein) but can also affect the deep system, including perforating veins. [3] The superficial segment is also marked by the presence of venous valves in small-diameter veins. When these valves become incompetent, they promote blood reflux to the microvenous networks of the skin, triggering skin changes that present a higher risk of developing venous ulcers when associated with incompetence of the great saphenous vein, aggravating the condition. [4,5]

The clinical presentations of varicose disease can vary, not necessarily indicating the anatomical or hemodynamic severity of the condition. [6] Symptoms—which include pain, skin irritation, heaviness or tightness, muscle cramps, and edema—are nonspecific and often confused with other diseases. Patients with suspected peripheral venous insufficiency related to valve incompetence or obstruction should undergo imaging tests to detect possible chronic venous disease, with continuous wave Doppler ultrasound being the recommended test as it allows for a topographic and hemodynamic assessment of the superficial and deep venous systems. To confirm the presence of venous dysfunction, vascular Doppler ultrasound, strain gauge plethysmography, intravascular ultrasound (IVUS), venography, photoplethysmography (PPG), and computed tomography (CT) can be used. [6,10]

Treatment can be performed using various techniques, which are mainly associated with the ablation of diseased veins. Classic surgery and ultrasound-guided dense foam sclerotherapy (EEED) are two of the main methods. Surgery for varicose veins is known as “High Ligation and Stripping” (HL&S), which consists of extracting the affected vein through two incisions, at the distal and proximal points of the vein, followed by dissection, ligation of its branches, and passage of a phlebectomy device [11]. EEED is an athermic endovenous ablation technique that aims to cause fibrosis of the diseased vein by injecting sclerosing agents—usually polidocanol and sodium tetradecyl sulfate. Ultrasound guidance is essential throughout the procedure, as it increases safety and efficacy rates, especially by preventing inadvertent administration of sclerosing agents into arteries. Another alternative is thermal ablation techniques for the diseased saphenous vein using endovenous laser or radiofrequency associated with excision of varicose veins.

The choice between these procedures depends on several factors, such as the patient's symptoms, the level of anatomical involvement, the availability of resources, and the classification of the lesion. Thus, the Brazilian Society of Angiology and Vascular Surgery recommends surgical treatment for patients with symptomatic varicose disease, especially of the great saphenous vein (GSV) and small saphenous vein (SSV), depending on technical availability.

Unfortunately, in the reality of the Brazilian public health system (SUS), there has been a growing accumulation of patients with complicated or uncomplicated varicose disease with no prospect of receiving adequate treatment due to a lack of beds, specialized staff, and referral centers. The emergence of EEED has changed this reality because it is an outpatient treatment, less invasive, requiring no hospitalization, with better results in the treatment of tributary veins, contributing to lasting effects, with a positive impact on the perception of improvement. [6,11,12] The same logic is followed by the North American guidelines: the Society for Vascular Surgery, American Venous Forum, and American Vein and Lymphatic Society indicate conventional surgical treatment for symptomatic varicose veins, which prioritizes the long-term performance of the treatment, while for patients with symptomatic telangiectasia and reticular veins, echo-guided foam treatment is prioritized. [13] In contrast, the logic followed by European guidelines explicitly prefers thermal sclerotherapy treatment over the surgical method, but follows the same indication as the above-mentioned societies for EEED. [14]

We have observed that in Brazil, EEED has advanced as the first-choice method for treating varicose veins, leaving conventional surgery as the second option. This study seeks to translate the epidemiological reality of these procedures in Brazil.

Materials And Methods

This is an observational, retrospective, aggregate, descriptive documentary study of secondary data extracted from the SUS Hospital Information System (SIH/SUS), available in the DataSUS database, referring to patients hospitalized in Brazil between 2017 and 2024, by place of residence, according to ICD-10 chapter: I83: Varicose veins of the lower limbs.

The data obtained were processed using Microsoft Excel software, where tables and graphs were constructed referring to the data collected, which can be verified through the TabNet and TabWin portal at the following link: <https://datasus.saude.gov.br/>.

The search commands used and available in SIH/SUS were: “Surgical Treatment of Varicose Veins (Bilateral)”, “Surgical Treatment of Varicose Veins (Unilateral)”, “Treatment of Varicose Veins of The Lower Limbs WITH Ulceration,” “Non-Cosmetic Sclerosing Treatment of THE Lower Limbs (Unilateral),” and “Non-Cosmetic Sclerosing Treatment of The Lower Limbs (Bilateral).”

To describe hospitalizations for surgical treatment of varicose veins and non-cosmetic sclerotherapy, the variables used were paid hospital admission authorizations (AIH), total cost, type of care, age group, gender, and race/color.

In order to calculate the average value of paid AIHs for hospitalizations for surgical treatment of varicose veins and non-cosmetic sclerotherapy, the ratio between the total value and the number of paid AIHs was calculated. To calculate the cost in dollars, the exchange rate on July 4, 2024, was used, at a value of 5.4084, according to the Central Bank of Brazil.

Regarding ethical considerations, this study was exempted from submission to a Research Ethics Committee, as it exclusively used publicly accessible data, in accordance with current legislation. Nevertheless, the researchers followed the ethical principles established by Resolution No. 466/2012 of the Brazilian National Health Council, ensuring confidentiality and responsible use of the analyzed information.

Results

Records from 2017 to 2024 documented 469,780 procedures performed for the surgical treatment of varicose veins, while for sclerotherapy treatment, the number reached 1,334,563 procedures.

Analysis of the temporal evolution shows that surgical treatment peaked in 2018, with 75,125 surgeries, remaining high in 2019. However, starting in 2020, there was a significant reduction, with only 28,564 procedures, a trend that intensified in 2021, with the lowest number in the series: 25,598 surgeries. The context of the pandemic during this period must be considered. In subsequent years, there was a gradual recovery, culminating in 80,911 surgeries performed in 2024, a figure higher than that observed at the initial peak.

At the same time, sclerotherapy showed a trend of continuous growth from 2018 onwards, with a significant expansion in 2021, surpassing surgical treatment, when the number of procedures jumped from 60,685 to 108,751. In subsequent years, this progression continued at an accelerated pace, characterized by exponential growth, with 169,921 procedures recorded in 2022, 314,841 in 2023, and finally a notable peak in 2024, with 571,529 procedures performed. These data reveal the reconfiguration of the care pattern, with the increasing adoption of the sclerosing technique for the treatment of varicose veins, in parallel with conventional surgical treatment.

The data also show a clear predominance of certain types of therapeutic approaches over the years analyzed. In the case of surgical treatment of varicose veins, 60% of procedures were performed bilaterally, while the remaining 40% were unilateral, with this pattern remaining consistent across all years evaluated. In contrast, in sclerotherapy treatment, there was a reversal of this proportion: most procedures were performed unilaterally, corresponding to 58% of the total, while 42% were bilateral, maintaining this distribution consistently throughout the period.

Another variable considered was the surgical treatment of varicose veins of the lower limbs associated with the presence of ulcers, which totaled 119,409 procedures performed between 2008 and 2024. The temporal analysis revealed a downward trend in the number of surgeries over the years, with the peak recorded in 2008 (10,540 procedures), followed by a progressive decline until 2021, when it reached its lowest level (4,042 procedures). From then on, a gradual recovery was identified in subsequent years, culminating in 6,479 procedures in 2024.

It should be noted that surgical treatment of varicose veins totaled \$67,626,558.80, while sclerotherapy treatment cost \$84,336,108.62 over the period analyzed. The average payment per procedure was \$143.95 for the surgical approach, compared to \$63.19 for the sclerotherapy technique. Specifically, in cases associated with the presence of ulcers in the lower limbs, surgical intervention involved a total cost of \$9,459,598.04, with an average cost of \$79.22 per procedure. When comparing costs according to the laterality of treatment, it can be observed that the unilateral sclerotherapy procedure has the lowest average cost, \$56.29, while the bilateral approach reaches \$72.85. In the surgical modality, the average costs are \$135.30 for bilateral procedures and \$114.96 for unilateral procedures.

Both surgical and sclerosing treatments were predominantly performed on an elective basis, corresponding to 99% and 98% of the cases, respectively. However, this pattern is reversed when considering cases of varicose veins associated with lower limb ulcers. In this subpopulation, only 13% of interventions occurred in an elective context, while the vast majority (87%) were performed on an emergency basis.

The highest concentration of surgical procedures for the treatment of varicose veins occurred among individuals aged 50 to 59 years, corresponding to approximately 30% of the total. Within this group, the 50 to 54 age group stands out, with 40,038 interventions recorded. Regarding sclerotherapy, the trend was similar, with the 50-59 age group being the most affected, accounting for 30% of the total cases. Among these, individuals between 55 and 59 years of age stand out, with 189,930 records. In the context of surgical treatment of varicose veins associated with the presence of ulcers in the lower limbs, the highest incidence was observed in the population aged 80 years or older, which accounted for approximately 15% of cases, showing a predominance in older individuals for this specific clinical condition.

Regarding the distribution by gender, it is observed that females correspond to the significant majority of surgical procedures for the treatment of varicose veins, representing approximately 80% of the total cases. Regarding the surgical treatment of varicose veins associated with the presence of ulcers in the lower limbs, the distribution between the sexes was relatively balanced, but with a female predominance, accounting for about 52.3% of the procedures.

In the analysis according to the color/race variable, it was observed that the white population constitutes the majority of cases undergoing unilateral surgical treatment of varicose veins, corresponding to 55% of procedures,

while in bilateral treatment this proportion is 44%. In both types of approach, the brown population ranks as the second most prevalent, representing 35% of cases in unilateral treatment and 43% in bilateral treatment. However, when considering surgical procedures for varicose veins associated with the presence of ulcers in the lower limbs, this pattern is reversed: the brown population represents the largest share with 43% of cases, followed by the white population with 35%.

Discussion

In the analysis conducted between 2017 and 2024, there is a clear preponderance in the number of sclerotherapy treatments compared to conventional varicose vein surgery, with the number of surgical treatments corresponding to 35.19% of the total number of sclerotherapy treatments. The absolute growth rate of sclerotherapy treatment (5,604.5%), compared to the smaller increase in surgery (20.5%), reinforces that even though surgical treatment is well established in Brazil, sclerotherapy is gaining more and more ground. One possible explanation for this pattern is the less invasive and outpatient nature of the sclerotherapy procedure, which makes it particularly favorable for patients who do not require surgery. Associated with this, a significant reduction in the surgical approach has been observed since 2020, possibly related to the impact of the COVID-19 pandemic, a period in which there was a preference for outpatient procedures, with the aim of reducing or avoiding hospitalizations. It is important to note that surgical treatment is generally more definitive, while sclerotherapy is subject to recanalization (6). Thus, the total number of procedures attributed to sclerotherapy tends to incorporate re-approaches, increasing the count in the comparison. Post-procedure spots and reports of phlebitis, thrombosis, and even strokes reported as complications of sclerotherapy must also be considered.

The higher rate of reintervention due to vessel recanalization (16) may also lead to a greater financial burden on the SUS, due to the increase in the number of procedures performed, even though the individual cost of sclerotherapy is lower than that of surgical treatment, as explained in studies (11). However, it is highly plausible that sclerotherapy remains economically advantageous because it offers faster recovery and a lower complication rate and does not require hospitalization, which favors its prevalence (17). Therefore, prospective studies are needed to systematically collect events and costs, allowing cost-effectiveness and threshold analyses by patient profile and technique used.

Following this logic, another important factor is the financial investment allocated to each procedure. The cost per procedure for sclerotherapy treatment is approximately 44% of that required for surgical treatment, a significant discrepancy. In this context, there are few differences in quality of life scores as well as in terms of clinical outcome (8), 19, 20 the lower-cost treatment appears to be the most cost-effective in the short term.

Although the discussion about the most appropriate technique is relevant, the personal anatomical and physiological characteristics of each individual are of great value for treatment indication. According to the European Society for Vascular Surgery (ESVS), ultrasound-guided dense foam sclerotherapy is indicated for smaller vessels, while surgery is indicated in cases where other forms of ablation are not available. (14 The 2023 SBACV guidelines strongly recommend chemical sclerotherapy treatment for patients with C1-identified CVC in the CEAP 6 classification. This fact speaks to the discrepancy in the number of sclerotherapy procedures performed during the period under review, since telangiectasias and reticular veins (smaller vessels) are highly prevalent findings in the adult population, including in

healthy patients, and are treated either for functional or aesthetic abnormalities 8.

Surgical treatment of varicose veins of the lower limbs associated with the presence of ulcers shows a downward trend between 2017 and 2024 in the number of surgeries performed over the years, a fact that can be justified by the growing number of studies that increasingly introduce endovenous treatments in general as a possible approach and/or improvement in primary care, reducing progression to more advanced stages.

The high amount invested in surgical treatment of varicose disease in stages complicated by ulceration highlights not only the relevance of this procedure for the SUS, but also the urgency of strengthening strategies for preventing complications of CVD in primary care in order to avoid unfavorable outcomes and reduce the socioeconomic impact.

The study showed that women tend to undergo treatment for varicose disease of the lower limbs more frequently, a result that reinforces a well-established discussion in the literature regarding women's greater susceptibility to developing varicose veins based on factors such as pregnancy, given physiological changes such as increased blood volume, weight gain, elevated intra-abdominal pressure, and reduced venous return. 10,22,23

Still regarding the gender variable, there is greater female participation in interventions related to the early and intermediate stages of CVD, whereas in advanced forms with ulceration, the distribution between the sexes tends to be more similar. This pattern may reflect differences in behavior in seeking care—with greater early demand among women and delay among men—in addition to possible sociocultural, occupational, and access influences.

The 50-59 age group is identified as having a common prevalence for surgical and sclerosing procedures. In the context of surgical treatment of varicose veins associated with the presence of ulcers in the lower limbs, the population aged 80 years or older stands out as the main age group. These data are possibly justified by the risk factors for the development of CVD, which include age, and by the fact that ulceration is a long-term complication of this disease. 22

In the analysis according to the color/race variable, a pattern is observed that is possibly compatible with inequity of access to care. The white population is predominant in the treatment of the early stages of CVD, while the brown population is more prevalent when considering surgical procedures associated with the presence of ulcers. This pattern reflects social determinants, barriers to access, and possible institutional biases, delaying early diagnosis and management of cases.

Regarding the nature of care, in general, surgical and sclerosing treatments are performed mostly on an elective basis, a pattern that reflects the chronic and non-emergency nature of most venous diseases. 22 On the other hand, the progression of the condition to the presence of ulcers reverses the treatment pattern, with urgency becoming more prevalent. This reversal can be interpreted as an indicator that ulcers are a serious complication of chronic venous disease, acting as a decisive factor in the search for and execution of immediate medical care. 24

Conclusion

Sclerotherapy is the predominant treatment for CVD in Brazil, and conventional surgery is increasingly rare, supported by factors such as lower invasiveness, reduced costs, and faster recovery, despite higher rates of recanalization and reintervention. Surgery, although relevant, shows a

downward trend, especially in cases associated with ulcers, possibly due to advances in endovenous methods and improvements in primary care. Women aged 50 to 59 years seek treatment more often, while patients aged 80 years or older represent the most severe cases. These findings reinforce the importance of policies that integrate cost-effectiveness, safety, and prevention of the progression of Chronic Venous Disease.

This study, although comprehensive, has limitations inherent to the use of secondary data from DATASUS, which do not allow for in-depth analysis of specific patient clinical characteristics or long-term outcomes. For future research, prospective multicenter studies integrating detailed clinical data are recommended, allowing for analyses adjusted by comorbidities and disease severity.

Conflict of Interest Statement: The authors declare that there are no conflicts of interest.

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