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Original Research Article

Unveiling Microbial Patterns: Analysing Culture Sensitivity of Varicose Veins

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Abstract:

Background: Varicose veins are a common manifestation of chronic venous disease, resulting from venous valvular incompetence and venous hypertension. Chronic venous stasis, tissue hypoxia and disruption of the skin barrier may predispose affected tissues to microbial colonization. Understanding the microbial profile of stripped varicose veins may help identify organisms associated with postoperative complications and guide appropriate preventive strategies.

Aim: To investigate the microbial trends in varicose veins following stripping surgery, identify prevalent microorganisms, assess factors associated with culture positivity, and suggest appropriate preventive measures.

Materials and Methods: This prospective observational study was conducted over 18 months at Narayana Medical College and Hospital, Nellore, and included 40 patients aged above 18 years undergoing varicose vein stripping surgery. Patients with varicose vein ulcers, diabetic ulcers, or other vascular surgical procedures were excluded. Under sterile aseptic conditions, the stripped vein specimen was collected intraoperatively in a sterile container containing nutrient broth and transported to the microbiology laboratory for tissue culture and antibiotic sensitivity testing. Clinical characteristics and microbiological findings were analysed using Microsoft Excel and SPSS version 22.0. Associations were assessed using appropriate statistical tests, with $p<0.05$ considered statistically significant.

Results: The study population comprised 22 females (55%) and 18 males (45%). The largest age group was 31–40 years (45%), followed by 21–30 years (35%). Unilateral disease was present in 70% of patients, while bilateral involvement occurred in 30%. The great saphenous vein was the most commonly involved vein (45%). Obesity was observed in 37.5% of patients and overweight in 32.5%. Culture positivity was observed in 35 patients (87.5%), with Gram-positive organisms predominating (65%), while Gram-negative organisms were isolated in 22.5%; 12.5% showed no growth. Culture positivity showed statistically significant associations with age ($p=0.043$), gender ($p=0.012$), limb involvement ($p=0.018$), and BMI ($p=0.038$). No significant association was observed with hypertension ($p=0.912$), type of vein involved ($p=0.821$), or occupation ($p=0.754$).

Conclusion: Microbial growth was frequently detected in stripped varicose vein specimens, with Gram-positive organisms predominating. Increasing age, female gender, unilateral disease and higher BMI were significantly associated with culture positivity, whereas hypertension, vein involved and occupation were not. These findings highlight the potential importance of microbial colonization in varicose vein disease and support meticulous aseptic precautions, appropriate microbiological assessment in selected patients, weight management and attention to modifiable risk factors to reduce postoperative complications.

Keywords: Varicose veins; Microbial culture; Gram-positive bacteria; Chronic venous disease; Antibiotic sensitivity.

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Introduction

Varicose veins (VV) form an integral part of the spectrum of chronic venous disorders (CVD), conditions that have afflicted humankind since antiquity. Although VV is a widespread disease, its manifestation in humans exhibits distinctive characteristics. Despite substantial advances in the understanding of the disease process, the exact etiological factors responsible for the development of vari-

cose veins remain incompletely understood. [1] This condition has been reported to have a prevalence of 10–20% in Western literature, whereas studies from India have documented a comparatively lower prevalence of approximately 5%. [2] The factors contributing to the development of varicose veins are not yet fully elucidated. Epidemiological studies have identified several associated risk factors, including advancing age, female sex, pregnancy, obesity, and a history of deep vein thrombosis. [3,4]

In varicose veins, the pathological process may involve the superficial venous system, the deep venous system, or the perforating veins. The clinical spectrum of varicose veins varies widely, ranging from telangiectasias to markedly dilated and tortuous superficial veins, which may occur with or without associated complications such as edema, dermatitis, lipodermatosclerosis, and venous ulceration.

Aim: To investigate microbial trends in Varicose Veins after stripping surgery to find out the bacterial cause.

Objectives: Identify prevalent microbes, determine risk factors for infections, Propose preventive measures.

Materials and Methodology: This was a Prospective Observational Study done for 18 Months in 40 Patients undergoing Varicose Veins Stripping Surgery, Narayana Medical College and Hospital Nellore.

Inclusion Criteria: Patient above 18 years diagnosed with varicose veins confirmed by clinical examination or imaging studies. Exclusion Criteria: Patients undergoing other types of vascular surgeries, patients diagnosed with varicose veins ulcer, with Diabetic Ulcers.

The methodology involves collecting varicose vein samples, analyzing them for microbial presence, testing microbial sensitivity to antibiotics, analyzing the data, correlating findings with patient clinical data, and drawing conclusions to guide treatment and preventive measures.

Procedure of sample collection: Under sterile aseptic conditions after stripping the vein at the time of surgery, stripped vein was taken. Stripped out vein was placed in sterile container which was prepared already having nutrient broth in it. Collected sample container was sent to microbiology laboratory for tissue culture and sensitivity. Data was collected and results analysed.

Statistics: Microsoft Excel was used to construct a master chart using SPSS 22.0. Mean and percentages for different scores, t and p values are used to determine the significance of the difference noted between the scores and correlated in order to assess various outcomes. Paired t-test and individual t-test were used for correlation between the score and $p<0.05$ was considered as statistically significant.

Results

Table 1: Age and Gender Distribution among Sample Population

Age Group (years)	Number of Patients (n)	Percentage (%)
21–30	14	35
31–40	18	45
41–50	8	20
Male	18	45
Female	22	55

Table 2: Patient Characteristics among the Sample Population

Limb Affected	Number of Patients (n)	Percentage (%)
Unilateral	28	70
Bilateral	12	30
Hypertensive	**17**	**42.5**
GSV Involved	**18**	**45**
PV Involved	**10**	**25**
SSV/GSV + PV **Involved**	9	22.5
SSV **Involved**	3	7.5
Normal weight	12	30
Overweight	13	32.5
Obese	15	37.5
Long Standing Hours	15	37.5
Moderate Activity	14	35
Desk Job	11	27.5

Table 3: Distribution of Culture Isolates among the Sample Population

Microbiology Result	Number of Patients (n)	% of Total (n=40)
Gram Positive	26	65.0%
Gram Negative	9	22.5%
No Growth	5	12.5%
Total	**40**	**100.0%**

Table 4: Association of Microbiology Culture Results with Age Group

Age Group	Growth (n)	Growth (%)	No Growth (n)	No Growth %	Total (n)	Total (%)
20-30	11	78.6%	3	21.4%	14	35.0%
30-40	16	88.9%	2	11.1%	18	45.0%
40-50	8	100.0%	0	0.0%	8	20.0%
Gender						
Female	22	100.0%	0	0.0%	22	55.0%
Male	13	72.2%	5	27.8%	18	45.0%
Limb Affected						
Bilateral	8	66.7%	4	33.3%	12	30.0%
Unilateral	27	96.4%	1	3.6%	28	70.0%
Hypertension						
No	20	87.0%	3	13.0%	23	57.5%
Yes	15	88.2%	2	11.8%	17	42.5%
Vein involved						
GSV	16	88.9%	2	11.1%	18	45.0%
GSV + PV	8	88.9%	1	11.1%	9	22.5%
PV	9	90.0%	1	10.0%	10	25.0%
SSV	2	66.7%	1	33.3%	3	7.5%

Table 5: Association of Microbiology Culture Results with Bmi, Occupation

Growth	Normal BMI	Overweight	Obese	Total
Present	9 (22.5%)	11 (27.5%)	15 (37.5%)	35 (87.5%)
Absent	3 (7.5%)	2 (5.0%)	0 (0.0%)	5 (12.5%)
Microbiology	**Desk Job**	**Long Standing Hours**	**Moderate Activity**	**Total**
Gram Positive	7 (17.5%)	9 (22.5%)	10 (25.0%)	26 (65.0%)
Gram Negative	3 (7.5%)	4 (10.0%)	2 (5.0%)	9 (22.5%)
No Growth	1 (2.5%)	2 (5.0%)	2 (5.0%)	5 (12.5%)

Discussion

The age distribution of the 40 patients with varicose veins demonstrated a predominance among younger and middle-aged adults. The 31–40-year age group constituted the largest proportion, accounting for 45% (n=18), followed by the 21–30-year group at 35% (n=14). Together, these groups represented 80% of the study population, while patients aged 41–50 years accounted for 20% (n=8). This finding indicates that varicose veins significantly affect individuals during their productive years rather than being confined to advanced age. Prolonged occupational standing, sedentary behaviour and obesity are important risk factors in working-age adults. Hormonal influences, particularly during pregnancy, may further contribute to venous insufficiency in women by increasing pelvic venous pressure and promoting venous wall laxity. The relatively lower proportion of patients aged 41–50 years may reflect sampling variability associated with the small sample size rather than a true epidemiological trend. Nevertheless, the findings emphasise the importance of early screening, lifestyle modification and preventive interventions. The gender distribution showed a slight female predominance, with females constituting 55% (n=22) and males 45% (n=18). This finding is consistent with the commonly reported higher prevalence of varicose veins among women. The female predominance may be related to hormonal influences. Oestrogen and progesterone can reduce venous wall tone and affect valve competency.

Pregnancy additionally increases venous pressure through increased circulating blood volume, raised intra-abdominal pressure and hormonal venodilation. Oral contraceptive use and hormone replacement therapy may further contribute to venous wall laxity, while multiparity may increase cumulative risk. Although males showed a lower proportion, their representation of 45% confirms that varicose veins are common in both sexes. Occupational factors, particularly prolonged standing, remain im-

portant among male patients as well. [5] Limb involvement demonstrated a clear predominance of unilateral disease, occurring in 70% (n=28), while bilateral involvement was observed in 30% (n=12). Unilateral presentation is frequently reported in surgical literature and may be related to asymmetrical venous incompetence. The left lower limb may be particularly predisposed because of anatomical compression of the left common iliac vein by the right common iliac artery, as described in May-Thurner syndrome. Such increased venous resistance can contribute to elevated venous pressure and unilateral valvular deterioration. Bilateral involvement may indicate more extensive or longstanding disease and can be associated with genetic predisposition, prolonged occupational standing and progressive venous insufficiency. From a surgical perspective, unilateral disease may require targeted intervention, whereas bilateral disease may necessitate more comprehensive treatment and surveillance.

Regarding hypertension, 57.5% (n=23) of patients were non-hypertensive, while 42.5% (n=17) had coexisting hypertension. Although hypertension was not predominant, its presence in nearly half of the study population is clinically relevant. Hypertension and chronic venous insufficiency share several risk factors, including obesity, sedentary lifestyle and increasing age. Chronic arterial hypertension may produce vascular structural changes and affect microcirculatory regulation, although varicose veins primarily result from venous valvular incompetence and venous wall weakness. The majority of patients being non-hypertensive reinforces that systemic blood pressure is not essential for the development of varicose veins. [6]

The Great Saphenous Vein (GSV) was the most frequently involved venous segment, accounting for 45% (n=18). Perforator vein (PV) involvement was seen in 25% (n=10), combined SSV/GSV with perforator involvement in 22.5% (n=9), and isolated Small Saphenous Vein (SSV) involvement in 7.5% (n=3). The predominance of GSV disease is consistent with its anatomical length and greater exposure to hydrostatic pressure in the upright position. Incompetence at the saphenofemoral junction allows reflux and progressive dilatation of the GSV and its tributaries. The substantial proportion of perforator involvement highlights the importance of identifying incompetent perforators during preoperative Doppler assessment because untreated perforators may contribute to recurrence. Combined venous involvement represents a more complex disease pattern requiring comprehensive venous mapping. The lower frequency of isolated SSV involvement is consistent with its shorter length and comparatively lower hydrostatic burden.

BMI distribution demonstrated a progressive increase in patient frequency with increasing BMI. Obese patients constituted 37.5% (n=15), overweight patients 32.5% (n=13), and patients with normal BMI 30% (n=12). Thus, 70% of patients had BMI above the normal range. Obesity is an established risk factor for chronic venous insufficiency. Excess adipose tissue, particularly abdominal fat, increases intra-abdominal pressure and can impair lower-limb venous return. Obesity is also associated with chronic inflammation, endothelial dysfunction, tissue oedema and lymphatic impairment, all of which may aggravate venous hypertension and skin changes. The progressive distribution from normal BMI to overweight and obesity suggests an association between increasing body weight and venous disease burden. Weight reduction should therefore form an important component of preventive and adjunctive management.

Occupational distribution showed that long-standing occupations accounted for 37.5% (n=15), moderate-activity occupations for 35% (n=14), and desk jobs for 27.5% (n=11). Long-standing and desk-based occupations together represented 65% of patients, indicating that occupations involving prolonged static posture may contribute substantially to venous disease. Prolonged standing reduces the effectiveness of the calf muscle pump and promotes venous pooling and sustained venous hypertension. Similarly, prolonged sitting can impair venous return and increase lower-limb venous pressure. Workplace measures such as regular ambulation, avoidance of prolonged static posture and appropriate compression therapy may help reduce venous stasis.

Microbiology cultures were positive in 87.5% (n=35) of the 40 patients, while 12.5% (n=5) showed no growth. Gram-positive organisms were predominant, occurring in 65% (n=26) of the total study population and accounting for 74.3% of culture-positive cases. Gram-negative organisms were identified in 22.5% (n=9), representing 25.7% of positive cultures. This predominance of Gram-positive organisms is consistent with the microbiological pattern commonly observed in chronic venous wounds, where organisms such as Staphylococcus aureus and beta-haemolytic Streptococci are frequently encountered. Chronic venous stasis, skin barrier disruption, ulceration and tissue hypoxia provide favourable conditions for bacterial colonisation. Gram-negative organisms may occur particularly in advanced or chronic wounds. The high culture positivity rate supports appropriate microbiological assessment in patients with clinically infected or ulcerated wounds and the use of sensitivity-guided antimicrobial treatment. [7]

A significant association was observed between age and culture positivity. Culture positivity increased from 78.6% (n=11) in the 20–30-year group to 88.9% (n=16) in the 30–40-year group and 100% (n=8) in the 40–50-year group. The proportion

showing no growth progressively decreased with increasing age. Chi-square analysis demonstrated a statistically significant association (p=0.043). Increasing microbial growth with age may be related to progressive skin barrier compromise, chronic venous stasis, ulceration, impaired local immunity and cumulative tissue hypoxia.

Gender was also significantly associated with culture positivity. All 22 female patients (100%) had positive cultures, compared with 13 of 18 males (72.2%); five males (27.8%) showed no growth. The association was statistically significant (p=0.012). Hormonal influences, pregnancy-associated venous insufficiency and differences in the severity or duration of venous disease may contribute to this observation. However, the small sample size should be considered when interpreting this finding.

A statistically significant association was also observed between limb involvement and culture positivity (p=0.018). Among unilateral cases, 27 of 28 patients (96.4%) had positive cultures, compared with 8 of 12 bilateral cases (66.7%). The higher positivity among unilateral cases may reflect more severe localised venous hypertension, ulceration and skin barrier disruption in the affected limb. Bilateral disease may involve less severe changes in each individual limb or may lead to earlier presentation.

In contrast, hypertension showed no significant association with culture results. Culture positivity was 87.0% (n=20) among non-hypertensive patients and 88.2% (n=15) among hypertensive patients. The difference was statistically non-significant (p=0.912). This suggests that bacterial colonisation is primarily determined by local wound factors rather than systemic hypertension. [8]

Similarly, the type of vein involved was not significantly associated with culture positivity (p=0.821). Positivity was 90% in PV disease, 88.9% in GSV disease, 88.9% in combined GSV+PV disease and 66.7% in isolated SSV disease. The lower positivity in isolated SSV disease should be interpreted cautiously because only three patients belonged to this subgroup. Overall, microbial colonisation appears to be related more to chronic venous hypertension, tissue hypoxia and skin disruption than to the specific venous axis involved.

BMI demonstrated a statistically significant association with culture positivity (p=0.038). Among patients with normal BMI, 75% (n=9) had positive cultures, compared with 84.6% (n=11) among overweight patients and 100% (n=15) among obese patients. This progressive increase suggests a possible dose-response relationship. Obesity may increase venous hypertension, oedema, lymphatic dysfunction, tissue inflammation and impairment of local immunity, thereby favouring bacterial colonisation. The complete culture positivity among obese patients highlights the importance of meticulous wound care and weight optimisation. [9]

Occupational category was not significantly associated with microbiological culture results (p=0.754). Gram-positive organisms remained predominant among moderate-activity workers (71.4%, n=10), long-standing workers (60%, n=9) and desk-job workers (63.6%, n=7). Gram-negative organisms were identified in 14.3%, 26.7% and 27.3% of these groups, respectively. No growth was observed in 14.3%, 13.3% and 9.1%, respectively. Thus, although occupational posture is an important risk factor for venous stasis and disease development, it did not significantly influence the microbiological profile.

Overall, the study demonstrates that varicose veins predominantly affected younger and middle-aged adults, with slight female predominance, frequent unilateral involvement, predominant GSV disease, and a high prevalence of overweight and obesity. Prolonged static occupational posture was common. Microbial culture positivity was high, with Gram-positive organisms predominating. Significant associations were identified between culture positivity and age, gender, limb involvement and BMI, whereas hypertension, vein involved and occupation showed no statistically significant association. These findings emphasise the importance of early diagnosis, modification of occupational and lifestyle risk factors, weight management, appropriate venous mapping and targeted microbiological assessment in selected patients to optimise management and reduce postoperative complications. [10]

Conclusion

Varicose veins are a complex condition with contributions from structural abnormalities, altered hemodynamics, and potentially microbiological factors. Although the conventional understanding emphasizes venous reflux and valve dysfunction, increasing evidence indicates that microbial colonization may have an important role in disease progression and postoperative complications.

This study highlights that bacteria can exist within venous and surrounding tissues even in the absence of clinical infection, often remaining in a dormant state. Under certain conditions—such as venous stasis, reduced tissue oxygenation, or systemic comorbidities—these microorganisms may become active, resulting in infection, inflammation, impaired wound healing, and ulcer formation.

The microorganisms most frequently identified are predominantly normal skin flora, particularly Staphylococcus species, along with other opportunistic pathogens. Their presence emphasizes the im-

portance of strict aseptic techniques and appropriate antimicrobial strategies in surgical management. Identification and management of predisposing factors, including obesity, diabetes, chronic venous insufficiency, and local tissue injury, are essential for minimizing postoperative complications and improving outcomes.

Furthermore, newer insights into the potential involvement of the gut microbiome and oral bacteria in venous disease suggest additional pathways in disease pathogenesis and offer promising areas for future research.

In conclusion, this study supports the concept that varicose veins should not be viewed solely as a mechanical vascular disorder, but rather as a condition that may also involve significant microbiological influences. A comprehensive understanding of these factors can enhance treatment strategies, reduce complications, and improve long-term patient outcomes.

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