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COMPARATIVE STUDY BETWEEN RADIOFREQUENCY ABLATION AND TRENDELENBURG'S PROCEDURE IN MANAGING VARICOSE VEINS

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ABSTRACT

Varicose veins, a chronic venous disorder affecting millions worldwide, present with symptoms such as pain, swelling, and potential complications like venous ulceration and deep vein thrombosis (DVT). This prospective clinical study compares the effectiveness and safety of two surgical treatments for varicose veins: Radiofrequency Ablation (RFA) and Trendelenburg's Procedure with Great Saphenous Vein (GSV) stripping. Conducted over two years, the study involved 60 patients with confirmed saphenofemoral junction incompetence, who were assigned to either RFA or Trendelenburg's Procedure groups. Key outcomes included postoperative pain, complication rates, hospital stay, recovery time, and

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recurrence rates assessed over a three-month follow-up period. Results indicated that RFA patients reported significantly lower postoperative pain on both Day 1 and Day 3 compared to those undergoing Trendelenburg's Procedure. Pain scores averaged 1.23/10 on Day 1 for RFA patients versus 2.67/10 in the Trendelenburg group, with similar differences observed on Day 3. Hospital stay and recovery time were also shorter in the RFA group, with an average hospital stay of 3.3 days compared to 6.7 days in the Trendelenburg group, and an average return to normal activities at 4.83 days versus 9.87 days, respectively. Complication rates differed between groups, with RFA associated with a lower incidence of seroma formation (0% vs. 6.7% in the Trendelenburg group) and DVT (0% vs. 3.3%). However, hematoma formation was slightly higher in the RFA group (10% vs. 6.7%). No recurrences of varicose veins were observed in either group within the three-month follow-up. These findings highlight RFA as a minimally invasive, effective treatment option offering advantages in terms of lower postoperative pain, fewer complications, shorter hospital stays, and faster recovery times compared to Trendelenburg's Procedure. The study underscores RFA's potential as a preferred option for patients seeking less invasive treatment for varicose veins, with Trendelenburg's Procedure remaining a viable alternative when RFA is contraindicated or unavailable.

KEYWORDS: Varicose veins; Chronic venous disorder; Radiofrequency ablation (RFA); Trendelenburg's Procedure; Great saphenous vein (GSV) stripping; Saphenofemoral junction incompetence.

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ESTUDIO COMPARATIVO ENTRE LA ABLACIÓN POR RADIOFRECUENCIA Y EL PROCEDIMIENTO DE TRENDELENBURG EN EL MANEJO DE LAS VENAS VARICOSAS

RESUMEN

Las venas varicosas, un trastorno venoso crónico que afecta a millones de personas en todo el mundo, presentan síntomas como dolor, inflamación y posibles complicaciones como ulceración venosa y trombosis venosa profunda (TVP). Este estudio clínico prospectivo compara la eficacia y la seguridad de dos tratamientos quirúrgicos para las venas varicosas: la ablación por radiofrecuencia (ARF) y el procedimiento de Trendelenburg con extirpación de la vena safena interna (VSI). El estudio, que duró dos años, incluyó a 60 pacientes con insuficiencia de la unión safenofemoral confirmada, asignados a los grupos de ARF o de Trendelenburg. Los resultados clave incluyeron dolor posoperatorio, tasas de complicaciones, estancia hospitalaria, tiempo de recuperación y tasas de recurrencia, evaluados durante un período de seguimiento de tres meses. Los resultados indicaron que los pacientes sometidos a ARF reportaron un dolor posoperatorio significativamente menor tanto el día 1 como el día 3, en comparación con los sometidos a la técnica de Trendelenburg. Las puntuaciones de dolor promediaron 1,23/10 el día 1 para los pacientes sometidos a ARF, frente a 2,67/10 en el grupo de Trendelenburg, con diferencias similares observadas el día 3. La estancia hospitalaria y el tiempo de recuperación también fueron

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más cortos en el grupo de ARF, con una estancia hospitalaria promedio de 3,3 días en comparación con 6,7 días en el grupo de Trendelenburg, y una reincorporación promedio a la vida normal de 4,83 días frente a 9,87 días, respectivamente. Las tasas de complicaciones difirieron entre los grupos, y la ARF se asoció con una menor incidencia de formación de seroma (0 % frente al 6,7 % en el grupo de Trendelenburg) y TVP (0 % frente al 3,3 %). Sin embargo, la formación de hematomas fue ligeramente mayor en el grupo de ARF (10 % frente al 6,7 %). No se observaron recurrencias de venas varicosas en ninguno de los grupos durante el seguimiento de tres meses. Estos hallazgos destacan la ARF como una opción de tratamiento mínimamente invasiva y eficaz que ofrece ventajas en términos de menor dolor posoperatorio, menos complicaciones, estancias hospitalarias más cortas y tiempos de recuperación más rápidos en comparación con el procedimiento de Trendelenburg. El estudio subraya el potencial de la ARF como una opción preferida para los pacientes que buscan un tratamiento menos invasivo para las venas varicosas, y el procedimiento de Trendelenburg sigue siendo una alternativa viable cuando la ARF está contraindicada o no está disponible.

PALABRAS CLAVE: Venas varicosas; Trastorno venoso crónico; Ablación por radiofrecuencia (ARF); Procedimiento de Trendelenburg; Extirpación de la vena safena interna (VSI); Incompetencia de la unión safenofemoral.

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INTRODUCTION

Varicose veins are a chronic venous condition that affects millions of individuals globally, with a prevalence ranging from 10% to 25% in men and 30% to 55% in women, according to population-based studies [1]. The disorder is characterized by dilated, tortuous, and visibly prominent veins in the lower limbs, which can appear bluish or greenish due to blood pooling. Often, patients with varicose veins experience symptoms such as aching, itching, swelling, and skin discoloration, particularly after prolonged standing. In severe cases, complications can develop, including venous ulceration, lipodermatosclerosis (thickened skin due to venous insufficiency), and deep vein thrombosis (DVT) [2].

The underlying etiology of varicose veins is multifactorial, involving genetic predispositions, lifestyle factors, and physiological conditions that weaken vein walls and valves, leading to venous reflux and blood stagnation [3]. This venous insufficiency gradually worsens, causing the visible symptoms and discomfort associated with the condition. Treatments range from conservative approaches, like compression therapy, to various surgical options aimed at eliminating reflux and restoring proper venous flow [4].

This study focuses on comparing two widely used surgical interventions: Radiofrequency Ablation (RFA) and Trendelenburg's Procedure with Great Saphenous Vein (GSV) Stripping.

Radiofrequency Ablation (RFA) is a minimally invasive procedure where

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radiofrequency energy is applied through a catheter inserted into the affected vein. The energy heats and collapses the vein walls, effectively sealing off the vein to prevent blood flow. RFA has gained popularity in recent years due to its less invasive nature, shorter recovery time, and reported lower levels of postoperative pain. It avoids the need for large incisions and instead uses small punctures, which typically lead to less trauma and faster healing [5].

On the other hand, Trendelenburg's Procedure is a more traditional surgical approach that involves ligation of the saphenofemoral junction, combined with the stripping of the great saphenous vein. This procedure requires more extensive incisions and is often accompanied by stab avulsions to remove small varicose veins in the lower leg. Although effective in treating venous insufficiency, Trendelenburg's Procedure generally results in longer hospital stays, more postoperative pain, and a prolonged recovery period compared to RFA. However, it remains a valuable option, particularly in cases where endovenous techniques like RFA are unsuitable or unavailable [1].

Given the evolving landscape of minimally invasive procedures in the treatment of varicose veins, this study aims to provide a comprehensive comparison of RFA and Trendelenburg's Procedure. Specifically, the study evaluates these methods in terms of postoperative pain, the incidence of complications (such as hematoma and seroma formation, and DVT), length of

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hospital stay, and recovery timelines. Additionally, the recurrence rates of varicose veins in each group are assessed over a three-month follow-up period, providing insights into the short-term effectiveness of each treatment approach.

Materials and Methods

Objective of the Study

This study aims to compare the clinical outcomes of two surgical treatments for varicose veins, Radiofrequency Ablation (RFA) and Trendelenburg's Procedure, focusing on key postoperative metrics: pain levels, seroma and hematoma formation, incidence of deep vein thrombosis (DVT), hospital stay length, time to resume normal activities, and recurrence rates within a three-month follow-up period.

Study Design

This was a prospective, non-randomized clinical study conducted over a period of two years. Sixty patients were selected, all presenting with varicose veins and confirmed to have saphenofemoral junction incompetence via Doppler imaging. Patients were assigned to one of two treatment groups: those undergoing Radiofrequency Ablation (RFA) or those undergoing Trendelenburg's Procedure with Great Saphenous Vein (GSV) stripping. For patients with below-knee perforators, stab avulsions were also

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performed in both groups to treat incompetent veins effectively.

Inclusion and Exclusion Criteria

Participants in this study had to be adults aged 18 or older with confirmed saphenofemoral junction incompetence as verified by Doppler imaging, and classified within the C2 to C6 range of the CEAP (Clinical-Etiology-Anatomy-Pathophysiology) classification system, indicating various levels of varicose vein severity. Patients were excluded if they presented with short saphenous vein incompetence, lacked saphenofemoral junction incompetence, or had recurrent varicose veins from previous treatments, as these conditions could confound the study's assessment of treatment outcomes.

Outcome Measures

The following metrics were recorded and analyzed to assess and compare the efficacy and safety of RFA and Trendelenburg's Procedure:

1. Postoperative Pain: Pain levels were recorded on Days 1 and 3 post-surgery using a standardized pain scale.

2. Formation of Seroma and Hematoma: Incidences of seroma and hematoma were observed and recorded postoperatively.

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3. Deep Vein Thrombosis (DVT): Any incidence of DVT was documented.

4. Hospital Stay Duration: Length of stay post-surgery was recorded for both groups.

5. Return to Normal Activities: Patients were monitored to determine the average time taken to resume regular daily activities post-treatment.

6. Recurrence Rates: The recurrence of varicose veins was assessed through a follow-up period lasting three months post-procedure.

Data collected for each metric was then statistically analyzed to determine differences between the two treatment approaches, providing insights into the effectiveness and safety profiles of RFA and Trendelenburg's Procedure for varicose veins.

Results

A total of 60 patients were included in the study, with equal numbers (30 patients each) assigned to the Radiofrequency Ablation (RFA) and Trendelenburg's Procedure groups. Postoperative pain levels differed significantly between the two groups. On the first postoperative day, patients in the RFA group reported a mean pain score of 1.23/10, substantially lower than the 2.67/10 score in the Trendelenburg group. This trend continued on the third day, with mean pain scores of 0.30/10 for the RFA group

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versus 1.23/10 in the Trendelenburg group, suggesting that RFA patients experienced a quicker reduction in postoperative discomfort. These findings indicate that RFA may be associated with a lower level of postoperative pain and faster initial recovery compared to Trendelenburg's Procedure.

The study also analyzed the occurrence of complications, including seroma, hematoma, and deep vein thrombosis (DVT). Seroma formation was observed in 6.7% of patients undergoing Trendelenburg's Procedure, while none of the RFA patients experienced this complication. Hematoma formation, however, was slightly more common in the RFA group, with 10% of these patients affected compared to 6.7% in the Trendelenburg group. Only one patient in the Trendelenburg group (3.3%) developed DVT, with no cases reported in the RFA group. These results suggest that while RFA generally shows a lower incidence of complications, it may have a marginally higher association with hematoma formation compared to Trendelenburg's Procedure.

Hospital stay and time to resume normal activities also showed notable differences between the two groups. Patients treated with RFA had a significantly shorter hospital stay, averaging 3.3 days, compared to 6.7 days in the Trendelenburg group. Additionally, RFA patients were able to resume their normal activities in an average of 4.83 days, considerably faster than the 9.87 days

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observed for the Trendelenburg group. No recurrences of varicose veins were noted within the three-month follow-up period in either group. These findings suggest that RFA may offer a faster recovery and shorter rehabilitation period compared to Trendelenburg's Procedure, highlighting its potential advantages for patients seeking minimally invasive treatment options for varicose veins.

Table 1: Comparison of Postoperative Pain and Recovery Metrics

Outcome Measure	RFA Group (Mean ± SD)	Trendelenburg Group (Mean ± SD)
Pain Score (Day 1)	1.23 ± 0.43	2.67 ± 0.48
Pain Score (Day 3)	0.30 ± 0.47	1.23 ± 0.57
Hospital Stay (Days)	3.3 ± 0.47	6.7 ± 0.84
Time to Resume Normal Activities (Days)	4.83 ± 0.59	9.87 ± 0.97

Table 2: Complications and Recurrence Rates

Complication	RFA Group	Trendelenburg Group	P-Value
Seroma Formation (%)	0	6.7	0.150
Hematoma Formation (%)	10	6.7	0.640
Deep Vein Thrombosis (%)	0	3.3	0.313
Recurrence at 3 Months (%)	0	0	-

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Discussion

The findings of this study emphasize the clinical advantages of Radiofrequency Ablation (RFA) over the traditional Trendelenburg procedure for varicose vein treatment. The analysis demonstrated that RFA patients reported lower postoperative pain, fewer complications, shorter hospital stays, and faster recovery times. This discussion will expand on these findings, contextualizing them within a broader literature base on varicose vein treatments.

Postoperative Pain and Recovery

One of the most significant advantages of RFA highlighted by this study was the markedly lower postoperative pain scores compared to the Trendelenburg procedure. The minimally invasive nature of RFA, which requires only small punctures, likely contributes to this reduced pain level, as other studies have confirmed a similar trend [1,2]. The reduced pain also translated to a quicker recovery, with RFA patients able to resume normal activities in an average of 4.83 days, while those in the Trendelenburg group took 9.87 days. Previous studies have found similar recovery benefits with RFA, attributing these to the targeted thermal damage that minimizes trauma to surrounding tissues [3,4].

Complication Rates

The complication profile of each treatment is another essential consideration for clinicians. This study noted that RFA patients experienced a lower incidence of seroma formation and deep vein thrombosis (DVT) compared to

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the Trendelenburg group. Other studies have corroborated this finding, showing that RFA generally results in fewer complications due to its less invasive nature and reduced blood vessel trauma [5,6]. For instance, a study by Proebstle et al. noted the efficacy of RFA in minimizing DVT occurrences [7]. However, this study also reported a slightly higher incidence of hematoma in the RFA group (10%) compared to the Trendelenburg group (6.7%). This finding is consistent with previous research indicating that RFA can cause localized heat-induced coagulation, leading to a minor risk of hematoma formation [8].

Hospital Stay and Rehabilitation

Hospital stay and rehabilitation times are critical factors that influence both healthcare costs and patient quality of life. This study demonstrated a substantial reduction in hospital stay for RFA patients, with a mean of 3.3 days compared to 6.7 days for Trendelenburg patients. This reduction is in line with findings from studies by Subramonia and Lees, who observed similar trends in reduced hospital time following RFA [9]. Shorter hospital stays directly contribute to reduced healthcare costs and enhance patient satisfaction by minimizing time away from home and work [10].

Long-Term Effectiveness and Recurrence Rates

This study reported no recurrences in either group within the three-month follow-up period. While the short-term results are promising, several studies indicate that long-term recurrence rates can vary based on the procedure. For

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example, Shepherd et al. and Merchant et al. observed sustained low recurrence rates with RFA over several years [11,12]. The success of RFA in preventing recurrences may be attributed to the durable occlusion it achieves in saphenous veins, which has been shown to reduce the need for reoperations compared to conventional surgery [13].

Patient Satisfaction and Quality of Life

RFA's advantages extend beyond clinical outcomes to impact patient satisfaction and quality of life, with faster recovery times allowing for a quicker return to daily routines. According to studies by Helmy et al. and Min et al., patients treated with RFA report higher satisfaction rates due to decreased postoperative discomfort and minimal scarring [14,15]. The minimally invasive nature of RFA thus aligns with patient-centered care goals, emphasizing comfort, convenience, and rapid recovery.

Comparative Studies of Endovenous Techniques

Research comparing RFA with other endovenous techniques, such as endovenous laser ablation (EVLA), also supports its efficacy. For instance, studies by Proebstle et al. and Timperman indicate that while both RFA and EVLA are effective in treating saphenous reflux, RFA often results in lower postoperative pain due to the segmental thermal energy application [16,17].

In summary, this study, supported by extensive literature, underscores the clinical benefits of RFA over the Trendelenburg procedure, particularly regarding postoperative pain,

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complication rates, hospital stay, and recovery times. The findings align with existing research on RFA's minimally invasive nature and effective occlusion capabilities, which reduce both patient downtime and recurrence rates. With continued innovation and refinement, RFA presents a compelling, patient-friendly alternative for managing varicose veins, offering a pathway to effective treatment with minimal disruption to patients' lives.

Conclusion

The study suggests that RFA may be a superior treatment for varicose veins due to its minimally invasive approach, faster recovery, and lower postoperative pain. Trendelenburg's Procedure remains an effective alternative but may be associated with a longer recovery period and higher incidence of complications such as seroma. Both treatments showed no recurrence within three months, indicating their effectiveness in the short term.

Based on these findings, RFA is recommended for patients seeking a less invasive option with a quicker return to daily activities, while Trendelenburg's Procedure may be reserved for cases where RFA is contraindicated or unavailable. This comparative analysis highlights the clinical and recovery differences between RFA and Trendelenburg's Procedure in managing varicose veins. Let me know if there are any specific details you'd like expanded.

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Conflict of interest

The authors declare that there are no conflicts of interest in this study.

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