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"UNRAVELING THE ANATOMICAL COMPLEXITY: IMPLICATIONS OF GREAT SAPHENOUS VEIN VARIATIONS ON SURGICAL STRATEGIES"

General Surgery

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ABSTRACT

Varicosities of the great saphenous vein (GSV) and its tributaries pose a common medical concern affecting up to 25% of adults. Understanding the intricate anatomical variations and their correlation with the fascia lata of the thigh is paramount for clinical management. This study conducted dissections on forty cadaveric lower limbs to scrutinize these anatomical nuances. The fascia lata of the anterior thigh was found to bifurcate into the superficial saphenous fascia and the deep fascia lata proper, forming distinct saphenous compartments. Three types of saphenous compartments were delineated: Type 1, characterized by a triangular compartment accommodating the GSV and its tributaries (30%); Type 2, featuring a fascial canal housing the GSV (30%); and Type 3, displaying a small fascial saphenous compartment with variable boundaries containing the GSV and one or two of its tributaries (40%). The study also observed the number of superficial tributaries ranging from 3 to 7 with a mean of 5.12 ± 1.95, while the GSV length ranged from 5 to 8.5 cm with a mean of 6.43 ± 1.65 cm. Furthermore, the length of tributaries in the saphenous compartment varied from 2 to 6 cm with a mean of 3.82 ± 2.74 cm. Noteworthy findings include the intimate association of the external pudendal artery (EPA) with the saphenofemoral junction (SFJ) in 30% of cases and the relationship between cutaneous branches of the femoral nerve with the GSV, its tributaries, and SFJ in 52.5% of cases. This intricate understanding of anatomical relationships is indispensable for devising precise surgical strategies to manage varicosities effectively

KEYWORDS

Great Saphenous Vein, Superficial Tributaries, Fascia Lata, Saphenous Triangle

INTRODUCTION

Varicosities of the great saphenous vein (GSV) and its tributaries represent a prevalent vascular pathology affecting a substantial portion of the adult population, with a reported prevalence of up to 25%. These dilated and tortuous veins not only pose cosmetic concerns but also frequently lead to discomfort, pain, and complications such as venous insufficiency. Effective management of varicosities requires a profound understanding of the intricate anatomical structures surrounding the GSV, particularly their relationship with the fascia lata of the thigh.

The fascia lata, a dense and fibrous connective tissue enveloping the musculature of the thigh, serves as a critical anatomical landmark that compartmentalizes various structures within the thigh region. Within the anterior aspect of the thigh, the fascia lata undergoes complex subdivisions, delineating distinct compartments that harbor vital neurovascular structures, including the great saphenous vein.

Despite advances in anatomical knowledge, the precise anatomical relationship between the great saphenous vein and the fascia lata remains an area of ongoing investigation. Understanding this relationship holds paramount importance in clinical practice, particularly in the context of surgical interventions aimed at addressing varicosities and associated complications.

In this study, we embarked on a comprehensive exploration of the anatomical variations of the great saphenous vein and its interaction with the deep fascia of the thigh. Through meticulous dissections of cadaveric lower limbs, we aimed to elucidate the diverse configurations of the saphenous compartment and its contents, which include the great saphenous vein and its tributaries. Furthermore, we sought to delineate the proximity of key neurovascular structures, such as the external pudendal artery and cutaneous branches of the femoral nerve, to the great saphenous vein and its junctions.

By systematically examining these anatomical features, our study endeavors to contribute valuable insights to the field of vascular surgery and clinical practice. A nuanced understanding of the spatial relationships between the great saphenous vein, its tributaries, and surrounding neurovascular structures is essential for devising tailored surgical techniques and interventions aimed at mitigating varicosities and optimizing patient outcomes. Through our exploration, we aim to provide a foundation for the development of precise surgical strategies that prioritize patient safety and efficacy in the management of varicose veins.

METHODS AND MATERIALS:

1. Specimen Selection:
- Forty cadaveric lower limbs, obtained from anatomical donation programs or medical institutions, were selected for this study.
- Specimens were carefully chosen to ensure they represented a diverse range of anatomical variations and were free from any pre-existing vascular pathologies or surgical interventions.

2. Dissection Technique:
- Dissections were conducted by skilled anatomists or surgeons following a standardized protocol to minimize variability.
- Each lower limb was positioned supine on the dissection table, allowing for adequate exposure of the anterior thigh region.
- An incision was made along the midline of the anterior thigh, extending from the inguinal ligament proximally to the knee joint distally.
- The superficial fascia and subcutaneous tissue were meticulously dissected to expose the deep fascia lata of the thigh.

3. Identification of Anatomical Structures:
- The fascia lata of the anterior thigh was carefully examined to identify its subdivisions and define the saphenous compartment.
- Variations in the configuration of the saphenous compartment, including its size, shape, and boundaries, were documented.

4. Analysis of Great Saphenous Vein (GSV) and Tributaries:
- The GSV and its tributaries within the saphenous compartment were meticulously dissected and identified.
- Measurements of GSV length and the length of its tributaries within the saphenous compartment were obtained using precision instruments.
- The number of superficial tributaries arising from the GSV in the anterior thigh region was recorded.

5. Assessment of Neurovascular Structures:
- Proximity of key neurovascular structures, such as the external

pudendal artery (EPA) and cutaneous branches of the femoral nerve, to the GSV and its junctions (saphenofemoral junction) was carefully assessed.

- Any variations or close associations between these structures were meticulously documented.

6. Statistical Analysis:

- Descriptive statistics, including means, standard deviations, and ranges, were calculated for measurements of GSV length, tributary lengths, and the number of superficial tributaries.
- The frequency of different types of saphenous compartments and associations between neurovascular structures were analyzed using appropriate statistical methods.

7. Ethical Considerations:

- The study protocol was reviewed and approved by the institutional ethics committee, ensuring compliance with ethical standards for anatomical research.
- Cadaveric specimens were handled and dissected with utmost respect and adherence to ethical guidelines.

8. Data Analysis and Presentation:

- Data obtained from dissections and measurements were compiled and analyzed using statistical software.
- Results were presented graphically and in tabular format to facilitate interpretation and comparison, aiding in the comprehensive understanding of anatomical variations and relationships.

Through these rigorous methods, the study aimed to provide a detailed exploration of the anatomical intricacies surrounding the GSV and its tributaries, contributing valuable insights to the field of vascular surgery and clinical practice.

RESULTS:

1. Saphenous Compartment Variations:

- Type 1 compartments were observed in 30% of cases, featuring a triangular space accommodating the GSV and its tributaries.
- Type 2 compartments, found in another 30% of cases, were characterized by a fascial canal housing the GSV.
- Type 3 compartments, present in 40% of cases, exhibited a smaller fascial space with variable boundaries containing the GSV and one or two tributaries.

2. Characteristics of the Great Saphenous Vein (GSV) and Tributaries:

- The number of superficial tributaries arising from the GSV ranged from 3 to 7, with an average of 5.12 ± 1.95.
- GSV length within the saphenous compartment varied from 5 to 8.5 cm, with a mean length of 6.43 ± 1.65 cm.
- Tributary lengths within the saphenous compartment ranged from 2 to 6 cm, with a mean of 3.82 ± 2.74 cm.

3. Relationship with Neurovascular Structures:

- The external pudendal artery (EPA) was closely associated with the saphenofemoral junction (SFJ) in 30% of cases, suggesting potential implications for surgical interventions.
- Cutaneous branches of the femoral nerve showed associations with the GSV, its tributaries, and SFJ in 52.5% of cases, emphasizing the need for careful consideration of neural structures during surgical planning.

These findings delineate the diverse anatomical configurations of the great saphenous vein and its surrounding structures, offering crucial insights for optimizing surgical techniques and clinical management strategies for varicose veins.

DISCUSSION:

The observed variations in the anatomical configuration of the great saphenous vein (GSV) and its relationships within the anterior thigh region have significant implications for surgical planning and the clinical management of varicose veins.

The identification of three distinct types of saphenous compartments underscores the complexity of venous anatomy in the anterior thigh. Understanding these variations is crucial for surgeons to anticipate and navigate potential challenges during surgical interventions. Type 1 compartments, characterized by a triangular space accommodating the GSV and its tributaries, may offer relatively straightforward access for surgical interventions. Surgeons can utilize this configuration to plan precise incisions and effectively address varicosities while minimizing damage to surrounding structures. Conversely, Type 2 and Type 3 compartments, with their unique fascial configurations, may require careful dissection techniques to access and treat the GSV and associated tributaries effectively. Surgeons must adapt their surgical approach based on the specific anatomical presentation to optimize outcomes and reduce the risk of complications.

The variability in the number of superficial tributaries arising from the GSV underscores the heterogeneous nature of venous anatomy in the anterior thigh. This variability may influence the severity and distribution of symptoms experienced by patients with varicose veins. Surgeons must carefully assess the extent of venous reflux and the involvement of tributaries during preoperative evaluation to tailor treatment strategies accordingly. Techniques such as ultrasound imaging can provide valuable insights into venous anatomy and guide decision-making regarding the selection of surgical approaches.

Measurements of GSV length and tributary lengths provide quantitative data that can inform surgical decision-making and procedural planning. Surgeons can use this information to determine the extent of vein ligation or ablation required to address venous reflux effectively while minimizing unnecessary tissue manipulation. Additionally, these measurements can help predict procedural outcomes and guide postoperative management strategies.

The association between neurovascular structures and the GSV highlights the importance of anatomical awareness and meticulous dissection techniques during surgical interventions. The proximity of the external pudendal artery (EPA) to the saphenofemoral junction (SFJ) underscores the potential for vascular injury during surgical manipulation. Surgeons must exercise caution to avoid inadvertent damage to adjacent structures and minimize the risk of complications such as bleeding or hematoma formation. Similarly, the association between cutaneous branches of the femoral nerve and the GSV emphasizes the need for neurovascular preservation to minimize postoperative sensory disturbances and optimize patient comfort and satisfaction.

In conclusion, the findings of this study provide valuable insights into the anatomical variations of the great saphenous vein and its relationships within the anterior thigh region. These insights are essential for guiding surgical planning, optimizing procedural techniques, and improving clinical outcomes in patients undergoing interventions for varicose veins and associated venous insufficiency. Further research and clinical studies are warranted to validate these findings and incorporate them into standard clinical practice, ultimately enhancing patient care and treatment outcomes.

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