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Original Research Paper

Anatomical Landmark Technique in the Placement of Jugular Hemodialysis Catheters

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ABSTRACT:
Deep venous access, requiring puncture of a large-caliber vein, represents a crucial step in many medical procedures, including the placement of hemodialysis catheters. This vein, often non-visible and non-palpable, can be located by referring to anatomical landmarks such as bony, muscular, or vascular structures. However, the success of this technique heavily relies on the operator's experience, as well as the likelihood that the patient's anatomy corresponds to the most commonly described patterns. Despite the advent of ultrasound guidance as the gold standard for hemodialysis catheter placement due to its increased precision and safety, it is essential for practitioners to remain proficient in the anatomical landmarks technique. There are situations where ultrasound is unavailable or urgent circumstances require immediate intervention, making knowledge and mastery of anatomical landmarks essential to ensure optimal patient care. Therefore, it is imperative for our young colleagues to continue learning and practicing the anatomical landmarks technique, especially in contexts where access to ultrasound is limited. This skill will enable them to effectively intervene in emergency situations and guarantee positive outcomes for patients, even in the absence of advanced technological equipment. By combining the advantages of ultrasound guidance with mastery of anatomical landmarks, healthcare professionals can deliver high-quality, patient-centered care in every clinical scenario.

Keywords: hemodialysis catheter, anatomical landmarks, internal jugular vein.

INTRODUCTION:

The success of the anatomical landmarks method heavily relies on the expertise of the operator and the likelihood that the patient's anatomy matches conventional anatomical patterns. Accessing deep veins involves puncturing a large-caliber, invisible, and non-palpable vein, which can be located by identifying anatomical landmarks such as bony, muscular, or vascular structures. The puncture is performed blindly through the skin and subcutaneous tissues, and the risk of complications underscores the importance of a thorough understanding of the anatomy of the targeted region. This procedure must be executed according to a rigorous protocol, with the indispensable cooperation of the patient to remain still. The main disadvantages of the anatomical landmarks method include the presence of anatomical variations [1], thromboses, and small-caliber virtual veins (<5 mm), which can make catheterization impossible. These challenges highlight the limitations of exclusive reliance on anatomical landmarks for venous access and underscore the need to explore alternative approaches to improve the safety and efficacy of the procedure.

Anatomy of the Internal Jugular Vein Access:

The internal jugular vein is a major anatomical structure located in the neck. Its course begins at the level of the skull, where it emerges through the posterior foramen, situated behind the internal carotid artery. From there, it descends almost vertically along the neck, positioning itself on the anterolateral aspect of the common carotid artery. Its trajectory continues to the superior thoracic aperture, where it terminates by joining the subclavian vein to form the brachiocephalic vein (Figure 1). This convergence point is an important juncture for venous vessels in the neck and thorax. The path of the internal jugular vein is characterized by its anterior covering by the sternocleidomastoid (SCM) muscle and its aponeurosis. The division between the sternal and clavicular portions of the sternocleidomastoid muscle, along with the clavicle, delineate what is known as the Sédillot's triangle (Figure 2). Notably, the internal

jugular vein lies posteriorly to this triangle, emerging from its apex and angling downward and slightly inward. Typically measuring between 120 and 150 mm in length, the internal jugular vein has a diameter ranging from 10 to 13 mm from its origin to its termination. In summary, the internal jugular vein represents a crucial central venous pathway, often utilized for various medical and surgical procedures requiring vascular access in the neck and upper thorax. Its precise anatomical knowledge is therefore essential for interventions such as catheter placement or other medical devices [2].

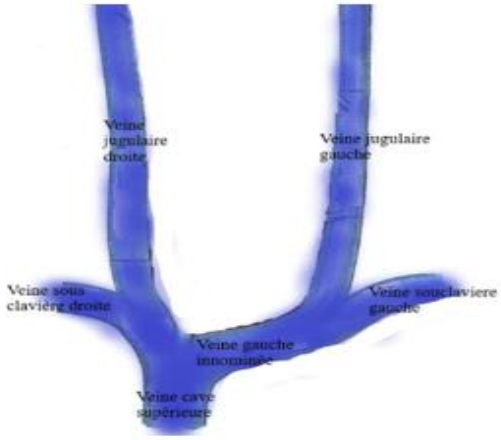

Figure 1: Anatomy of the jugular veins

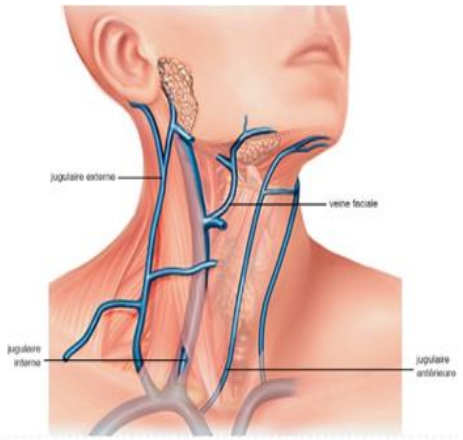

Figure 2: Collaterals of the internal jugular vein

Vein Approach Paths of the Internal Jugular Vein:

Several approaches are described for accessing the internal jugular vein, but regardless of the chosen method, patient positioning is crucial. It is recommended that the patient be in a supine position, with the head turned to the opposite side of the puncture, thus adopting the Trendelenburg position. This disposition aims to prevent gas embolism, associated with negative pressure in the internal jugular vein, particularly during inspiration, while also improving vascular filling. Preferring the right internal jugular vein is commonly recommended, due to its axis being similar to that of the superior vena cava, thus facilitating catheter advancement. Depending on the location of the puncture point relative to the sternocleidomastoid muscle (SCM), several approach paths can be distinguished: posterior paths, axial or median paths, and anterior paths. Each of these approaches has its own advantages and specific considerations, requiring careful evaluation to choose the most appropriate method based on clinical needs and patient anatomy [3].

The Posterior Approaches:

- **The Jernigan Approach**:

This approach (Figure 3) involves a puncture point located approximately two fingerbreadths, about 5 centimeters, above the clavicle. This point is found along the posterior border of the sternocleidomastoid (SCM) muscle, aiming at the suprasternal notch. The insertion in this approach is perpendicular to the internal jugular vein. However, it is important to note that this approach does not always guarantee easy passage of the catheter. Although this technique may be used in some cases, it may be associated with difficulties during catheter insertion due to its angle of approach. Therefore, other approaches may be preferred depending on the specific clinical situation and anatomical characteristics of the patient.

- **The Conso approach**:

This approach involves a puncture point located higher than that of the Jernigan approach (Figure 4). The puncture point is defined at the intersection of a horizontal line passing through the angle of the lower jaw and the outer edge of the sternocleidomastoid (SCM) muscle. The needle is inserted beneath the muscle toward the manubrium sternum, forming an angle of approximately 20° to 30° relative to the skin plane. This technique allows for a more direct approach to the internal jugular vein by avoiding a portion of the SCM muscle. This may facilitate catheter passage by providing a more direct path to the vein, which can be advantageous in certain clinical situations [2].

- **The Brinkman Approach**:

Similar to the previous technique, the Brinkman approach involves puncturing just below the intersection of the posterior border of the sternocleidomastoid (SCM) muscle and the external

jugular vein. This method aims to provide optimal access to the internal jugular vein while minimizing anatomical obstacles. By choosing this specific puncture point, the goal is to ensure precise and direct access to the internal jugular vein by effectively bypassing the SCM muscle. By targeting just below the point where the posterior border of the SCM and the external jugular vein intersect, this technique offers an access route that maximizes visibility of the vein and minimizes the risks of perforation or trauma to surrounding tissues. Although the Brinkman approach is similar to other techniques for accessing the internal jugular vein, it presents subtle nuances that can influence the ease and safety of the procedure.

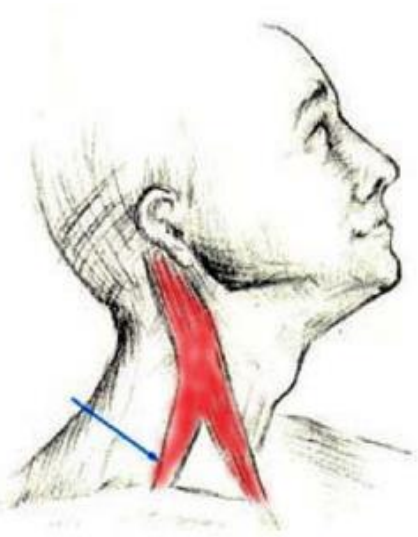

Figure 3: Jernigan Approach

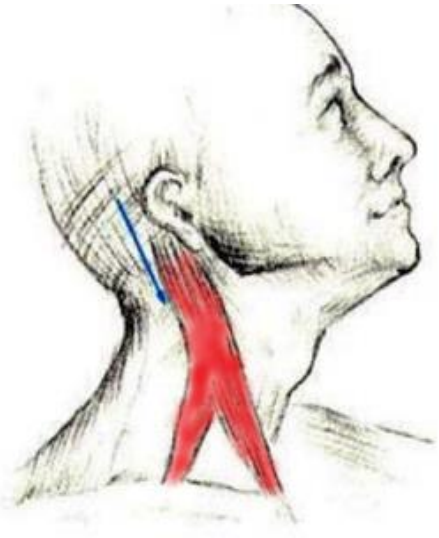

Figure 4: Conso Approach

The Anterior Approaches:

- **Mostert's Approach**:

It is a technique for accessing the internal jugular vein (Figure 5), aiming to puncture the vein at a specific point along the anterior border of the sternocleidomastoid muscle (SCM), following identification of the carotid artery. This method provides a precise approach to accessing the internal jugular vein while minimizing the risk of complications. For this technique, the puncture point is located approximately 5 cm above the clavicle along the anterior border of the SCM. The needle is then directed downward and outward, aiming for the junction of the inner and middle thirds of the clavicle. This direction allows effective bypassing of the SCM muscle while providing direct access to the internal jugular vein [2]. Mostert's approach has the advantage of offering a relatively safe and direct access to the internal jugular vein, using easily identifiable anatomical landmarks. However, as with any venous access procedure, expertise in executing the technique and a thorough understanding of local anatomy are essential to minimize the risk of complications and ensure procedural success.

- **Boulanger's Approach**:

It is a specific method of accessing the internal jugular vein, which provides a precise approach to accessing this vein (Figure 6). This technique relies on identifiable anatomical landmarks and allows for a relatively direct and secure approach to the internal jugular vein. For this technique, the puncture point is located at the junction of the anterior border of the sternocleidomastoid muscle (SCM) with a horizontal line passing through the upper edge of the thyroid cartilage [2]. The needle is then inserted at an angle of approximately 50° with the anterior border of the SCM, and directed downward and outward. During insertion, the needle follows the posterior surface of the SCM muscle until reaching the internal jugular vein. Once the vein is accessed, the trocar is aligned with the axis of the vessel to facilitate catheter introduction. Boulanger's approach has the advantage of using easily identifiable anatomical landmarks to guide the puncture of the internal jugular vein. This allows for a reduction in the risk of complications and improved precision during catheter placement.

However, posterior and lateral approaches, where the needle is directed inward toward the neck, pose an increased risk of encountering vital anatomical structures such as the carotid artery, trachea, pleural dome, and mediastinum. This orientation potentially exposes the patient to serious complications, including vascular injuries, tracheal perforations, pleural punctures, and mediastinal involvement. These complications can lead to severe consequences such as massive hemorrhage, respiratory infections, pneumothorax, and mediastinal injuries. In contrast, anterior approaches, which are higher and directed outward, offer increased protection against pleural punctures and significantly reduce the risk of carotid injury. Although complications related to carotid puncture remain rare, this approach provides an

additional level of safety when placing a catheter in the internal jugular vein. By choosing anterior approaches, practitioners can minimize the risk of serious complications and ensure patient safety during internal jugular vein venous access procedures.

Figure 5: Mostert's Approach

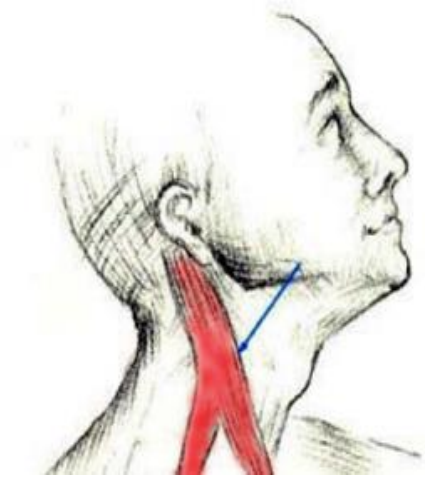

Figure 6: Boulanger's Approach

The Axial Approaches:

- **The English Method**:

Named after its inventor, it proposes a specific puncture point located at the apex of the Sédillot triangle [2], along the inner edge of the clavicular head of the sternocleidomastoid (SCM) muscle. This precise location allows optimal access to the internal jugular vein while minimizing the risk of complications. During this technique, the needle is inserted towards the lower and outer part of the neck, forming an angle of approximately 30 to 40 degrees with the skin plane. This orientation helps avoid nearby anatomical structures, such as the carotid artery and trachea, thus reducing the risk of serious complications. By following the English approach, practitioners can benefit from a safe and effective method for puncturing the internal jugular vein, providing optimal vascular access while preserving patient safety. This technique is particularly useful in situations where maximum precision is required and the risk of complications must be minimized.

- **The Daily Method**:

Also known as the internal jugular vein puncture technique proposed by Daily (Figure 7), is a specific method for accessing this crucial vein in the neck. During this procedure, the operator selects a puncture point precisely at the center of the Sédillot triangle, an anatomical area defined by the edges of the sternocleidomastoid (SCM) muscle. Once the puncture point is identified, the needle is inserted towards the lower part of the neck, in a parasagittal plane. This means that the needle is oriented slightly backward, parallel to the body's median plane. The angle of needle insertion relative to the skin plane is typically about 30 degrees [2]. This technique allows the operator to avoid vital adjacent anatomical structures, such as the carotid artery and trachea, while ensuring optimal access to the internal jugular vein.

- **The Miller Technique**:

Similar to the Daily method, it presents some variations in the process of puncturing the internal jugular vein. Unlike the Daily technique, which targets the center of the Sédillot triangle, the Miller technique proposes inserting the needle at the apex of this anatomical triangle. Once the needle is inserted at the apex of the Sédillot triangle, the operator directs it aiming at a specific point: the junction of the middle and inner thirds of the clavicle. This precise orientation optimizes the localization of the internal jugular vein and ensures secure access to it. The Miller technique is often considered one of the safest approaches for the patient, as it minimizes the risks of serious complications, such as pneumothorax or arterial puncture [4,5]. By targeting a specific point near the clavicle, this method reduces the chances of puncturing vital anatomical structures and avoids potentially life-threatening complications, such as compression of the airways. Thus, the Miller technique is preferred in many cases for its increased safety and effectiveness in accessing the internal jugular vein.

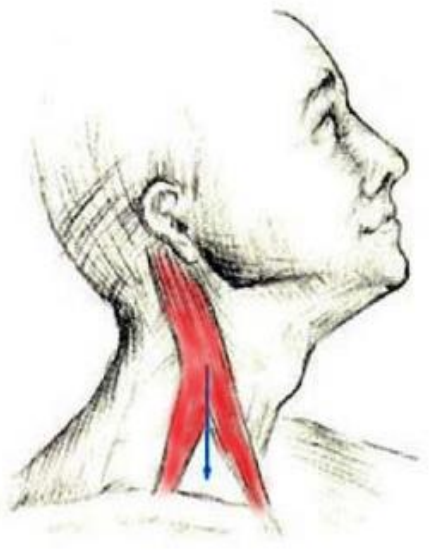

Figure 7: The Miller Technique.

CONCLUSION:

While ultrasound guidance has emerged as the gold standard for placing hemodialysis catheters, it is essential to ensure that our junior colleagues remain proficient in the anatomical landmarks technique. This traditional approach remains valuable in situations where ultrasound is unavailable or in cases of extreme urgency, where every minute counts. Therefore, providing adequate training on the anatomical landmarks technique, with a focus on hands-on practice using simulators or mannequins, is crucial. This training enables trainees to acquire the necessary skills to navigate situations where access to ultrasound is limited. In this way, we can prevent unnecessary complications for our patients and ensure high-quality care even in the most challenging circumstances. Ultimately, while ultrasound guidance represents a significant advancement in medical practice, it is important not to overlook traditional skills that remain relevant in many clinical scenarios. By combining these two approaches, we can provide optimal and patient-tailored care, while ensuring that our junior colleagues are well-prepared to meet the challenges encountered in their daily practice.

REFERENCES:

1. Lin BS, K.C., Tarng DC, et al Anatomical variation of the internal jugular vein and its impact on temporary haemodialysis vascular access: an ultrasonographic survey in uraemic patients. . Nephrol Dial Transplant 1998. 13(1): p. 134 – 138.
2. Paiement, M.B.D.-G.M., Une nouvelle voie d'abord de la veine jugulaire interne. Canadian Anaesthetists' Society Journal, 1976. 23(6): p. 609 - 615.
3. Schmalz-Ott S , M.M., Vollenweider P, Mise en place d'un cathéter veineux central chez l'adulte. Revue médicale suisse, 2008. 4: p. 2349 - 2353.
4. M, L. Abords veineux in DESAR 2014 - 2015. 2015. France.
5. McGee DC, G.M., Preventing complications of central venous catheterization. The New England Journal of Medicine, 2003. 348(12): p. 1123 - 1133.