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## RESEARCH ARTICLE

# INNOVATORY PIN POINTING TECHNIQUE OF SPINAL ACCESSORY NERVE DURING NECK DISSECTION

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### ABSTRACT

**Background:** The spinal accessory nerve (SAN) plays a crucial role in shoulder function by innervating the trapezius and sternocleidomastoid muscles. Its injury during neck dissection can lead to significant postoperative morbidity, including shoulder dysfunction. While various anatomical landmarks have been described for locating the SAN, these can be unreliable, particularly in the presence of metastatic lymphadenopathy. **Objective:** To present a novel and consistent technique for identifying the SAN during neck dissection using fixed anatomical landmarks. **Methods:** A prospective observational study was conducted on 27 patients undergoing functional or modified radical neck dissections. An imaginary line was drawn from the body of the hyoid bone to the anterior border of the sternocleidomastoid muscle. Dissection was focused along this path to identify the SAN in level 2 of the neck anterior to sternocleidomastoid muscle. **Results:** The SAN was successfully located in all patients using this method, regardless of age, gender, or the presence of bulky nodal disease. The use of the hyoid bone as a fixed bony landmark provided a reliable reference point, reducing the need for deep or risky dissections. **Conclusion:** This innovative technique provides a simple, reproducible method for early identification and preservation of the SAN during neck dissection, especially in challenging anterior triangle scenarios. It holds potential for widespread adoption in surgical practice to enhance patient outcomes.

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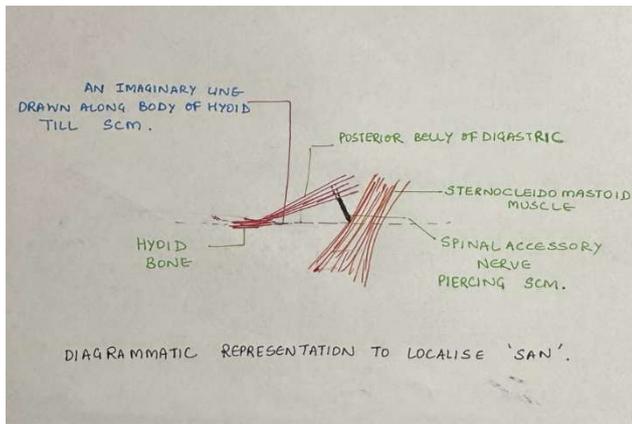
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## INTRODUCTION

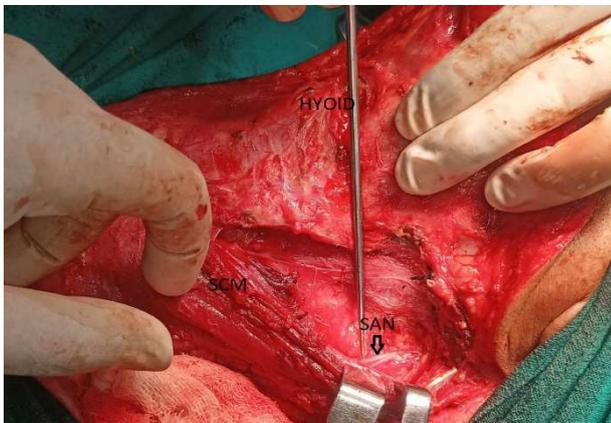
The spinal accessory nerve (SAN) plays a critical role in head and neck function by innervating the trapezius and sternocleidomastoid muscles. During neck dissections, preserving this nerve is crucial to prevent shoulder dysfunction, commonly termed "drooping shoulder syndrome" (1). Despite advancements in nerve-preserving techniques, unintentional SAN injury remains a significant risk (2). Studies, including that by Van Wilgen et al., report up to 33.3% of patients experiencing shoulder issues post-surgery (3). Existing literature outlines several anatomical landmarks for locating the SAN within the posterior triangle of the neck. The distance from the clavicle to the point where the SAN enters the trapezius, Erb's point (emergence of cervical plexus nerves), the superficial cervical vein's junction with the anterior trapezius, the SCM branch of the occipital artery. In the anterior triangle, the transverse process of the atlas and the internal jugular vein (IJV) are common references (4). Given the importance of identifying and preserving SAN, especially during surgeries, this study introduces a new method using fixed anatomical landmarks.

**Anatomical Overview of SAN:** The SAN exits via the jugular foramen alongside cranial nerves IX and X and the IJV. It crosses the IJV and courses obliquely downward toward the deep surface of the SCM. After innervating the SCM, it continues inferiorly and laterally through the posterior triangle, lying in superficial connective tissue between fascial layers before entering the trapezius (2).

**Description of Technique:** This technique was evaluated in 27 patients (ages 28–65) undergoing neck dissection for head and neck cancers. Patients were positioned supine with neck extension. Depending on cancer staging, either functional or modified radical neck dissections were carried out. Subplatysmal flaps were raised conventionally. The SCM's anterior border was exposed, and its fascia carefully removed. The hyoid bone was fully visualized in all patients. An imaginary line was drawn horizontally from the hyoid body to the lateral border of the SCM. Dissection proceeded medially along the anterior border of SCM, gently retracting it laterally at the intersection point with the line from the hyoid. Figures 1 and 2 illustrate this approach. This method allowed for successful SAN identification in every case, regardless of patient demographics.



**Figure 1. Schematic illustration showing the method to identify the spinal accessory nerve (SAN). A conceptual line traced from the body of the hyoid bone toward the lateral border of the sternocleidomastoid (SCM) muscle helps pinpoint the SAN's location**



**Figure 2. Clinical photograph demonstrating the spinal accessory nerve (SAN) as it enters the sternocleidomastoid (SCM) muscle at the level of the hyoid bone. A metal pointer placed along the hyoid bone highlights the nerve's entry point at Level II**

## DISCUSSION

Preserving the spinal accessory nerve (SAN) is a vital priority in neck dissection surgeries to prevent postoperative complications such as shoulder dysfunction and trapezius muscle atrophy. Although numerous anatomical landmarks and methods have been described, identification of the SAN can be challenging, especially in the presence of bulky metastatic nodes or neovascularization in level II of the neck. Traditionally, studies such as those by Soo et al., Hill et al., and Hone et al. have focused on posterior triangle landmarks like the greater auricular nerve and clavicle as spatial reference points, with the SAN found approximately 1.5–2 cm above these points (6–8). Sheen et al. highlighted the transverse process of the atlas (C1) as a consistent anatomical guide, located anterior to the internal jugular vein (IJV) and deep to the posterior belly of the digastric (9). Bhalgat et al. (2023) proposed the “SMS Hospital Point” and “Upward Pointing Arrow” sign, involving the junction of the SAN, IJV, and posterior belly of the digastric as a reliable landmark for SAN detection in level II dissections (11). However, newer studies offer improved techniques and tools for SAN identification. Recent research by Gupta et al. evaluated SAN localization in 50 neck dissections and found that the nerve consistently entered the SCM approximately 2 cm below and medial to the mastoid tip. This suggests that mastoid-centered mapping may improve accuracy in identifying SAN in upper neck regions (12).

In 2020, Lee et al. demonstrated the use of high-frequency intraoperative ultrasound to trace the SAN, particularly effective in patients with prior surgeries or radiation-induced fibrosis. The real-time imaging allowed noninvasive identification of SAN beneath fibrotic or nodal masses, improving intraoperative decision-making and reducing iatrogenic injury (13). A study by Wang et al. compared SAN preservation techniques in robotic versus open neck dissections and found that the robotic-assisted approach allowed superior visualization and earlier nerve identification, with reduced functional shoulder morbidity at 6 months. Although not universally accessible, this underscores the role of technology in enhancing surgical precision (14). Meanwhile, Park et al. analysed magnetic resonance imaging (MRI) of 100 patients and identified a consistent anatomical zone between the anterior border of the SCM and the posterior belly of the digastric where the SAN was detectable on T1-weighted imaging, suggesting a possible role of preoperative imaging protocols in planning nerve-preserving dissections (15). Despite these innovations, anterior triangle approaches remain underrepresented in literature, especially for patients with extensive level II disease. Most existing methods require careful dissection or preoperative imaging, which may not always be feasible in resource-limited settings or emergent scenarios. Our proposed technique, utilizing the fixed bony landmark of the hyoid bone in conjunction with the anterior border of the sternocleidomastoid muscle, addresses this gap. These structures are consistently visible and palpable even in the presence of nodal pathology, and the imaginary line drawn between them localizes the SAN entry point into the SCM with high reliability. This method not only avoids nodal - tumor manipulation and reduces the risk of tumor spillage but also simplifies SAN identification early in the surgical procedure, particularly beneficial during supra-omohyoid neck dissections. To date, no other study has proposed the hyoid bone as a central reference for SAN identification in the anterior triangle. This innovation introduces a safe, reproducible, and cost-effective solution for surgeons operating in both high-tech and conventional environments.

## CONCLUSION

This novel technique provides surgeons with a reliable, reproducible method to identify the spinal accessory nerve early during neck dissection—especially in the anterior triangle. Its adoption may improve surgical outcomes by minimizing nerve damage and preserving function. We encourage its integration into clinical practice for enhanced surgical precision and patient safety.

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**Conflict of interest:** NIL.

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