Exocranial & Intracranial Anatomy of the Jugular Tubercle: An Endoscopic Endonasal Approach Projection

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Objectives

- Anatomical description of the ventral Jugular Tubercle (vJT), and the dorsal Jugular Tubercle (dJT).
- Description of the limits of vJT and surgical projection via Endoscopic Endonasal Approach (EEA).

Introduction

The jugular tubercle is a rounded bony prominence located in the inferolateral portion of the clivus (1). The description is reported in relation to the intracranial triangular surface of the petroclival fissure, the jugular foramen, and the hypoglossal canal (2). Notwithstanding, in the current literature, there may be some confusion between the intracranial and exocranial jugular tubercle during an EEA. In addition, there are some limitations, and it may be confusing to understand the limits of this osseous structure from an EEA. This last gains adequate access to the anterior portion of the foramen magnum from a medial- lateral route corresponding with the lower clivus portion. We think that the best way to get an appreciation of the jugular tubercle is an osseous anatomy study. This research work complements the current advances in endoscopic endonasal anatomy.

Methods and Materials

4 skulls from the Department of Anatomy (Laboratory 1), at the Faculty of Medicine (UNAM) and one cadaveric specimen from the Surgical Neuroanatomy Laboratory (La Salle, Faculty of Medicine) were used. To get the proportional relation between the intracranial and extracranial jugular tubercle, four stilettos were applied on each limit of the jugular tubercle to get an appreciation of the limits related to some anatomical osseous landmarks represented during an EEA **(Figure 1).**

The endoscopic projection of the Jugular Tubercle was obtained to get the limits of the osseous structure. Lenses of 0º and 45º were used to get the projection and exposure of the ventral jugular tubercle. In addition, a 3D reconstruction and photos of each skull were performed to get a stereoscopic visualization of the jugular tubercle.

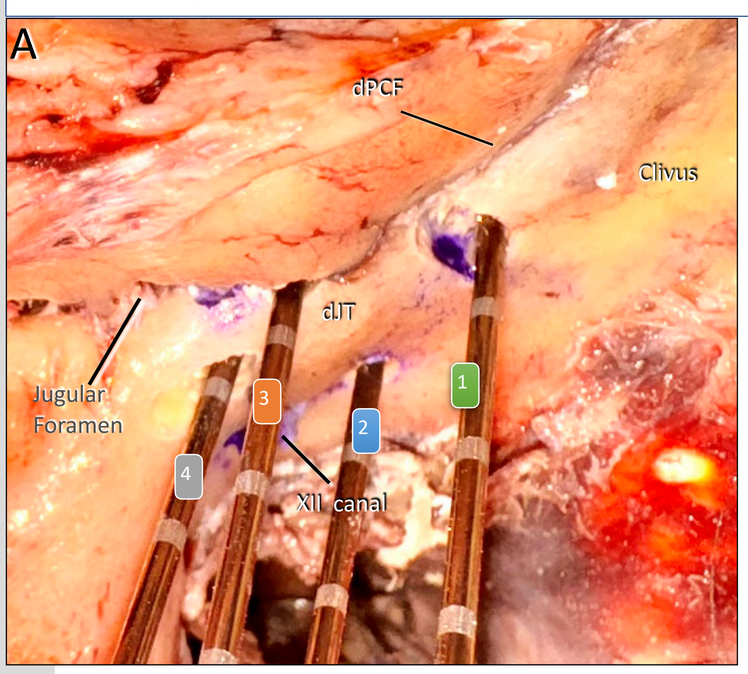

Figure 1. (A) (Left intracranial side), Stilletos are applied in the superior, inferior, medial, and lateral limits of the dJT, correlated, (B) on the extracranial surface of the cranium depending on the osseous landmark of the ventral clivus with an Endoscopic Endonasal Approach after the disinsertion and mobilization of the Eustachian tube. The upper limit of the dJT #1 corresponds with the LPT, the medial dJT corresponds with the midlevel of the supracondylar groove without interfering with the XII canal, the Lateral dJT through the petroclival fissure corresponds just aside from the ventral Jugular tubercle, and the lower dJT represents the upper level of the extracranial XII canal. dJT; Dorsal Jugular, dPCF; Dorsal Petroclival Fissure, vPCF; Ventral Petroclival Fissure, vJT; Ventral Jugular Tubercle, LPT; Lateral Pharyngeal Tubercle, XII canal; Hypoglossal Canal.

Results

Dorsal Jugular Tubercle (dJT): The dJT, from the endocranial perspective, is a rounded paired bone prominences that emerge from the inferolateral margin of the clivus (4). It is located anterosuperior to the occipital condyle, and it is formed by the junctions of the condylar and occipital portions of the occipital bone (5). The dJT represents a bridge between the condylar and basilar parts of the occipital bone. The dJT can be found as a large, or it can be represented as a flat formation (5).

The protuberances have a posterosuperior projection. The hillocks of the dJT are slightly anterior to the hypoglossal canals. In a gross mode, the dJT is located above the hypoglossal canal and located medial to the jugular foramen (6)(4), and the caudal petroclival fissure (7).

The dJT represents the passage of the lower cranial nerves (IX, X, XI), creating a shallow groove over its surface on the endocranial visualization (4). **(Figure 1 A, Figure 2A)**

Superior limit: The inferior petrosal sinus, which runs on the petroclival fissure toward the jugular foramen, forms the superolateral limit of the jugular tubercle (1). The medial margin of the jugular tubercle is situated just posteromedial to the lower portion of the foramen lacerum (1). Medial limit: The medial margin of the jugular tubercle is situated posteromedial to the inferior portion of the foramen lacerum. Inferior limit: The inferior limit of the vJT is formed by the hypoglossal canal (1)(2), situated on the medial aspect of the tubercle. Lateral limit: The lateral to the vJT is located in the Jugular foramen (1) **(Figure 1A).**

Ventral Jugular Tubercle (vJT): The vJT is a small prominence visualized from an extracranial projection and is located posteromedially in relation to the foramen lacerum (1). The ventral JT is situated anterior to the Jugular process (5). Upper limit: To estimate the upper portion from the exocranial perspective, the lateral pharyngeal tubercle estimates the upper and medial portion of the jugular tubercle itself. Inferior limit: From the endocranial perspective, the dJT is limited inferiorly by the hypoglossal canal. The analogue described from the exocranial perspective, in relation to the vJT, corresponds to the supracondylar groove (1)(3). This landmark approximates the emergence of the XII cranial nerve on the lateral supracondylar groove (1). Lateral limit: The lateral limit of the vJT is located aside from the jugular foramen just aside from the caudal ventral Petroclival Fissure. Medial limit: The medial margin of the vJT is situated posteromedial to the lower portion of the foramen lacerum, and it represent the upper portion of the JF (1).

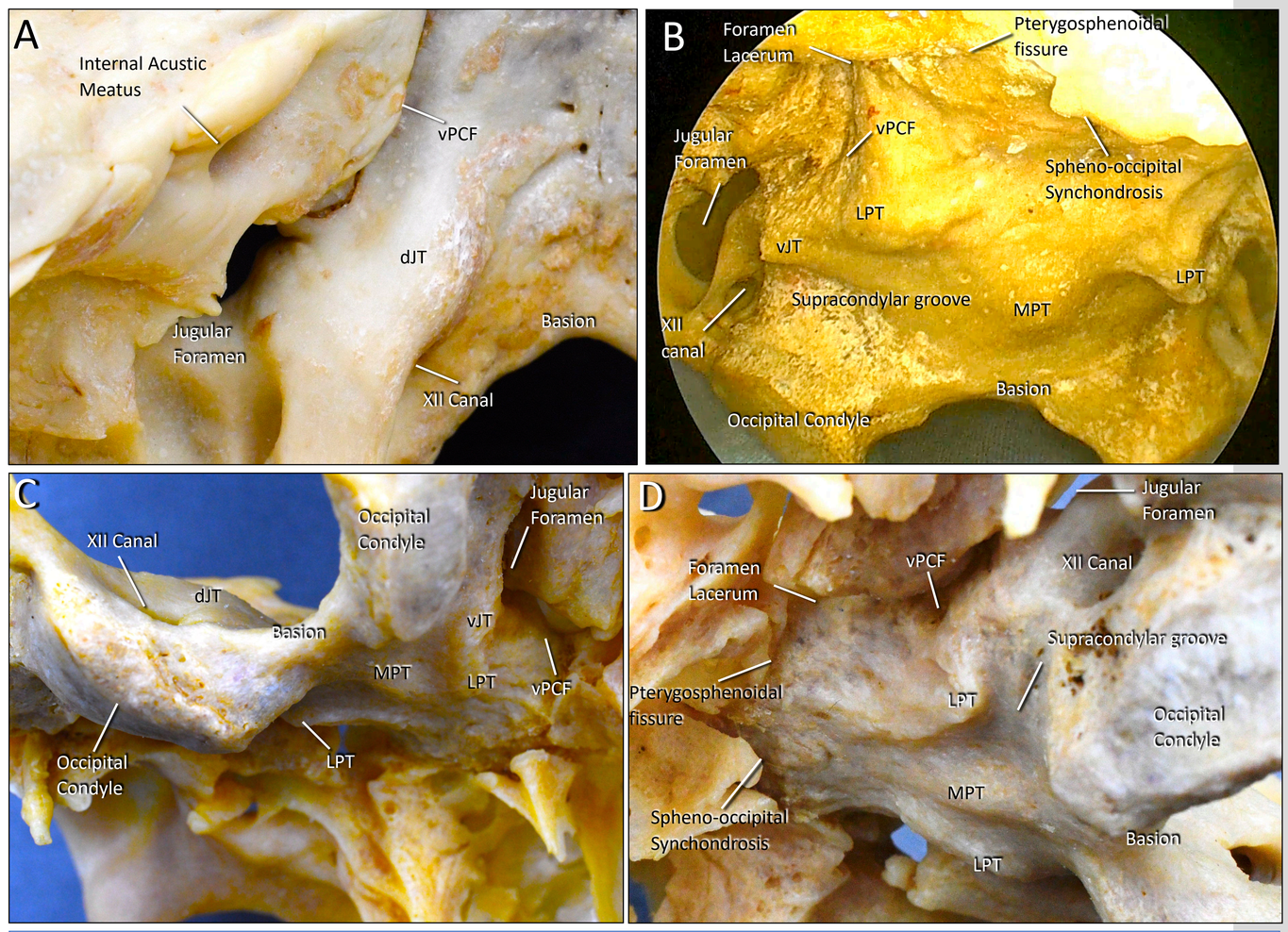

Figure 2.
(A) Macroscopic image showed from the intracraneal visualization on the left side, the adjacent anatomic osseous structures around the dorsal Jugular Tubercle. The caudal petroclival fissure and the rostral portion of the Jugular Foramen are located lateral to the dorsal Jugular Tubercle. Lower the dJT is located the Hypoglossal canal. (B) From a ventral perspective, some anatomical osseous landmarks can be visualized in respect to the lower clivus. From midline to lateral. (C) From a right visualization, the left LPT corresponds with the upper limit of the intracraneal dJT. (D) In this image, we can visualize from the left lateral projection, and the adjacent osseous anatomical structures from the Lateral Pharyngeal Tubercle.
dJT; Dorsal Jugular, dPCF; Dorsal Petroclival Fissure, vPCF; Ventral Petroclival Fissure, vJT; Ventral Jugular Tubercle, LPT; Lateral Pharyngeal Tubercle, XII canal; Hypoglossal Canal

Conclusions

The advantages of delimiting the jugular tubercle from a ventral perspective will facilitate and enhance the EEA to the lower clivus and adjacent areas which could reduce the risk to damage of neurovascular structures. The ventral jugular tubercle visualized from an extracranial projection represents a different osseous prominence from the dorsal jugular tubercle visualized from an intracranial visualization. The dJT and the vJT are related, but represent two different anatomical osseous structures.

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