

# Sudden bleeding from a high jugular bulb: a rare complication of tympanoplasty

Matas Kuncė<sup>1</sup>, Rokas Trainavičius<sup>2</sup>

<sup>1</sup> Vilniaus universiteto Medicinos fakultetas

Faculty of Medicine, Vilnius University

<sup>2</sup> Vilniaus universiteto Medicinos fakulteto Klinikinės medicinos

instituto Ausų, nosies, gerklės ir akių ligų klinika

Clinic of Ear, Nose, Throat and Eye Diseases, Institute of Clinical  
Medicine, Faculty of Medicine, Vilnius University

El. paštas: matas.kunce@mf.stud.vu.lt

## Summary

**Introduction.** The jugular bulb is a crucial component of the venous circulatory system in the head and neck region, serving as a connection between the sigmoid sinus and the internal jugular vein. Positioned at the inferior pole of the tympanic cavity, the jugular bulb is separated from it by a thin bony lamina. Anatomical variations, such as a high-placed jugular bulb or bony dehiscence of the jugular bulb, significantly increase the risk of injury and hemorrhage during surgical procedures. Early detection of these variations is essential to prevent complications. Although computed tomography imaging of the temporal bone is useful in detecting jugular bulb anatomical variations, it is not routinely performed prior to tympanic membrane reconstructive surgery.

**Clinical case.** A 34-year-old male presented to our clinic with complaints of hearing loss in his right ear and intermittent purulent discharge. Examination revealed a central perforation of the tympanic membrane in the right

ear, and audiological assessment confirmed mixed hearing loss. A decision was made to perform tympanic membrane reconstruction. During the surgery, the surgeons encountered significant venous bleeding in the tympanic cavity after elevating the tympanomeatal flap. This bleeding was successfully controlled using hemostatic agents. Postoperative imaging, performed via computed tomography, revealed a high-placed jugular bulb with bony dehiscence.

**Discussion.** The jugular bulb can exhibit several anatomical variations, including a high-placed jugular bulb, hypoplasia, hyperplasia, bony dehiscence, and diverticulum. Among these, the high-placed jugular bulb is the most common, occurring in 10–15% of cases. While typically asymptomatic, variations may present with symptoms such as pulsatile tinnitus, vertigo, headache, or hearing loss, suggesting an atypical jugular bulb anatomy. These anatomical changes increase the risk of complications during surgical procedures. Although imaging studies are crucial for detecting such variations, they are not routinely conducted before tympanic membrane reconstruction surgery.

**Conclusions.** The jugular bulb can present with diverse anatomical variations, which may increase the risk of complications during surgery. Since patients with these variations are often asymptomatic, diagnosing such variants can be challenging. This challenge is compounded by the fact that imaging studies are not typically conducted before minor ear surgeries.

**Keywords:** tympanoplasty, jugular vein; hemorrhage, computed tomography.

## INTRODUCTION

The jugular bulb (JB) is a dome-shaped structure that facilitates the venous connection between the sigmoid sinus and the internal jugular vein. Positioned within the jugular fossa, it extends into the floor of the tympanic cavity, where it is separated by a layer of compact bone [1].

Depending on the position of the JB within the temporal bone and the integrity of its bony covering, several anatomical variations can be identified: a high-placed JB, hypoplasia or hyperplasia, JB dehiscence, and JB diverticulum [2].

The anatomical variability of the JB may increase the risk of surgical injury and venous bleeding during middle ear procedures [3].

Chronic inflammatory processes in the middle ear cleft can erode the hypotympanic bone, leading to JB dehiscence and a heightened risk of iatrogenic injury [4].

A high-placed JB is the most prevalent anatomical variation observed in 10–15% of cases, while JB dehiscence is reported only in 1–3% of cases [5].

Although a high-riding JB is typically asymptomatic and detected incidentally during computed tomography (CT) imaging, symptomatic cases may present with conductive hearing loss, pulsatile tinnitus, or vestibular disturbances [1].

Preoperative evaluation, including otomicroscopy or otoendoscopy and a temporal bone CT, plays a critical role in identifying patients at higher risk for intraoperative complications due to atypical JB anatomy [4].

However, preoperative CT imaging generally is not performed routinely in chronic suppurative otitis media patients undergoing tympanoplasty. This is due to concerns over cost and unnecessary radiation exposure. Instead, it is primarily reserved for patients with suspected chronic otitis media

complications, congenital abnormalities, loss of anatomical landmarks that are obscured by prior surgeries, or in cases where the tympanic membrane is not clearly visible [6].

A comprehensive preoperative assessment and early detection of a high JB are essential for determining surgical approaches, mitigating intraoperative risks, and optimizing overall patient outcomes.

## CLINICAL CASE

A 34-year-old male presented to our outpatient clinic with a longstanding history of right-sided hearing loss and recurrent episodes of purulent otorrhea, all of which had progressively worsened over time. An endoscopic examination of the right ear revealed a dry central perforation of the tympanic membrane and no signs of abnormal middle ear mucosa or cholesteatoma. Based on the findings, surgical intervention was advised. A tympanoplasty of the right ear was planned to reconstruct the damaged tympanic membrane and reestablish effective sound conduction.

On the day of the surgery, the patient was placed under general endotracheal anesthesia, and postaural approach was adopted. The skin of the external auditory canal was lifted, and during the subsequent elevation of the annulus to access the middle ear, significant bleeding was encountered from the tympanic cavity.

After multiple attempts to control the bleeding with cotton pledgets proved unsuccessful, the site was packed with Surgicel, successfully achieving complete hemostasis. The hemostatic agent was left in situ within the tympanic cavity to prevent further bleeding.

With the bleeding successfully controlled, the surgeon advanced to reconstruct the tympanic membrane using cartilage and perichondrium harvested from the tragal region. After placing the graft, the external auditory canal was packed with hemostatic sponges, and the incision was carefully sutured. The estimated blood loss during the surgery was approximately 900 mL.

Owing to significant intraoperative bleeding, an urgent CT scan with contrast enhancement was performed to identify the underlying cause. The imaging revealed a high-riding jugular bulb with a defect in the wall of the right jugular vein (Fig.).



**Fig.** Contrast-enhanced computed tomography. An axial view during the venous phase reveals an enlargement of the jugular foramen with dehiscence of the sigmoid (jugular) plate

A blood analysis conducted on the first postoperative day showed leukocytosis, likely as a response to surgical trauma, along with neutrophilia, decreased hemoglobin levels, reduced erythrocyte count, and low hematocrit, suggesting postoperative inflammation and anemia. During six days of inpatient care, the patient remained stable, with no signs of active bleeding observed. The patient experienced no complications and was subsequently discharged in good condition.

## DISCUSSION

The jugular bulb (JB) is a crucial vascular structure within the head and neck region near the tympanic cavity. Normally, the JB is enclosed within a bony canal, lined by pneumatically structured temporal bone, which acts as a barrier and separates the JB from adjacent anatomical structures [4].

However, anatomical variations of the JB may significantly increase the risk of iatrogenic injuries. Furthermore, extensive inflammatory processes in the middle ear cleft may result in erosion of the bony plate that isolates vascular structures from the middle ear, thereby increasing the risk of vascular injury and intraoperative hemorrhage.

Anatomical variations of the JB include a high-riding JB, hypoplasia or hyperplasia, JB dehiscence, and JB diverticulum [2]. Among these, the high-riding JB is the most prevalent variation, with an estimated prevalence of 10–15% [5]. Less commonly, JB dehiscence is observed, a variant associated with a heightened risk of intraoperative bleeding. A high-riding JB is characterized by its protrusion into one or more regions of the temporal bone, such as the floor of the middle ear, the base of the cochlea, or the internal auditory canal [7].

Clinical manifestations associated with a high-riding JB are determined by the extent of its mass effect on adjacent anatomical structures. Symptoms may include headache, vertigo, pulsatile tinnitus, and conductive or mixed hearing loss [8].

High-resolution computed tomography (HRCT) of the temporal bone plays a vital role in identifying anatomical anomalies, confirming the diagnosis, and assessing the risk of intraoperative complications [2]. Additionally, CT is crucial for detecting key factors that directly impact the success of tympanoplasty [9]. However, routine imaging is generally unnecessary for straightforward tympanoplasty cases. In such scenarios, detailed micro-otoscopic examinations and pure-tone audiometry often provide more practical information for the surgeon than HRCT scans [10]. Imaging is typically reserved for cases with suspected cholesteatoma, intracranial complications, or when detailed anatomical mapping of the middle ear is required [11]. Consequently, this selective approach may present challenges, as most individuals with a high-riding JB remain asymptomatic, leading to the absence of CT imaging and, subsequently, a lack of awareness regarding its presence.

## CONCLUSIONS

A high-riding jugular bulb is the most common anatomical variation associated with the jugular bulb. Injury to this structure during middle ear surgery can result in

sudden and severe hemorrhage. Although preoperative high-resolution computed tomography of the temporal bone is effective in detecting these anatomical variations, it is not routinely conducted before relatively straightforward procedures, such as tympanoplasty, primarily due to concerns about cost and unnecessary radiation exposure. Consequently, the initial identification of these anomalies depends on clinical suspicion and a comprehensive preoperative evaluation. Additionally, maintaining vigilance during surgery is essential for minimizing complications and ensuring optimal surgical outcomes.

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## Santrauka

### STAIGUS KRAUJAVIMAS IŠ AUKŠTO JUNGO VENOS STORMENS: RETA TIMPANOPLASTIKOS KOMPLIKACIJA

Matas Kuncė, Rokas Trainavičius

**Įvadas.** Jungo venos stormuo yra svarbi galvos veninės kraujotakos dalis, jungianti riestinį antį su vidine jungo vena. Stormuo išsidėstęs ties apatiniu būgninės ertmės poliumi, nuo kurios yra atskirtas plona kauline plokšte. Esant anatominiams variacijoms, tokioms kaip aukštas jungo venos stormuo ar kaulinė stormens dehiscencija, didėja pažeidimo ir kraujavimo rizika operacijos metu. Siekiant išvengti pažeidimo, svarbu anksti nustatyti šias anatomines variacijas. Stormens variacijoms nustatyti atliekamas smilkinkaulių kompiuterinės tomografijos tyrimas, tačiau šis tyrimas nėra įprastai atliekamas prieš ausies būgnelio rekonstrukcines operacijas.

**Klinikinio atvejo aprašymas.** Trisdešimt ketverių metų vyras kreipėsi į mūsų kliniką dėl dešinės ausies klausos suprastėjimo ir periodinio pūliavimo iš jos. Apžiūrint ausį pastebėta centrinė būgnelio perforacija, audiologiškai nustatytas mišrus klausos pažeidimas. Nuspręsta atlikti dešinės ausies būgnelio rekonstrukciją. Operacijos metu atkėlus timpanometinį lopą, pastebėtas gausus kraujavimas iš būgninės ertmės. Kraujavimas sustabdytas naudojant hemostatines priemones. Po operacijos pacientui atliktas kompiuterinės tomografijos tyrimas patvirtino aukštą jungo venos stormenį su kauline dehiscencija.

**Diskusija.** Galimos jungo venos stormens anatominės variacijos yra aukštas jungo venos stormuo, stormens hipoplazija, stormens hiperplazija, stormens kaulinė dehiscencija ir stormens divertikulas. Aukštas

jungo venos stormuo yra dažniausia anatominė stormens variacija, aptinkama 10–15 % visų atvejų. Daugelis pacientų simptomų nejaučia, tačiau pulsuojančio pobūdžio ūžesys, galvos svaigimas, galvos skausmas ir klausos suprastėjimas leidžia įtarti atipinį jungo venos stormens anatominį variantą. Esant pakitusiai jungo venos stormens anatomijai, didėja pažeidimo rizika operuojant. Jungo venos stormens pokyčiams nustatyti naudojami vaizdiniai tyrimai, kurie nėra įprastai atliekami prieš ausies būgnelio rekonstrukcines operacijas.

**Išvados.** Jungo venos stormuo gali turėti kelis anatominius variantus. Jiems esant didėja pažeidimo rizika operacijos metu. Pacientai, turintys pakitusį jungo venos stormenį, dažniausiai yra besimptomiai. Tai sunkina jungo venos stormens anatominių variantų diagnostiką, kadangi papildomi vaizdiniai tyrimai nėra atliekami prieš nesudėtingas ausies operacijas.

**Reikšminiai žodžiai:** timpanoplastika, jungo vena, kraujavimas, kompiuterinė tomografija.

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