

# Evaluation of high placed jugular bulbus density with multislice temporal computed tomography

**Selmin Perihan Kömürçü Erkmen, Nimet Akın, Ömer Koray Hekimoğlu**

Department of Radiology, Etlik City Hospital, Ankara, Türkiye

Received: 05.01.2024

Accepted: 25.01.2024

Published: 29.01.2024

**Cite this article:** Kömürçü Erkmen SP, Akın N, Hekimoğlu ÖK. Evaluation of high placed jugular bulbus density with multislice temporal computed tomography. *J Radiol Med.* 2024;1(1):5-7.

**Corresponding Author:** Selmin Perihan Kömürçü Erkmen, selminperi@gmail.com

## ABSTRACT

**Aims:** In this study, it is aimed to investigate the density of high placed jugular bulbus which is useful to know from a clinical and surgical perspective.

**Methods:** Between the dates of May and November 2023, temporal computed tomography scans which took place in the computed tomography (General Electric) were evaluated retrospectively. 742 cases and 1484 ears were included in the study. Jugular bulbus was evaluated based on the internal acoustic canal.

**Results:** The age range of 742 cases was 18-72. Of the cases, 796 were women and 688 were men. High placed jugular bulbus was detected in 44 (3%) of 1484 ears. Of the 44 ears in which high placed jugular bulbus was detected, 26 (59%) were located on the right and 18 (41%) were located on the left. High placed jugular bulbus were monitored more frequently on the right side.

**Conclusion:** In this study, the density of high placed jugular bulbus was investigated. The density of high placed jugular bulbus is lower than the literature. Additionally, it was detected more frequently on the right side, consistent with the literature.

**Keywords:** Jugular bulbus, internal acoustic canal, skull base surgery

## INTRODUCTION

Jugular bulbus (JB); is a formation located at the base of the middle ear, at the level of the hypotympanum, and provides the venous connection between the sigmoid sinus and the internal jugular vein (IJV). It is separated from the cavum tympani by a compact bone in its upper part. There are several variations of the JB that may be clinically important. JB location and size may vary between individuals. High placed jugular bulbus (HPJB) is a rare developmental variation, but it is the most common anomaly of the jugular vein in the temporal bone.<sup>1</sup> The definition and density of HPJB vary depending on the underlying anatomical formation. HPJB; in clinical practice, it is often asymptomatic and detected incidentally. It is mostly detected during computed tomography (CT) examination of the temporal bone for another reason. When HPJB is symptomatic, the most common symptom is venous tinnitus.<sup>2</sup> It is known that HPJB may cause conductive and mixed hearing loss.<sup>3</sup> Additionally, recognition of HPJB during skull base surgery planning is important to prevent morbidity and complications. For this purpose, in this study, temporal CT scans were evaluated retrospectively in terms of the density of HPJB according to the internal acoustic canal (IAC).

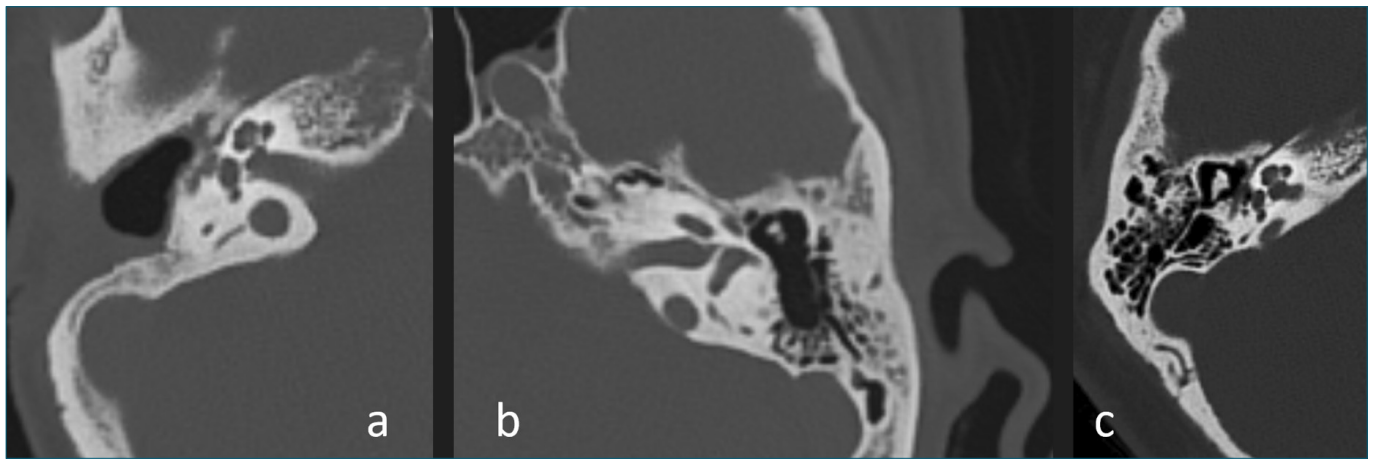
## METHODS

The study was carried out with the permission of the Ankara Etlik City Hospital Scientific Researches Evaluation and Ethics Committee (Date: 20.12.2023, Decision No: AEŞH-EK1-2023-800). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

742 temporal CT scans performed on CT (General Electric) were included in the study. The scans were evaluated retrospectively. Temporal CT protocol had Kv; 130, mAs; 130 FOV; 220 rotation time; 1 slice thickness; 1 mm values.

Evaluation according to IAC was performed on images obtained in the axial plane without contrast and with a section thickness of 1 mm. JB ending at the IAC lower limit and above was considered highly placed. In this study, the density of HPJB was investigated. Additionally, grading was performed in cases in which HPJB was detected; In images obtained with an axial section thickness of 1 mm, JB was evaluated as grade I if it was 0-2 mm above the lower limit of IAC, and grade II if it was >2 mm above the lower limit of IAC.





**Figure 1.** a, b; in the axial plane with a section thickness of 1 mm, jugular bulb on the right and left is observed along 3 sections starting from the level of the internal acoustic canal (grade 2). c; left jugular bulb is observed in 1 section at the base of the internal acoustic canal (grade 1).

## RESULTS

742 cases with temporal CT scan, 1484 ears were included in this study. Of the cases, 796 were women and 688 were men. HPJB was evaluated according to IAC (Figure 1).

According to IAC; there were HPJB in the 44 out of 1484 ears (3%). Of the HPJB cases, 32 were women and 8 were men (Table 1). According to IAC, the age range of HPJB cases was 18-72, and the average age was 40. Of the 44 ears in which HPJB was detected, 26 (59%) were located on the right and 18 (41%) were located on the left. The number of bilateral HPJB cases was 4 (Table 1). Of the 44 ears with HPJB, 18 (41%) were evaluated as grade I and 26 (59%) as grade II (Table 2).

**Table 1.** Cases of HPJB according to position

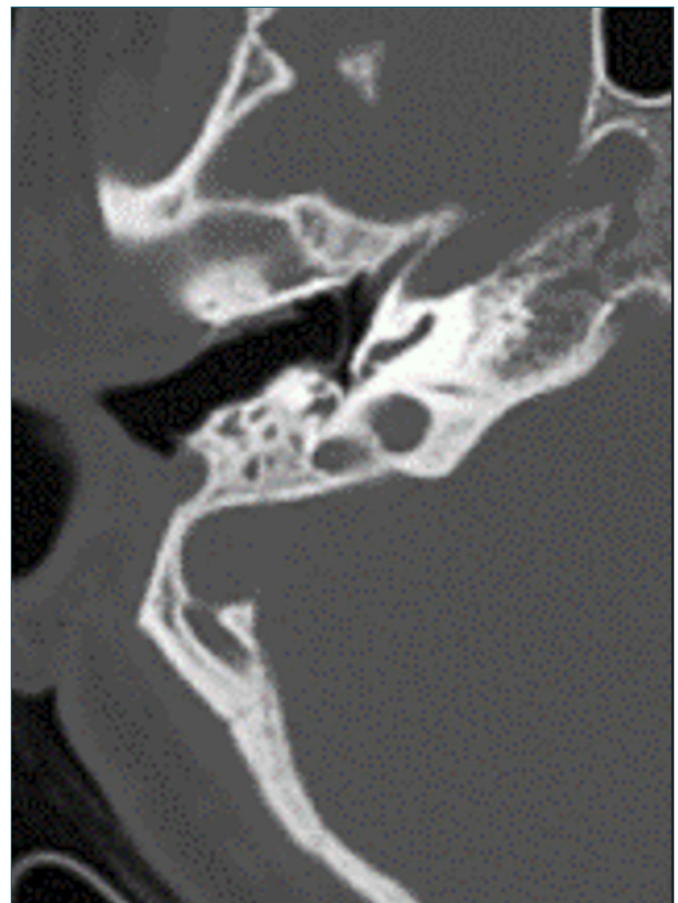
	Men	Women
Right	2	20
Left	4	10
Bilateral	2	2

**Table 2.** Grades of HPJB cases according to IAC

	Men	Women	Total	Percentage
Right Grade 1	2	8	10	23%
Right Grade 2	2	14	16	36%
Left Grade 1	0	8	8	18%
Left Grade 2	6	4	10	23%

## DISCUSSION

JB is the venous structure that provides the connection between the sigmoid sinus and IJV. Various studies are available in the literature evaluating JB-related pathologies such as HPJB, JB diverticulum, JB adjacent to the inner ear, JB-related inner ear dehiscence, JB dehiscence, and asymmetric JB.<sup>4</sup> In addition, JB diverticulum, which is detected more rarely, was observed in 2 ears in our study (Figure 2). Pathologies associated with JB are rare, and the most common is HPJB. The definition and density of HPJB varies depending on the reference point (6-65%).<sup>5</sup> For example, according to Wadin et al.<sup>6</sup> the diagnosis of HPJB is made based on the JB reaching the round window niche on radiological examination. Frequency of HPJB according to IAC; It was found to be 5.3% in the study of Asal et al.<sup>7</sup> and 10-15% in the study of Freidmann et al.<sup>8</sup> In this study, the frequency of HPJB compared to IAC was 3% and was found to be low compared to the literature.



**Figure 2.** Grade 2 high placed jugular bulb on the right is accompanied by a jugular diverticulum.

Gejrot<sup>9</sup> reported in his study that HPJB is more common on the right side because the jugular vein and transverse sinus are wider on the right side. In this study, consistent with the literature, HPJB was detected on the right side in 59% and on the left side in 41%.

HPJB is usually asymptomatic. Tinnitus is the most common symptomatic complaint.<sup>2</sup> Vestibular dysfunction is less common, and it is thought that this condition may be caused by compression of the endolymphatic sac and distal aqueduct.<sup>10</sup> It has also been reported that HPJB causes conductive and mixed hearing loss.<sup>3</sup> HPJB should be considered in various otological findings whose cause cannot be determined.

In the anatomical and radiological study conducted by Orr and Todd, it was reported that the distance between

the internal acoustic canal and the jugular apex could be estimated accurately with CT.<sup>11</sup>

Depending on the level it reaches, HPJB may make labyrinthectomy difficult or prevent the determination of the boundaries of the mass in tumor surgeries, and may cause venous injuries.<sup>12</sup>

Before lateral skull base surgery, a possible HPJB should be detected with preoperative temporal CT scanning and necessary precautions should be taken.

Asymptomatic cases of HPJB are usually detected incidentally and these cases do not require treatment. Surgery may be considered in patients with persistent pulsatile tinnitus that causes cranial nerve involvement in HPJB. The rate of success and symptom relief after surgery is quite high.<sup>13</sup> In this study, the frequency of HPJB is 3%, which is lower than the literature. Additionally, it was detected more frequently on the right side, consistent with the literature. The limitations of this study are that the patients' symptoms were not known and otological examinations could not be performed.

## CONCLUSION

HPJB should also be considered in patients whose etiology cannot be determined and who present with various otological symptoms, especially tinnitus; the risks posed by HPJB for lateral skull base and middle ear surgery should be known, to prevent complications, the possibility of HPJB should be examined. We believe that the results obtained in this study investigating the density of HPJB will benefit studies investigating otological findings of unknown etiology. We think that the results of this study will contribute to the literature.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

The study was carried out with the permission of Ankara Etlik City Hospital Scientific Researches Evaluation and Ethics Committee (Date:20.12.2023, Decision No: AEŞH-EK1-2023-800).

### Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

### Referee Evaluation Process

Externally peer-reviewed.

### Conflict of Interest Statement

The authors have no conflicts of interest to declare.

### Financial Disclosure

The authors declared that this study has received no financial support.

### Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

## REFERENCES

1. Atmaca S, Elmali M, Kucuk H. High and dehiscence jugular bulb: clear and present danger during middle ear surgery. *Surg Radiol Anat.* 2014;36(4):369-374.
2. Lin DJ, Hsu CJ, Lin KN. The high jugular bulb: report of five cases and a review of the literature. *J Formosan Med Assoc= Taiwan yi Zhi.* 1993;92(8):745-750.
3. Weiss RL, Zahtz G, Goldofsky E, Parnes H, Shikowitz MJ. High jugular bulb and conductive hearing loss. *Laryngoscope.* 1997;107(3):321-327.
4. Park JJH, Shen A, Keil S, Kuhl C, Westhofen M. Jugular bulb abnormalities in patients with Meniere's disease using high-resolution computed tomography. *Eur Arch Oto-Rhino-Laryngol.* 2015;272(8):1879-1884.
5. Couloigner V, Bozorg Grayeli A, Bouccara D, Julien N, Sterkers O. Surgical treatment of the high jugular bulb in patients with Meniere's disease and pulsatile tinnitus. *Eur Arch Oto-Rhino-Laryngol.* 1999;256(5):224-229.
6. Wadin K, Thomander L, Wilbrand H. Effects of a high jugular fossa and jugular bulb diverticulum on the inner ear: a clinical and radiologic investigation. *Acta Radiol Diagnosis.* 1986;27(6):629-636.
7. Asal N, Güney B, Savranlar A. Yüksek yerleşimli juguler bulbus sıklığının radyolojik açıdan değerlendirmesi. *SDU J Health Sci Inst/ SDÜ Sağ Bil Enst Derg.* 2014;5(1):5.
8. Friedmann DR, Eubig J, Winata LS, Pramanik BK, Merchant SN, Lalwani AK. Prevalence of jugular bulb abnormalities and resultant inner ear dehiscence: a histopathologic and radiologic study. *Otolaryngol--Head Neck Surg.* 2012;147(4):750-756.
9. Gejrot T. Retrograde jugularography in the diagnosis of abnormalities of the superior bulb of the internal jugular vein. *Acta Oto-Laryngol.* 1964;57(1-2):177-180.
10. Graham MD. The jugular bulb: its anatomic and clinical considerations in contemporary otology. *Laryngoscope.* 1977;87(1):105-125.
11. Orr JB, Wendell Todd N. Jugular bulb position and shape are unrelated to temporal bone pneumatization. *Laryngoscope.* 1988;98(2):136-138.
12. Shao KN, Tatagiba M, Samii M. Surgical management of high jugular bulb in acoustic neurinoma via retrosigmoid approach. *Neurosurg.* 1993;32(1):32-37.
13. Filipović B, Gjurčić M, Hat J, Glunčić I. High mega jugular bulb presenting with facial nerve palsy and severe headache. *Skull Base.* 2010;20(6):465-468.