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Variability and surgical anatomy of jugular foramen — a systematic review with a meta-analysis

Kamil Możdżeń[1], Agnieszka Murawska[1], Patryk Janda[1], Krzysztof Zachwieja[1], Nadia Kroker[1], Jakub Pękala[1], Tomasz Kozioł[1], Grzegorz Fibiger[1], Aleksandra Szlachcic[2], Przemysław Pękala[1], Jerzy Walocha[1]

[1] Department of Anatomy, Jagiellonian University Medical College, Kraków, Poland
[2] Department of Physiology, Jagiellonian University Medical College, Kraków, Poland

Corresponding author: Tomasz Kozioł, M.Sc.
Department of Anatomy, Jagiellonian University Medical College
ul. Kopernika 12, 31-034 Kraków, Poland
e-mail: tomasz1.koziol@uj.edu.pl

Abstract: Purpose: The jugular foramen (JF), located at the junction of the occipital and temporal bones, exhibits significant morphological variability due to its developmental origin. It transmits key neurovascular structures, including the glossopharyngeal (IX), vagus (X), and accessory (XI) cranial nerves, as well as the internal jugular vein. Detailed anatomical knowledge of the JF is essential for planning and safely performing surgical procedures in this region. The objective of this study was to provide a comprehensive quantitative synthesis of the anatomical characteristics of the JF based on global data.
Materials and Methods: A systematic search of major medical databases (PubMed, Embase, Scopus, Web of Science, and Google Scholar) was conducted to identify studies reporting on the morphometry and surgical anatomy of the JF. Data extraction and meta-analysis were performed across seven anatomical parameters: (1) length, (2) width, (3) depth, (4) area, (5) distance to the stylomastoid foramen, (6) maximum width of the jugular fossa, and (7) minimum distance between the round window and roof of the jugular fossa.
Results: Thirty studies met the inclusion criteria, comprising data from 5204 JFs. The analysis revealed significant asymmetry between the right and left JFs, with the right side generally larger across all measured parameters. Considerable heterogeneity was noted across populations and study types. The compiled morphometric data underscore notable geographic and demographic differences in JF anatomy.
Conclusions: This meta-analysis offers a detailed and up-to-date reference for the morphometric characteristics of the jugular foramen. These findings have critical implications for neurosurgeons and skull base surgeons, particularly in the management of lesions such as glomus jugulare tumors, schwannomas, or during decompressive procedures involving cranial nerves IX–XI. Enhanced anatomical awareness may contribute to improved surgical planning, reduced complication rates, and better clinical outcomes.

Keywords: jugular foramen, meta-analysis, skull base, surgical anatomy, cranial nerves.

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Introduction

The jugular foramen (JF) is a sizable, irregular aperture located at the junction of the occipital bone and the petrous portion of the temporal bone. The JF shows significant morphological variations as it is created by connecting these two bones [1–3]. The primary anatomical elements that traverse this foramen include the glossopharyngeal (IX), vagus (X), and spinal accessory (XI) nerve, as well as the internal jugular vein. The JF consists of two sections, sometimes separated by a fibro-osseous bridge that connects the temporal bone's jugular spine to the occipital bone's jugular process. However, in more cases there is no separation between the sections [4, 5]. The anteromedial compartment of the JF – pars nervosa, houses several structures, including the glossopharyngeal nerve (cranial nerve IX), the tympanic branch of cranial nerve IX, and the inferior petrosal sinus. The posterolateral component known as pars venosa or vascularis contains the internal jugular vein, jugular bulb, cranial nerves X (vagus nerve) and XI (spinal accessory nerve), the auricular branch of the vagus nerve, and the posterior meningeal branch of the ascending pharyngeal artery. The jugular fossa is a deep hollow found in the lower part of the temporal bone at the base of the skull. Its main function is to provide a space for the bulb of the internal jugular vein, allowing it to reside and fit within this anatomical depression [6].

In the case of pathologies affecting the glossopharyngeal nerve (cranial nerve IX), symptoms caused by involvement of the surrounding nerves are often observed due to the mutual passage of cranial nerves IX, X, and XI through the JF. The presence of tumors in this area can result in the development of palsies of these nerves. This condition is known as JF syndrome or Vernet syndrome, characterized by noticeable symptoms such as dysphagia, dysarthria, persistent unilateral periauricular pain and headache [6].

Several studies have been conducted on the morphology of the jugular foramen. These investigations have predominantly utilized cadaveric specimens or advanced imaging techniques such as computed tomography. Gaining a comprehensive understanding of the normal anatomy of the JF is crucial for accurate diagnosis and effective treatment of conditions affecting this area, such as JF syndrome, parapharyngeal abscesses, aneurysms of the extracranial internal carotid artery or vertebral artery, paragangliomas or traumas involving the posterior skull base [6]. Knowing the anatomical structures and variations within the JF is essential to provide appropriate care for patients with pathologies in this region. Hence, the objective of this meta-analysis was to present the latest, evidence-based findings concerning the morphometric characteristics of the JF and jugular fossa. Relevant research was compiled and analyzed to provide comprehensive and up-to-date insights into the anatomical properties of these structures. Our findings aim to assist surgeons in accurately diagnosing and effectively treating diverse pathologies anatomically associated with the JF. By providing valuable insights into the morphometric properties of this anatomical region, we hope to contribute to improved surgical outcomes and enhance patient care in cases of JF-related pathologies.

Materials and Methods

Search strategy

To carry out this meta-analysis, a thorough literature search was undertaken to identify all studies examining the anatomy of the JF up to May 2024. Key online databases including PubMed, Scopus, Embase, Web of Science, and the Cochrane Library were systematically searched using the

following phrases: "jugular foramen" or "jugular foramina". No limitations on language or publication date were imposed. References within the selected articles were also reviewed to identify further studies for inclusion. This meta-analysis was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Eligibility assessment and data extraction

Two researchers independently reviewed all studies to determine their eligibility for data extraction. For inclusion, studies needed to satisfy these criteria: (1) provided full prevalence data for the JF in human skulls, (2) included morphometric data for the JF, (3) was conducted via cadaveric dissection, MRI, or computed tomography, and (4) analyze at least four JF. The following criteria were used to exclude articles: (1) incomplete or missing data, (2) studies involving fetuses, (3) review papers, (4) case reports, (5) case series, and (6) animal studies [7].

A preliminary search identified 8001 articles. After excluding duplicates and irrelevant studies, 30 articles met the eligibility criteria and were included in this meta-analysis. The detailed process of article selection is shown in Fig. 1.

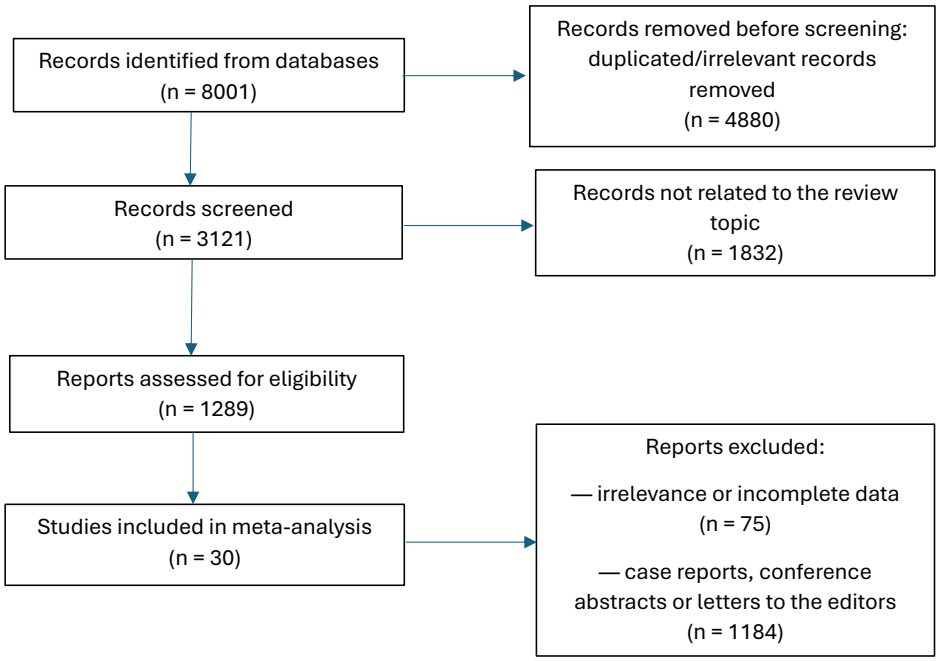

Fig. 1. Flow diagram presenting process of collecting data included in this meta-analysis.

Two researchers independently extracted data from the eligible studies. Qualitative information was collected, including year of publication, country and continent. In addition, quantitative data were collected in different categories with a split between right and left JF: (1) length of JF,

(2) width of JF, (3) depth of JF, (4) distance to stylomastoid foramen, (5) max width of jugular fossa, (6) area of JF, and (7) minimum distance between round window and roof of jugular fossa. Should any discrepancies be identified between the findings of the two researchers, an attempt was made to resolve them through the involvement of a third researcher.

Quality assessment

To assess the quality, reliability, and potential bias of the studies included, the Anatomical Quality Assessment (AQUA) tool was employed. The risk of bias was evaluated in five domains, categorised as low, high, or unclear. These were: (1) participant characteristics and study objectives, (2) study design, (3) methodological characterisation, (4) description of anatomical features, and (5) presentation of results [8].

Statistical analysis

Morphometric and prevalence data were pooled using successively: Comprehensive Meta-Analysis (Version 3.3, Biostat) and MetaXL version 5.3 (EpiGear International). Single and multicategorical pooled prevalence rates were calculated using a random-effects model.

The χ-square test and I^2 statistic were used to determine study heterogeneity following the guidelines of the Cochrane Handbook for Systematic Reviews of Interventions [9]. A P value <0.05 indicated statistically significant heterogeneity in all χ-square tests. I^2 statistical values were interpreted in the following way: 0%–40% may be unimportant, 30%–60% may indicate moderate heterogeneity, 50%–90% may indicate substantial heterogeneity, and 75%–100% may indicate considerable heterogeneity.

Sources of heterogeneity were assessed using group analysis. Studies were categorized by type (cadaveric dissection, computed tomography (CT)) and geographic region. Differences between groups or subgroups were considered insignificant if 95% confidence intervals overlapped.

Results

All the studies included in our work are presented in Table 1. Following our initial search, a total of 8001 articles were identified. Subsequently, upon thorough evaluation, 30 studies met the criteria for data extraction. Twenty-eight studies were cadaveric (4750 JFs) and two were imaged with computed tomography scans (454 JFs). A total of 5204 JFs were included in our analysis

Length

The length (Table 2) of the JF was reported in fourteen studies, in which 2404 JFs (1202 left and 1202 right JFs) were measured. The mean overall cadaveric length of the left JF was 14.7 mm (95% confidence interval (CI), 13.3–16.1 mm), while that of the right JF was 15.5 mm (95% CI, 13.6–17.3 mm). Among the Indian population, the mean value for the left JF was 15.7 mm (95% CI, 14.3–17.1 mm) and 16.6 mm (95% CI, 14.6–18.6 mm) for the right JF. In contrast, among the population of Nigeria, the mean length of the left JF was notable lower compared to other groups and was 13.6 mm (95% CI, 13.0–14.2 mm). For the right JF the mean length was also lower, reaching a value of 14.8 mm (95% CI, 13.0–16.7 mm), but it was not statistically significant.

In the Asian population, the mean length value for the left JF was 14.8 mm (95% CI, 13.1–16.5 mm) and 15.6 mm (95% CI, 13.4–17.9 mm) for the right JF. Additionally, two studies (300 left and 300 right JFs) measured the mean length extracranially, with the left JF exhibiting a mean length of 16.1 mm (95% CI, 15.8–16.5) and the right JF exhibiting a mean length of 16.7 mm (95% CI, 16.2–17.1 mm). Furthermore, the intracranial mean length was also measured in 2 studies (300 left and 300 right JFs) and for the left JF it was 14.2 mm (95% CI, 13.9–14.6 mm) and 14.7 mm (95% CI, 14.2–15.2 mm) for the right JF.

Width

The width of the JF (Table 2)was reported in thirteen studies, in which 1828 JFs (914 left and 914 right JFs) were measured. The width of the JF was reported in thirteen studies, in which 1828 JFs (914 left and 914 right JFs) were measured. The overall mean width of the left JF was 7.8 mm (95% CI, 7.5–8.2 mm), while the mean width of the right JF was 9.3 mm (95% CI, 9.0–9.6 mm). In the case of cadavers, the mean width of the left JF was 7.9 mm (95% CI, 7.6–8.2 mm) and 9.4 mm (95% CI, 9.1–9.7 mm) for the right JF. The width results exhibited considerable variation among the Asian population, with the mean value for the left JF being 7.7 mm (95% CI, 7.4–8.0 mm) and 9.4 mm (95% CI, 9.1–9.7 mm) for the right JF. The width values were higher for African residents than Asian residents with the mean value for the left JF being 8.6 mm (95% CI, 6.7–10.5 mm) and 9.7 mm (95% CI, 8.9–10.6 mm) for the right JF. Furthermore, in four studies (440 left and 440 right JFs) mean width measured extracranially was found to be 8.7 mm (95% CI, 7.9–9.6 mm) for the left JF and 10.1 mm (95% CI, 9.4–10.9 mm) for the right JF. Among cadavers, the mean extracranial width of the left JF was 8.7 mm (95% CI, 7.4–9.9 mm) and 9.8 mm (95% CI, 9.2–10.5 mm) for the right JF. For Africans, the mean extracranial width of the left JF was 8.5 mm (95% CI, 6.5–10.5 mm) and 9.6 mm (95% CI, 8.8–10.4 mm) for the right JF. Furthermore, the mean intracranial width was also measured in two studies (300 left and 300 right JFs). For the left JF, the mean length was 14.2 mm (95% CI, 13.9–14.6 mm), while for the right JF, it was 14.7 mm (95% CI, 14.2–15.2 mm).

Depth

The depth of the JF (Table 2) was reported in nine studies, in which 1662 JFs (831 left and 831 right) were measured. The overall mean depth of the left JF was 10.0 mm (95% CI 9.1–10.9 mm) and 11.7 (95% CI, 10.9–12.5 mm) for the right JF. The depth of the JF among Asian residents (measured on 734 right and 734 left JFs) exhibited variability, with a mean of 9.9 mm (95% CI, 8.8–10.9 mm) for the left JF and 11.8 mm (95% CI, 10.9–12.7 mm) for the right.

Area

The area of the JF (Table 3) was reported in four studies, in which 700 JFs (350 left and 350 right) were measured. The overall mean area of the left JF was 291.0 mm^2 (95% CI, 121.1–460.8 mm^2), while that of the right JF was 335.6 mm^2 (95% CI, 94.5–576.7 mm^2). The mean area of the JF among Asian residents (measured on 330 right and 330 left JFs) was 248.9 mm^2 (95% CI, 53.2–444.5 mm^2) for the left JF and 301.9 mm^2 (95% CI, 17.7–586.1 mm^2) for the right JF.

Distance to stylomastoid foramen

The distance to the stylomastoid foramen (SF) (Table 4) was reported in four studies, in which 521 sides of the head (197 left and 324 right) were measured. The mean distance on the left side of the head was 4.5 mm (95% CI, 1.1–7.8 mm), while the mean distance on the right side was 4.4 mm (95% CI, 1.7–7.1 mm). The mean distances observed in the Indian population were smaller than the overall mean, with a value of 3.2 mm (95% CI, 0.6–7.0 mm) for the left side of the head and 3.0 mm (95% CI, 0.4–6.4 mm) for the right side.

Maximum width of the jugular fossa

The maximum width of the jugular fossa was reported in seven studies, in which 1368 jugular fossae (684 on the left and 684 on the right) were measured. The mean value for the left jugular fossa was 7.3 mm (95% CI, 6.2–8.4 mm), while the mean value for the right jugular fossa was 8.6 mm (95% CI, 7.2–10.0 mm).

Minimum distance between the round window and roof of the jugular fossa

The minimum distance between the round window and the roof of the jugular fossa (Table 5) was reported in four studies, in which 764 sides of the head (382 left and 382 right) were measured. The mean distance was found to be 2.7 mm (95% CI, 2.6–2.9 mm) overall and 2.8 mm (95% CI, 2.4–3.1 mm) for Asians.

Discussion

The present meta-analysis aims to analyze the measurements of JF to provide better understanding of its anatomy, as various surgeries are performed in the area of JF. Knowledge of the jugular foramen dimensions aids surgeons in assessing the feasibility of tumor removal and determining the extent of resection that can be safely achieved without causing damage to vital structures within or surrounding JF. Neurosurgeons often face considerable challenges when dealing with jugular fossa tumors, which are considered to be one of the most difficult pathologies they encounter [10, 11]. Therefore, precise information on size, shape and location of JF is crucial in surgical management of such lesions as the hypervascular glomus jugular tumor, which is the predominant type of tumor found in the JF, or jugular foramen schwannoma which can cause an enlarged JF [12]. In case of the tympanojugular paraganglioma, the treatment advised is stereotactic radiosurgery and surgical resection which also requires enhanced knowledge of the anatomy of JF [13]. Having an understanding of the size and shape of the JF allows surgeons to effectively plan their surgical approach. By knowing the dimensions, they can determine the appropriate instruments and techniques required for safe access to the area. This knowledge helps in mapping out the surgical trajectory and identifying any potential challenges or obstacles that may arise during the procedure. Moreover, JF houses critical structures, including cranial nerves IX, X, and XI [2, 5]. Therefore, correct identification of nerve compressions or impingements is closely linked to the anatomical understanding of JF variations. Furthermore, it is essential in planning interventions to relieve pressure on these nerves and restore proper function. Surgeons can develop strategies to decompress the affected nerves while considering the dimensions of the JF to ensure the best possible outcome for the patient. Understanding the dimensions of the JF is of great importance in the education and training of surgeons.

In the present study, the right JF in both males and females was larger on the right side. This makes sense as the internal jugular vein is smaller on the left side [14]. Mean overall cadaveric length measured in this meta-analysis was 14.7 mm and 15.5 mm for the left and right JF, respectively. The lowest mean length of both right and left JF was noted by Akdag *et al.* in 2020, in Turkey, Asia. The authors reported 7.31 mm as the mean length of the left JF and 7.85 mm as the mean length of the right JF [15]. The lowest mean area of 100.58 mm^2 in the left JF was also noted in Asia, in a study on Indian population performed by Kothari *et al.* [16], whereas in the current meta-analysis the mean area of the left JF was found to be 291.0 mm^2 and of the right JF — 335.6 mm^2. The mean overall width reported in the present meta-analysis was 7.8 mm and 9.3 mm for the left and right JF, respectively. Taking into consideration specific populations, the mean width was higher in African residents than in Asian residents both in left and right JFs. The distance between the JF and the SF is significant for neurosurgeons in terms of the procedure of rerouting of the facial nerve, as this nerve transverse through the SF [6]. The mean overall distance to the SF was greater on the left side (4.5 mm) than on the right side (4.4 mm). The lowest mean distance of 3.0 mm for the right and 3.2 for the left JF was noted in the Indian population.

This study was limited by the high heterogeneity among the included studies, which was assessed using the AQUA Tool. Out of 29 studies included in this meta-analysis, the risk of bias due to methodology characterization was judged as high for 10 studies, as low for 18 studies and was unclear for one study. Risk of bias due to the description of the anatomy was assessed as high for two studies, as low for 26 studies and was unclear for one study.

We hope that our study offers significant benefits to surgeons in their clinical practice. By providing a comprehensive understanding of the anatomical structures and dimensions of the jugular fossa, we empower surgeons with precise knowledge for surgical planning and execution. This enhanced understanding allows for improved surgical outcomes, reduced complications, and enhanced patient care. Additionally, our study contributes to the advancement of medical education by providing valuable insights that can be incorporated into training programs, refining surgical skills and decision-making abilities. Surgeons can leverage this knowledge to make informed choices during procedures involving the jugular fossa, ultimately raising the standard of surgical practice and ensuring optimal patient outcomes.

Table 1. Summary of included studies evaluating the jugular foramen.

Study ID	Country	Type of the study (cadaveric, ct)	Number of patients (number of sides of head) (used)
Swaroop 2016 [17]	India	cadavers	114 (228)
Aggarwal 2011 [18]	India	cadavers	50 (100)
Shruthi 2015 [19]	India	cadavers	250 (500)
Idowu 2004 [20]	Nigeria	cadavers	20 (40)
Osunwoke 2012 [21]	Nigeria	cadavers	120 (240)
Gupta 2014 [22]	India	cadavers	50 (100)
Stozitzky Muñoz 2016 [23]	Colombia	cadavers	37 (74)
Jyothi 2022 [24]	India	cadavers	50 (100)
Anbumani 2019 [25]	India	cadavers	33 (66)
Kizilkanat 2013 [26]	Turkey, Scotland	cadavers	25 (50)

Table 1. Cont.

Study ID	Country	Type of the study (cadaveric, ct)	Number of patients (number of sides of head) (used)
Kumar 2014 [27]	India	cadavers	68 (136)
Tewari 2020 [28]	India	cadavers	58 (116)
Saman 2010 [29]	USA	cadavers	61 (84)
Baisakh 2021 [30]	India	cadavers	50 (100)
Raso 2011 [31]	Brazil	cadavers	127 (254)
Barros 2021 [4]	Brazil	cadavers	97 (194)
Thunyacharoen 2023 [32]	Thailand	cadavers	160 (320)
Delhi raj 2013 [33]	India	cadavers	50 (100)
Dichiro 1964 [34]	USA	CT	200 (400)
Aubaniac 1951 [35]	Algeria	cadavers	100 (200)
Akdag 2020 [15]	Turkey	cadavers	17 (34)
Booth 2011 [36]	Georgia	CT	27 (54)
Mahajan 2017 [37]	India	cadavers	50 (100)
Jain 2018 [38]	India	cadavers	250 (500)
Singla 2014 [39]	India	cadavers	50 (100)
Mehanna 2020 [40]	Egypt	cadavers	20 (40)
Anjankar 2020 [41]	India	cadavers	120 (240)
Amudha 2019 [42]	India	cadavers	30 (60)
Singla 2016 [43]	India	cadavers	87 (174)

Table 2. Morphometric parameters of the jugular foramen.

Category		Side	Group	Number of studies (number of sides of head (used))	Pooled mean value: mm (95% CI)	I^2: %
Length		right FJ	overall (cadaveric)	14 (1202)	15.5 (13.6–17.3)	99.8
			India	9 (848)	16.6 (14.6–18.6)	99.7
			Nigeria (Africa)	2 (140)	14.8 (13.0–16.7)	97.7
			Asia	11 (1025)	15.6 (13.4–17.9)	99.9
		left FJ	overall (cadaveric)	14 (1202)	14.7 (13.3–16.1)	99.6
			India	9 (848)	15.7 (14.3–17.1)	99.3
			Nigeria (Africa)	2 (140)	13.6 (13.0–14.2)	47.7
			Asia	11 (1025)	14.8 (13.1–16.5)	99.7
	extracranial	right FJ	overall	2 (300)	16.7 (16.2–17.1)	0.0
		left FJ	overall	2 (300)	16.1 (15.8–16.5)	0.0
	intracranial	right FJ	overall	2 (300)	14.7 (14.2–15.2)	48.6
		left FJ	overall	2 (300)	14.2 (13.9–14.6)	0.0

Table 2. Cont.

Category		Side	Group	Number of studies (number of sides of head (used))	Pooled mean value: mm (95% CI)	I^2: %
Width	extracranial	right FJ	overall	4 (440)	10.1 (9.4–10.9)	89.7
			cadaveric	3 (240)	9.8 (9.2–10.5)	76.8
			Africa	2 (140)	9.6 (8.8–10.4)	49.7
		left FJ	overall	4 (440)	8.7 (7.9–9.6)	92.5
			cadaveric	3 (240)	8.7 (7.4–9.9)	93.8
			Africa	2 (140)	8.5 (6.5–10.5)	94.9
	intracranial	right FJ	overall	2 (300)	7.5 (6.0–8.9)	94.2
		left FJ	overall	2 (300)	6.9 (5.2–8.5)	96.5
		right FJ	overall	13 (914)	9.3 (9.0–9.6)	88.8
			cadaveric	12 (887)	9.4 (9.1–9.7)	88.7
			India	8 (650)	9.5 (9.2–9.8)	95.1
			Africa	2 (40)	9.7 (8.9–10.6)	64.6
			Asia	9 (810)	9.4 (9.1–9.7)	89.8
		left FJ	overall	13 (914)	7.8 (7.5–8.2)	94.1
			cadaveric	12 (887)	7.9 (7.6–8.2)	94.4
			India	8 (650)	7.7 (7.3–8.1)	93.3
			Africa	2 (40)	8.6 (6.7–10.5)	96.3
			Asia	9 (810)	7.7 (7.4–8.0)	92.4
Depth	exocranial	right FJ	overall	9 (831)	11.7 (10.9–12.5)	97.6
			Asia	8 (734)	11.8 (10.9–12.7)	97.8
		left FJ	overall	9 (831)	10.0 (9.1–10.9)	98.0
			Asia	8 (734)	9.9 (8.8–10.9)	98.2
Mediolateral diameter		right FJ	overall	8 (715)	15.0 (14.4–15.6)	96.9
			India	6 (518)	15.1 (14.3–15.9)	97.7
			Asia	7 (678)	15.0 (14.4–15.7)	97.2
		left FJ	overall	8 (715)	14.6 (13.9–15.3)	97.4
			India	6 (518)	14.5 (13.7–15.3)	97.5
			Asia	7 (678)	14.5 (13.7–15.2)	97.4
Max width of jugular fossa		right	overall	7 (684)	8.6 (7.2–10.0)	99.5
		left	overall	7 (684)	7.3 (6.2–8.4)	99.3

Table 3. Pooled area measurements of the jugular foramen.

Side	Group	Number of studies (number of sides of head (used))	Pooled mean area: mm2 (95% CI)	I2: %
right FJ	overall	4 (350)	335.6 (94.5–576.7)	99.9
	Asia	3 (330)	301.9 (17.7–586.1)	99.9
left FJ	overall	4 (350)	291.0 (121.1–460.8)	99.8
	Asia	3 (330)	248.9 (53.2–444.5)	99.9

Table 4. Distance to stylomastoid foramen.

Side	Group	Number of studies (number of sides of head (used))	Pooled mean value: mm (95% CI)	I^2: %
right FJ	overall	4 (324)	4.4 (1.7–7.1)	99.8
	Asia	3 (197)	4.0 (1.1–7.0)	99.6
	India	2 (172)	3.0 (0.4–6.4)	99.8
left FJ	overall	3 (197)	4.5 (1.1–7.8)	99.8
	India	2 (172)	3.2 (0.6–7.0)	99.8

Table 5. Minimum distance between round window and roof of jugular fossa.

Group	Number of studies (number of sides of head (used))	Pooled mean distance: mm (95% CI)	I^2: %
overall	4 (382)	2.7 (2.6–2.9)	67.4
Asia	3 (342)	2.8 (2.4–3.1)	77.2

Conclusions

This study emphasizes that knowledge of the detailed anatomy of the jugular foramen is crucial in clinical practice, especially for neurosurgeons and physicians performing procedures in this region. We believe that this paper represents the most precise and up-to-date analysis of the anatomy of JF. It is our hope that the results of this study will assist clinicians in the future when undertaking appropriate surgery in and around the JF.

Conflict of interest

None declared.

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