INTERNATIONAL JOURNAL OF MEDICAL SCIENCE AND DENTAL HEALTH
(ISSN: 2454-4191)
www.ijmsdh.org (2026)

Check for updates

Received: 30 Sep 2026
Revised: 10 Oct 2026
Accepted: 22 Oct 2026
Published: 15 Nov 2026

2026: OCTOBER - IJMSDH
Page No – 26-35
DOI - 10.55640/ijmsdh-12-11-04

Article Citation: Nargiza Ozodova, Gulnora Rozixodjaeva, & Gulsanam Aytimova. (2026). Characteristics of Internal Jugular Vein Reflux on Duplex Ultrasound in Symptomatic Adults and Asymptomatic Volunteers. International Journal of Medical Science and Dental Health, 12(11), 26-35. https://doi.org/10.55640/ijmsdh-12-11-04

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Characteristics of Internal Jugular Vein Reflux on Duplex Ultrasound in Symptomatic Adults and Asymptomatic Volunteers

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Abstract

Introduction: Internal jugular vein reflux is assessed using heterogeneous ultrasound criteria, and its association with nonspecific symptoms remains uncertain.

Objective: To compare jugular valve morphology and reflux characteristics in symptomatic adults and asymptomatic volunteers using the same bilateral duplex ultrasound protocol.

Methods: Cross-sectional data prospectively collected from 80 symptomatic adults and 30 asymptomatic volunteers were analyzed. All participants underwent bilateral B-mode, color-flow, and pulsed-wave Doppler ultrasound examinations, both at rest and during the Valsalva maneuver. The primary focus of the comparison was reflux associated with the Valsalva maneuver. Differences between the groups were described using unadjusted odds ratios (ORs) and 95% confidence intervals (CIs).

Results: The mean age was 46.2 years and 44.8 years, respectively; women accounted for 60.0% of each group. Reflux associated with the Valsalva maneuver was observed in 53 of the 80 symptomatic participants (66.3%) and in 3 of the 30 volunteers (10.0%; OR 17.67, 95% CI 4.91-63.52). Spectral retrograde flow was recorded in 50 of 80 and 2 of 30 participants, respectively; cranial extension above the valve was observed in 44 of 80 and 1

of 30 participants. In all three comparisons, P<0.001. Resting reflux was observed in 20 of 80 symptomatic participants and in none of the volunteers. Restricted leaflet mobility, incomplete coaptation, and thickening were more frequent in the symptomatic group, whereas the clarity of valve visualization did not differ significantly.

Conclusions: Valsalva-associated jugular reflux and spectral retrograde flow were more frequent in symptomatic adults in this sample. Valve morphology and functional flow findings should be reported separately. The findings do not establish a causal link to symptoms, diagnostic accuracy, or indications for population screening.

Keywords: Internal jugular vein; Venous reflux; Duplex ultrasound; Venous valves; Valsalva maneuver; Doppler ultrasound.

1. Introduction

The internal jugular veins (IJVs) serve as the primary extracranial outflow pathways for blood from the head and neck. Their anatomy varies among individuals and between sides, including the configuration of the terminal valvular apparatus. Current anatomical evidence confirms that a terminal IJV valve is a common finding; however, its presence alone does not guarantee functional competence. [1, 2]

Jugular blood flow reflects the interplay between venous anatomy and respiration, posture, intrathoracic pressure, and right-sided cardiac hemodynamics. Consequently, changes in the caliber of the vein or the morphology of the Doppler waveform can have multiple explanations. Reviews of venous Doppler sonography and ultrasound assessment of the internal jugular vein (IJV) in the context of heart failure illustrate the importance of this physiological framework; however, evaluating central venous congestion addresses a different clinical question than assessing the competence of the terminal valve. [3, 4]

Duplex ultrasound allows for the combined assessment of valve leaflet morphology, the direction of blood flow, and the response to pressure changes. Brief retrograde flow occurring during valve closure must be distinguished from persistent retrograde flow resulting from an incompetent valve. Nedelmann and colleagues demonstrated this distinction using a pressure-controlled Valsalva maneuver. Standard practice guidelines for venous ultrasound also emphasize a combined approach, incorporating grayscale imaging, color-flow mapping, and spectral analysis, though they do not establish a universal duration threshold for defining clinically significant jugular reflux. [5, 6]

The clinical interpretation of jugular venous reflux (JVR) is less well-established than its sonographic detection. One controlled study identified a high prevalence of internal jugular valve incompetence in patients with transient global amnesia; however, a subsequent study failed to demonstrate the intracranial hemodynamic mechanism that had been proposed to explain this association. A separate controlled study on migraine found no increased prevalence of valvular incompetence. These data support the consideration of a specific clinical phenotype, rather than treating headache or dizziness as evidence of a venous disorder. [7, 8, 9]

Recent work has extended this inquiry to include cognitive impairment and ischemic white matter lesions. Studies published in 2023 and 2025 have reported an association involving spontaneous reflux or impaired jugular drainage, though they utilized different study populations and varying definitions for ultrasound-based assessment.

These observations cannot be directly extrapolated to nonspecific symptoms or provoked reflux. The internal jugular vein also plays a role in image interpretation, as it can mimic a dural arteriovenous fistula on certain MRI sequences. [10, 11, 12, 13]

A practical research question is how structural valve changes and functional signs of reflux differ when adults with nonspecific complaints and volunteers without such complaints undergo the same examination protocol. Methodological reviews and current guidelines for ultrasound training emphasize the importance of clearly defining procedures for data acquisition and interpretation. A recent expert consensus on internal jugular vein ultrasound also highlights the importance of competency assessment, although it focuses on the evaluation of jugular venous pressure rather than the validation of jugular reflux criteria. [14, 15, 16]

Therefore, we compared valve morphology and reflux characteristics in symptomatic adults and asymptomatic volunteers, all of whom were examined using the same bilateral duplex ultrasound protocol. The primary hypothesis was that reflux associated with the Valsalva maneuver would be more frequent in the symptomatic group. We also described spectral confirmation, reflux duration, peak retrograde velocity, and cranial extent. The study was designed to characterize relationships within the study groups, without assuming that reflux accounts for the presenting complaints.

2. Methods

Study Design and Participants

This comparative cross-sectional observational study utilized prospectively collected clinical and ultrasound data from June 2025 to August 2026. The work was conducted primarily at the private clinic ULTRA VEDA, a family-run practice in

Urgench, Khorezm Region, Uzbekistan. The analysis included 110 eligible adults aged 18 years or older: 80 participants presenting with a specific set of symptoms and 30 asymptomatic volunteers. Clinical and ultrasound data were compared at the time of the initial examination, with no longitudinal follow-up. Reporting was guided by the STROBE statement [17].

The symptomatic group consisted of adults reporting at least one of the following: headache, dizziness, tinnitus, a sensation of pressure or heaviness in the head, heaviness in the occipital region, or morning fatigue. The comparison group comprised volunteers who reported no such complaints and had no diagnosed neurological conditions; thus, the absence of symptoms was a selection criterion for the control group. Differences in the prevalence of symptoms between the groups were not interpreted as evidence of a causal link to reflux.

Exclusion criteria included a history of, or ultrasound-detected, thrombosis of the neck veins; significant cardiovascular diseases capable of substantially affecting central venous hemodynamics (including NYHA functional class III-IV heart failure, unstable angina, or severe cardiac arrhythmias); acute infectious diseases; active malignant neoplasms or autoimmune disorders; as well as an inability to correctly perform the Valsalva maneuver. A history of prior catheterization of the internal jugular vein was also taken into account. Participants in both groups met the established inclusion criteria.

The study was approved by the Ethics Committee of the Urgench State Medical Institute (protocol No. 1 dated January 5, 2024). All participants provided informed consent.

Clinical and Ultrasound Examination

Clinical assessment preceded the ultrasound examination and included the recording of patient complaints and relevant medical history. The characteristics of any headaches, such as their nature, time of onset, frequency of recurrence, and potential association with physical exertion, coughing, or straining, were documented. These complaints were considered non-specific clinical observations and were not used to diagnose valvular insufficiency.

Both internal jugular veins (IJVs) were examined with the patient in a supine position, using a MINDRAY Consona N8 ultrasound system equipped with a 7-12 MHz linear transducer. The examinations were performed by two specialists, each with over five years of experience in ultrasound diagnostics. Both examiners were aware of the patients' group assignments and reported complaints. Pressure applied to the neck was kept to a minimum to avoid compressing the vein, which could alter its apparent caliber or blood flow. The terminal segment of the IJV and the valvular region were evaluated in both transverse and longitudinal planes.

B-mode imaging was used to assess the appearance of the valve, leaflet mobility, closure, and the presence of thickening or fibrosis. The diameters of the right and left IJVs were measured at rest. Structural findings were interpreted in conjunction with observations of blood flow; neither anatomical variations nor increased vessel diameter were considered sufficient to establish functional valvular insufficiency.

Color Doppler ultrasound was employed to evaluate antegrade flow and any cranially directed flow components, both at rest and during the Valsalva maneuver. Suspected retrograde flow was assessed using pulsed-wave Doppler ultrasound, with the sample volume positioned at the level of the valve and, if necessary, cranial to it. The duration of the reflux and the peak retrograde flow velocity were recorded. A color change alone was not considered equivalent to a fully characterized spectral reflux signal.

Prior to the Valsalva maneuver, participants were instructed to perform a forceful strain while in a supine position. Both color and spectral recordings were obtained during the maneuver. The assessment took into account the presence of retrograde flow, the persistence of a spectral component, and its cranial extent above the valve. No additional positional tests were performed.

Reflux duration was described using the nested thresholds ≥0.5 s and >1.0 s. The ≥0.5-s threshold was a study-specific descriptive criterion rather than a universal diagnostic standard. Duration >1.0 s denoted longer reflux and did not independently define severity.

Outcomes and statistical analysis

The primary outcome was the occurrence of reflux during the Valsalva maneuver. Secondary measures were reflux at rest, a spectral retrograde component, reflux duration, cranial extension above the valve, peak retrograde velocity, valve morphology, and IJV diameter. Valsalva-associated reflux, spectral retrograde flow, and duration ≥0.5 s were reported as separate variables. The participant was the unit of analysis; right and left veins were not treated as independent observations. Categorical outcomes were analyzed using the participant-level classifications recorded in the source data; right and left diameter measurements were reported separately.

Categorical data are presented as absolute values (counts) and percentages. Fisher’s exact test (two-tailed) was used to compare binary variables between groups. The association between observed characteristics and group membership (symptomatic vs. asymptomatic) was assessed using

unadjusted odds ratios (ORs) with 95% confidence intervals (CIs) calculated via the Wald method. ORs were not estimated for tables containing a zero-count cell. These ORs characterize a specific cross-sectional comparison and do not represent an estimate of the risk of developing symptoms in the future.

Quantitative variables are presented as mean and standard deviation (SD) or median and interquartile range (IQR), depending on the data distribution. Welch's t-test was used to compare means; for variables with non-normal distributions, the Mann-Whitney U test was used. The authors verified the reported quantitative results against the study's primary documentation. Pairwise comparisons and odds ratio (OR) values (where contingency tables contained non-zero cells) were also cross-checked against the raw data. For the proportions shown in Figure 1, 95% confidence intervals were calculated using the Wilson method.

P values < 0.05 were considered nominally significant. Additional comparisons were exploratory in nature and were not adjusted for multiple hypothesis testing. Diagnostic sensitivity, specificity, predictive values, and threshold values (based on ROC curves) were not calculated due to the absence of an independent "gold standard." Pairwise comparisons of results at rest versus during functional tests were not performed, as data on parameter consistency at the individual participant level were unavailable.

3. Results

Participant characteristics

The analysis included 80 symptomatic adult patients and 30 asymptomatic volunteers. The mean age was 46.2 years (SD 11.8) and 44.8 years (SD 10.7), respectively; the age difference between the groups was not statistically significant (P=0.563). Women accounted for 48 of the 80 participants in one group and 18 of the 30 in the other, representing 60.0% in each group. Table 1 presents participant characteristics and the complaints that formed the basis for the symptomatic group. Headache was reported by 64 of the 80 participants (80.0%), a sensation of pressure in the head by 56 of 80 (70.0%), heaviness in the occipital region by 51 of 80 (63.8%), dizziness by 48 of 80 (60.0%), morning fatigue by 45 of 80 (56.3%), and tinnitus by 34 of 80 (42.5%). A single participant could present with multiple complaints simultaneously. The absence of these complaints among the volunteers was due to the study inclusion criteria.

Table 1 Participant characteristics

Characteristic	Symptomatic adults (n=80)	Asymptomatic volunteers (n=30)
Age, years, mean (SD)	46.2 (11.8)	44.8 (10.7)
Women	48 (60.0)	18 (60.0)
Men	32 (40.0)	12 (40.0)
Headache	64 (80.0)	0
Dizziness	48 (60.0)	0
Tinnitus	34 (42.5)	0
Sensation of pressure in the head	56 (70.0)	0
Occipital heaviness	51 (63.8)	0
Morning fatigue	45 (56.3)	0

Data are n (%) unless otherwise indicated. Participants could report more than one complaint. The absence of the listed complaints was an inclusion criterion for volunteers; symptom frequencies were therefore not compared statistically between groups. SD, standard deviation.

Valve morphology and vein diameter

Clear visualization of the valvular apparatus was achieved in 68 of 80 participants with complaints (85.0%) and in 28 of 30 volunteers (93.3%; P=0.343). Restricted leaflet mobility was observed in 35 of 80 participants versus 2 of 30 volunteers; incomplete coaptation was noted in 37 of 80 versus 1 of 30; and thickening or fibrous changes were found in 24 of 80 versus 1 of 30. The corresponding odds ratios (OR) were 10.89 (95% CI: 2.43-48.85), 24.95 (3.24-192.17), and 12.43 (1.60-96.55), respectively.

The mean diameter of the right internal jugular vein (IJV) was 15.1 mm (SD 3.1) in the group of participants with complaints and 12.6 mm (SD 2.3) in the volunteer group. The mean diameter of the left IJV was 13.9 mm (SD 2.9) and 11.8 mm (SD 2.0), respectively; in both cases, P < 0.001. These measurements characterize the study groups and were not used to establish normative values or independent diagnostic thresholds (Table 2).

Table 2 Valve morphology and resting internal jugular vein diameter

Finding	Symptomatic adults (n=80)	Asymptomatic volunteers (n=30)	P value
Clear valve visualization	68 (85.0)	28 (93.3)	0.343
Restricted leaflet mobility	35 (43.8)	2 (6.7)	<0.001
Incomplete leaflet coaptation	37 (46.3)	1 (3.3)	<0.001
Leaflet thickening or fibrotic appearance	24 (30.0)	1 (3.3)	0.002
Right IJV diameter, mm, mean (SD)	15.1 (3.1)	12.6 (2.3)	<0.001
Left IJV diameter, mm, mean (SD)	13.9 (2.9)	11.8 (2.0)	<0.001

Data are n (%) unless otherwise indicated. All participants in each group were used as the denominators for categorical findings. Morphological features could coexist. Binary P values were obtained with two-sided Fisher exact tests; diameter comparisons used Welch's t-test. IJV, internal jugular vein; SD, standard deviation.

Reflux at rest and during functional maneuvers

Reflux associated with the Valsalva maneuver was recorded in 53 of 80 symptomatic participants (66.3%) and in 3 of 30 volunteers (10.0%). The absolute difference in proportions was 56.3 percentage points; the unadjusted odds ratio (OR) was 17.67 (95% CI: 4.91-63.52; P < 0.001). Reflux at rest was observed in 20 of 80 symptomatic participants (25.0%) and was not detected in any of the volunteers (P = 0.001). These figures indicate that provoked reflux was recorded more frequently than reflux at rest; however, they do not allow for the determination of the exact number of cases detected exclusively during the Valsalva maneuver.

A retrograde component of the spectral signal was present in 50 of 80 symptomatic participants (62.5%) and in 2 of 30 volunteers (6.7%; OR 23.33; 95% CI: 5.18-105.02). Reflux lasting at least 0.5 s was observed in 49 of 80 participants and 2 of 30 volunteers, respectively. A duration exceeding 1.0 s was noted in 38 of 80 symptomatic participants (47.5%) and in none of the volunteers. In all three comparisons, the P-value was < 0.001.

Cranial extension of reflux above the valve was recorded in 44 of 80 symptomatic participants (55.0%) and in 1 of 30 volunteers (3.3%; odds ratio [OR] 35.44; 95% CI: 4.60-273.02; P < 0.001). The median duration of reflux was 0.9 s (interquartile range [IQR] 0.0-2.1) versus 0.0 (0.0-0.0), and the median peak retrograde velocity was 34.8 cm/s (0.0-50.7) versus 0.0 (0.0-0.0); in both cases, P < 0.001. These distributions include participants in whom no reflux was detected; thus, they characterize the entire group rather than only those who exhibited reflux (Table 3).

Figure 1 presents the main functional findings with confidence intervals for the proportions in each group. Figure 2 shows unadjusted odds ratios for comparisons with no zero-count cells. The wide confidence intervals, particularly for findings observed in only one volunteer, indicate imprecise effect estimates.

Table 3 Functional and spectral reflux findings

Finding	Symptomatic adults (n=80)	Asymptomatic volunteers (n=30)	P value
Reflux at rest	20 (25.0)	0 (0.0)	0.001
Reflux during Valsalva	53 (66.3)	3 (10.0)	<0.001
Spectral retrograde component	50 (62.5)	2 (6.7)	<0.001
Reflux duration ≥0.5 s	49 (61.3)	2 (6.7)	<0.001
Reflux duration >1.0 s	38 (47.5)	0 (0.0)	<0.001
Cranial extension above the valve	44 (55.0)	1 (3.3)	<0.001

Reflux duration, s, median (IQR)	0.9 (0.0-2.1)	0.0 (0.0-0.0)	<0.001
Peak retrograde velocity, cm/s, median (IQR)	34.8 (0.0-50.7)	0.0 (0.0-0.0)	<0.001

Data are n (%) unless otherwise indicated. Medians include participants without detected reflux. Binary P values use two-sided Fisher exact tests; continuous P values are from the reported Mann-Whitney analyses. Duration thresholds are nested study definitions and do not establish universal diagnostic cutoffs. IQR, interquartile range.

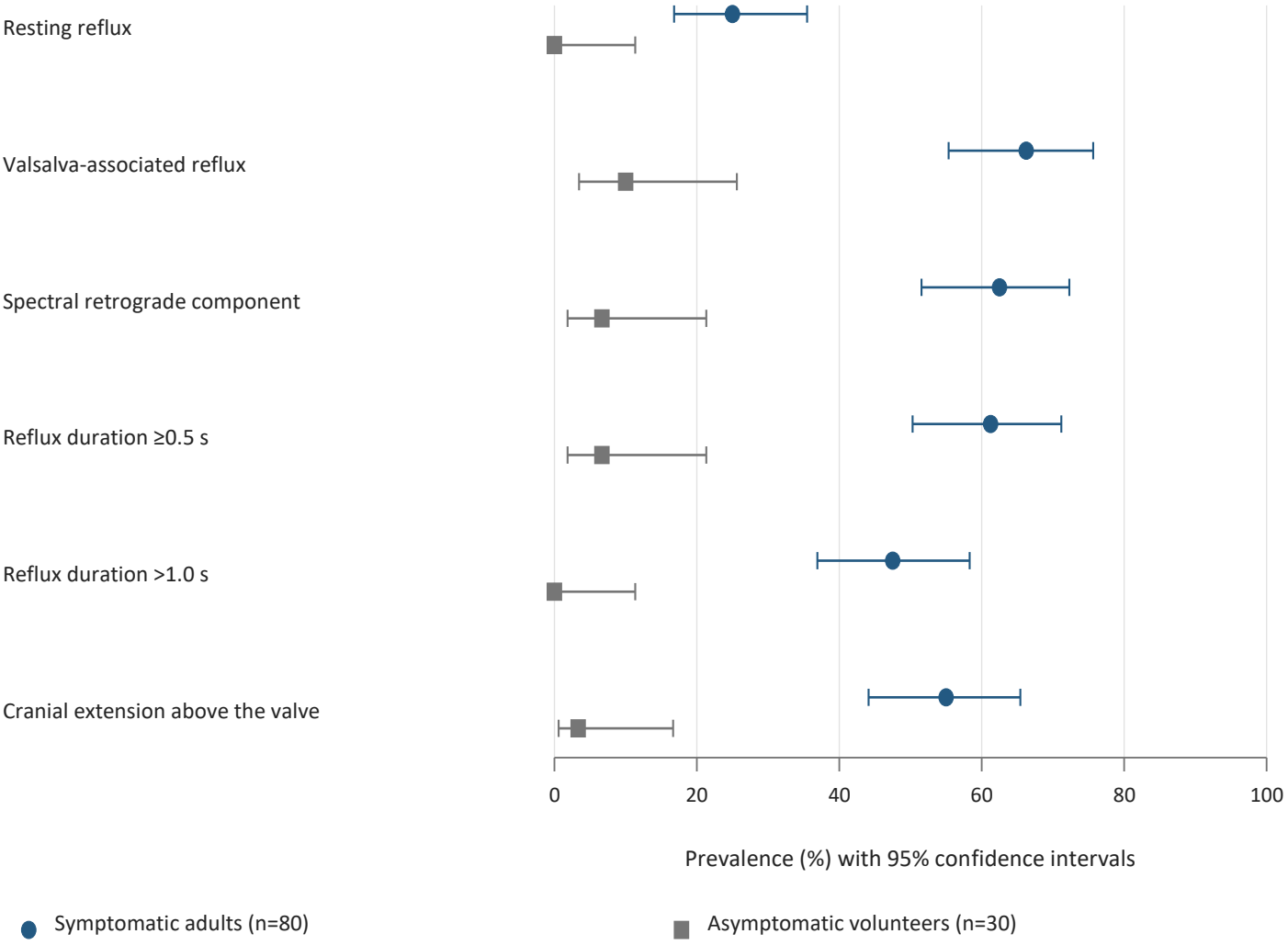


Figure 1 Functional reflux findings in the two groups

Points show participant-level proportions and horizontal lines show Wilson 95% confidence intervals. Symptomatic adults are represented by blue circles and asymptomatic volunteers by gray squares. The denominators are 80 and 30, respectively. These are frequencies within selected samples, not estimates of diagnostic sensitivity or specificity.

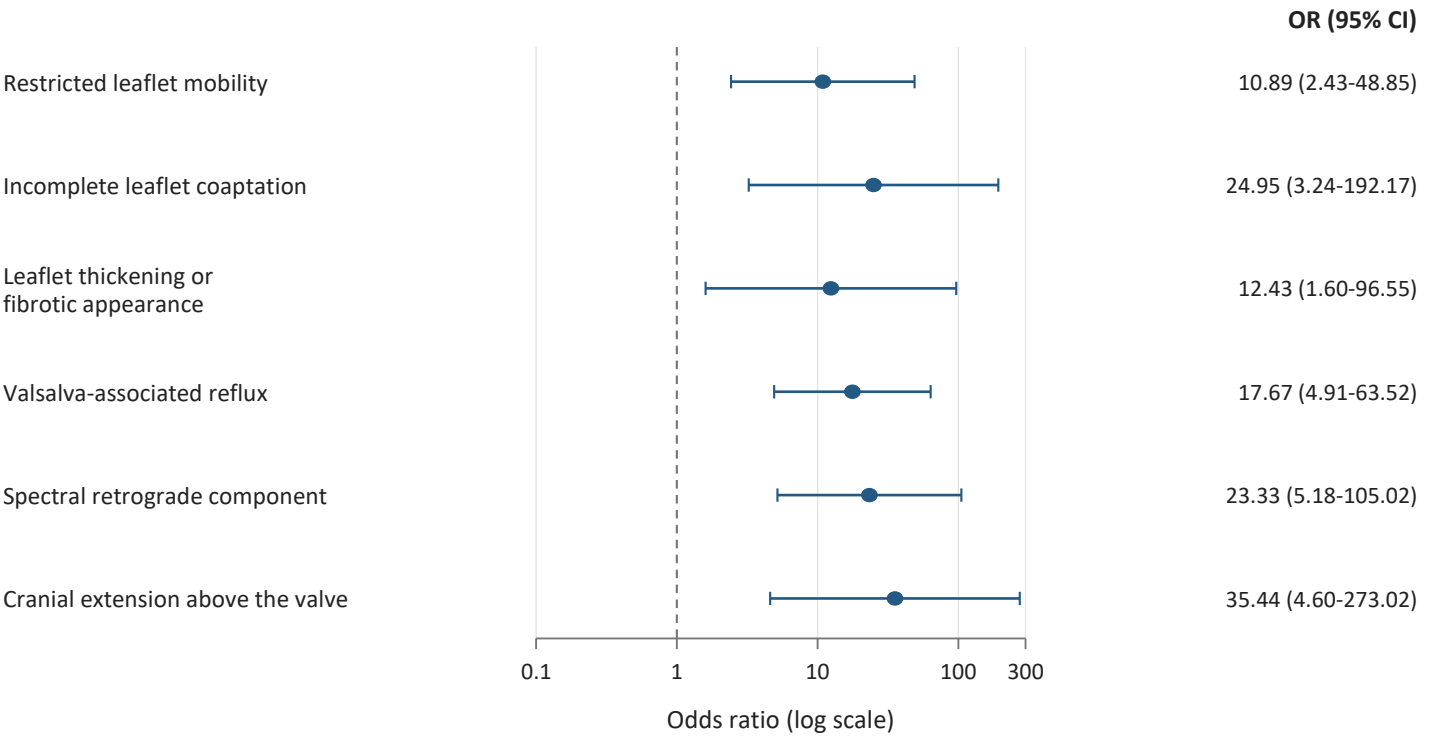


Figure 2 Selected associations with symptomatic group

Unadjusted odds ratios and 95% Wald confidence intervals were calculated based on participant-level 2×2 contingency tables. The dashed line represents an odds ratio of 1. Results with zero-count cells were excluded rather than assigned continuity-corrected estimates.

4. Discussion

This study identified significant differences in the characteristics of jugular reflux between the selected symptomatic adults and the asymptomatic volunteers included in the study. Reflux during the Valsalva maneuver, a retrograde spectral component, prolonged reverse flow, and cranial extension of flow above the valve were more frequent in the symptomatic group. Structural abnormalities of the valve leaflets also differed, whereas the ability to clearly visualize the valve did not. These findings describe an association between group membership and an ultrasound phenotype; they do not demonstrate that the observed reflux was the cause of the reported symptoms.

The distinction between morphology and function is clinically significant. Identifying a valve provides an anatomical observation; it does not indicate whether the valve effectively obstructs cranially directed flow during a pressure-loading maneuver. Conversely, restricted leaflet mobility or incomplete coaptation may support a functional interpretation, but cannot replace a direct assessment of flow. The group comparisons presented here are consistent with this distinction.

Provoked reflux was recorded more frequently than resting reflux. However, without paired participant-level results, the number of additional cases detected during Valsalva cannot be established.

Duration thresholds require interpretation in relation to the acquisition protocol [5]. Air-contrast ultrasonography has also been used to assess jugular valve competence, and comparisons with Doppler methods have been reported [18,19]. The duplex findings presented here do not establish agreement with a separate contrast test.

A larger resting diameter of the internal jugular vein is not a specific marker for valvular insufficiency; the vessel caliber responds to pressure, respiration, and body position. Literature concerning heart failure and venous congestion illustrates this dependency and highlights the need to document the relevant physiological context. [3, 4]

Comparison groups were selected based on the presence or absence of the complaints under study. Consequently, the observed frequencies do not represent estimates of JVR prevalence in an unselected clinical population. Despite similarities in age and sex, differences in specialist referrals, comorbidities, body habitus, pressure loads, or physician expectations may have contributed to the contrast between

groups. Therefore, the high odds ratio for Valsalva-associated reflux should be interpreted in light of its wide confidence interval and the nature of the selected sample.

Earlier studies on transient global amnesia offer an instructive comparison. Cejas et al. reported an association with valvular insufficiency, whereas Baracchini et al. did not confirm the proposed explanation regarding intracranial venous hemodynamics. A negative study on migraine conducted by Rabe et al. further demonstrates that findings regarding one neurological syndrome cannot be generalized to another. Our participants presented with a heterogeneous symptom complex rather than a single, strictly defined neurological disorder. [7, 8, 9]

More recent cognitive studies have examined various exposures and outcomes. Adachi et al. evaluated spontaneous reflux and monitored cognitive status; Yin et al. investigated impaired jugular drainage using flow velocity and luminal behavior during inspiration; and Zhang et al. explored associations with ischemic white matter lesions. The present study included neither comparable neuropsychological testing nor MRI-based cerebral metrics. While these reports underscore the need for further research into jugular hemodynamics, they cannot establish the presence of brain injury or cognitive consequences in our participants. [10, 11, 12]

In radiological practice, a thorough description of an observed phenomenon remains useful, even when its symptomatic significance is uncertain. Caton et al. demonstrated that jugular reflux can mimic a dural arteriovenous fistula of the posterior cranial fossa on MRI/MRA. This highlights the importance of distinguishing the direction and context of blood flow when maintaining an appropriate differential diagnosis. However, this does not justify attributing unexplained symptoms to any instance of retrograde flow detected in the jugular vein. [13]

5. Strengths and Limitations

The study used prospective data collection and the same non-contrast imaging protocol in both groups, with bilateral examination of the IJVs. Anatomical findings were reported separately from flow characteristics, and resting and provoked reflux were treated as separate variables. Participant-level analysis avoided treating the two veins from one person as independent observations.

Several limitations affect the interpretation of the findings. The sample size was small, particularly the volunteer group, and the limited control data resulted in imprecise odds ratio (OR) estimates. While the authors verified the reported results against individual patient records, the report does not include side-specific modeling, a formal missing-data analysis, or paired comparisons of resting and Valsalva findings. Examiners were aware of group assignment and complaints, introducing a risk of observer bias. Potential confounders were not addressed in adjusted models, and secondary comparisons were not corrected for multiplicity.

The study lacked an independent reference standard, external validation, and a formal assessment of reproducibility. Consequently, no claims can be made regarding the sensitivity, specificity, or superiority of this comprehensive assessment approach. Standardization is particularly critical, as factors such as venous compression, body position, respiratory phase, and the intensity of the Valsalva maneuver can all alter the recorded results. Although individuals with severe cardiovascular disease were excluded, this study cannot definitively distinguish primary valvular dysfunction from other hemodynamic factors. Previous IJV catheterization is a further relevant consideration because it may impair valve competence [20]. Moreover, the cross-sectional design precludes establishing a temporal link, that is, whether the observed reflux preceded the onset of symptoms.

6. Future Research Perspectives

Future studies should recruit a clearly defined clinical cohort, document Valsalva performance and anatomical landmarks, and assess reproducibility using blinded review. Analyses should account for paired measurements within participants and relevant confounders. Proposed thresholds or grading systems require independent validation.

7. Conclusion

In this cross-sectional sample, features such as reflux in the jugular vein during the Valsalva maneuver, the presence of retrograde flow (detected via spectral analysis), and the extension of flow cranially beyond the terminal valve were observed more frequently in symptomatic adult patients than in asymptomatic volunteers. Differences in morphological characteristics were also identified, whereas visualization of the valve alone was insufficient to distinguish between the study groups. Research protocols should document valve morphology, the conditions under which reflux occurs, and its spectral and spatial characteristics.

Declarations

Ethics and Consent

The study was approved by the Ethics Committee of the Urgench State Medical Institute (Protocol No. 1, dated January 5, 2024). All participants provided informed consent. This approval and consent also covered the performance of the provocative test

involving the administration of an agitated saline solution (saline-air suspension).

Funding

The study was conducted without external funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

Nargiza Muminjanovna Ozodova, Gulnora Akhmedovna Rozikhodjaeva, and Gulsanam Yusupovna Aytimova contributed to manuscript preparation and revision, reviewed the content, approved the final version, and accept responsibility for the integrity of the work.

Data availability

Data supporting the research findings may be provided by the corresponding author upon reasonable request, subject to confidentiality requirements regarding participants and the institution's internal policies.

Use of generative artificial intelligence

The tool ChatGPT (OpenAI) was used in drafting the English-language text, editing it. The authors have verified and confirmed the content of the work, assuming full responsibility for the submitted manuscript.

References

1. Nova-Baeza P, Valenzuela-Fuenzalida JJ, Valdivia-Arroyo R, Becerra-Rodríguez ES, Escalona-Manzo C, Castaño-Gallego YT, et al. Systematic review and meta-analysis of internal jugular vein variants and their relationship to clinical implications in the head and neck. Diagnostics (Basel). 2024;14(23):2765. doi:10.3390/diagnostics14232765.
2. Rusu MC, Bănică DA, Tudose RC. Venous valves of the head and neck: a narrative review. Surg Radiol Anat. 2026;48:137. doi:10.1007/s00276-026-03910-1.
3. Deschamps J, Denault A, Galarza L, Rola P, Ledoux-Hutchinson L, Huard K, et al. Venous Doppler to assess congestion: a comprehensive review of current evidence and nomenclature. Ultrasound Med Biol. 2023;49(1):3-17. doi:10.1016/j.ultrasmedbio.2022.07.011.
4. Chaudhary R, Sukhi A, Simon MA, Villanueva FS, Pacella JJ. Role of internal jugular venous ultrasound in suspected or confirmed heart failure: a systematic review. J Card Fail. 2022;28(4):639-649. doi:10.1016/j.cardfail.2021.08.009.
5. Nedelmann M, Eicke BM, Dieterich M. Functional and morphological criteria of internal jugular valve insufficiency as assessed by ultrasound. J Neuroimaging. 2005;15(1):70-75. doi:10.1177/1051228404267997.
6. American Institute of Ultrasound in Medicine. AIUM practice parameter for the performance of a peripheral venous ultrasound examination, 2024 revision. J Ultrasound Med. 2026;45(1):E1-E9. doi:10.1002/jum.70049.
7. Cejas C, Cisneros LF, Lagos R, Zuk C, Ameriso SF. Internal jugular vein valve incompetence is highly prevalent in transient global amnesia. Stroke. 2010;41(1):67-71. doi:10.1161/STROKEAHA.109.566315.
8. Baracchini C, Tonello S, Farina F, Viaro F, Atzori M, Ballotta E, et al. Jugular veins in transient global amnesia: innocent bystanders. Stroke. 2012;43(9):2289-2292. doi:10.1161/STROKEAHA.112.654087.
9. Rabe K, Küper M, Holle D, Savidou I, Kastrup O, Jähne-Blasberg A, et al. No evidence of jugular venous valve insufficiency in patients with migraine: a controlled study. J Headache Pain. 2013;14:52. doi:10.1186/1129-2377-14-52.
10. Adachi U, Toi S, Hosoya M, Hoshino T, Seki M, Yoshizawa H, et al. Association of age-related spontaneous internal jugular vein reflux with cognitive impairment and incident dementia. J Alzheimers Dis. 2023;96(3):1221-1230. doi:10.3233/JAD-230771.
11. Yin JH, Chi NF, Sheng WY, Wang PN, Sung YF, Peng GS, et al. Ultrasound evaluation of internal jugular venous insufficiency and its association with cognitive decline. Diagnostics (Basel). 2025;15(11):1427. doi:10.3390/diagnostics15111427.
12. Zhang H, Deng J, He Y, Guo Y, He Y. Whether jugular venous reflux relates to more serious ischemic white matter lesions? Clin Neurol Neurosurg. 2023;225:107582. doi:10.1016/j.clineuro.2022.107582.
13. Caton MT Jr, Callen AL, Copelan AZ, Narsinh KH, Smith ER, Amans MR. Jugular venous reflux can mimic posterior fossa dural arteriovenous fistulas on MRI-MRA. AJR Am J Roentgenol. 2021;216(6):1626-1633. doi:10.2214/AJR.20.24012.
14. Korneeva NV, Lovrikova MA, Zhmerenetsky KV. Methodology for venous outflow assessment during ultrasound of extracranial vessels: status of the problem. Cardiovasc Ther Prev. 2024;23(6):3913. (In Russ.) doi:10.15829/1728-8800-2024-3913.
15. Todsen T, Ewertsen C, Jenssen C, Evans R, Kuenzel J. Head and neck ultrasound: EFSUMB training recommendations for the practice of medical ultrasound in Europe. Ultrasound Int Open. 2022;8(1):E29-E34. doi:10.1055/a-1922-6778.
16. Aguilar Franco L, Rosenberg N, Mohanty A, Baston C, Gargani L, Kimura BJ, et al. Development of validity evidence of a standardized competency tool for internal jugular vein point of care ultrasound: consensus recommendations from international experts. J Gen Intern

Med. 2026;41:2119-2124. doi:10.1007/s11606-025-10098-4.

17. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS Med. 2007;4(10):e296. doi:10.1371/journal.pmed.0040296.

18. Akkawi NM, Agosti C, Borroni B, Rozzini L, Magoni M, Vignolo LA, et al. Jugular valve incompetence: a study using air contrast ultrasonography on a general population. J Ultrasound Med. 2002;21(7):747-751. doi:10.7863/jum.2002.21.7.747.

19. Nedelmann M, Teschner D, Dieterich M. Analysis of internal jugular vein insufficiency: a comparison of two ultrasound methods. Ultrasound Med Biol. 2007;33(6):857-862. doi:10.1016/j.ultrasmedbio.2007.01.001.

20. Wu X, Studer W, Erb T, Skarvan K, Seeberger MD. Competence of the internal jugular vein valve is damaged by cannulation and catheterization of the internal jugular vein. Anesthesiology. 2000;93(2):319-324. doi:10.1097/00000542-200008000-00007.