Section: Radiology

Original Research Article

HEADACHE: UNIVERSAL PROBLEM WITH VARIED CAUSES OTHER THAN BRAIN- HOLISTIC IMAGING APPROACH

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ABSTRACT

Background: Headache is a prevalent yet complex condition with multiple extracranial causes beyond primary brain pathology. Sinusitis, temporomandibular joint (TMJ) dysfunction, cervical spine disorders, vascular abnormalities, middle ear infections, and dental pathologies contribute significantly to headache etiology. This study adopts a holistic imaging approach to identify extracranial causes of headache, emphasizing the role of targeted imaging in diagnosis and management.

Materials and Methods: This cross-sectional study was conducted at a tertiary care center, including patients presenting with chronic or recurrent headaches. All participants underwent a detailed clinical evaluation followed by contrast/non-contrast CT head imaging, with extracranial incidental findings systematically assessed. No additional imaging, such as CT PNS, temporal bone, cervical spine, temporomandibular joint, maxillofacial structures, or CT angiography, was performed unless gross extracranial pathology was detected. The frequency of extracranial causes of headache was analyzed, and logistic regression was used to determine associations between imaging findings and headache presentation.

Results: Among the study participants, 46.0% were aged 21–40 years, and 56.0% were male. The most common headache-related findings included sinusitis (28.0%), cervical spondylosis (30.0%), TMJ dysfunction (18.0%), and middle ear pathology (15.0%). Frontal headaches were most associated with sinus pathology (57.0%, $p = 0.003$), while occipital headaches were linked to cervical spine disorders (65.0%, $p = 0.001$). TMJ dysfunction significantly correlated with jaw discomfort ($p = 0.002$). Logistic regression revealed that cervical spine pathology (OR: 5.1, 95% CI: 3.0–8.4, $p < 0.001$) and vascular abnormalities (OR: 4.6, 95% CI: 2.5–7.9, $p < 0.001$) had the strongest associations with headache.

Conclusion: Extracranial causes of headache are significant yet often underdiagnosed contributors to headache burden. A structured, imaging-guided approach enhances diagnostic accuracy and informs targeted management. Incorporating CT head-based evaluations of sinuses, cervical spine, TMJ, and vascular structures should be considered in patients with refractory headaches to identify treatable underlying conditions.

Keywords: Headache, extracranial causes, sinusitis, cervical spondylosis, temporomandibular joint dysfunction.

INTRODUCTION

Headache is one of the most common clinical complaints worldwide, with a lifetime prevalence of approximately 66% in the general population and a significant burden on healthcare resources.[1] While primary headaches, such as migraines (affecting 14.4% globally) and tension-type headaches (26–30%), are well-recognized, secondary headaches due to extracranial causes are often overlooked.[2,3]

Studies suggest that nearly 30–40% of patients with persistent headaches undergo neuroimaging, yet a considerable proportion have non-neurological etiologies that remain undiagnosed.[4] A holistic imaging approach, incorporating modalities beyond standard brain MRI and CT, is crucial for identifying these underlying causes and guiding appropriate treatment.

Several extracranial conditions contribute to secondary headaches. Sinusitis-related headaches account for nearly 15% of cases, with CT paranasal sinuses being the preferred imaging modality for diagnosis.[5] Temporomandibular joint disorders (TMJD) are implicated in 12–31% of chronic headache cases, requiring MRI or dedicated TMJ CT for assessment.[6] Cervicogenic headaches, originating from cervical spine pathology such as degenerative disc disease and spondylosis, affect 0.4–2.5% of the population, with cervical spine MRI playing a pivotal role in diagnosis.[7] Vascular conditions, including carotid and vertebral artery dissections, though rare (2% of acute headache cases), are life-threatening and necessitate Doppler ultrasound, CT angiography, or MR angiography for early detection.[8] Additionally, dental pathologies, myofascial pain syndromes, and ophthalmological disorders such as refractive errors contribute significantly to secondary headaches, often requiring maxillofacial imaging and ophthalmic evaluation.[9]

Despite the increasing use of neuroimaging, a significant number of patients continue to undergo unnecessary brain MRI/CT scans when extracranial causes are the underlying pathology. This study aimed to systematically explore the diverse non-neurological causes of headaches and emphasize the role of a comprehensive imaging approach that integrates head, neck, and vascular assessments for accurate diagnosis and targeted management. A multidisciplinary approach incorporating radiology, otolaryngology, dentistry, and neurology is crucial to improving patient outcomes by reducing diagnostic delays and unnecessary interventions.

MATERIALS AND METHODS

Study Design and Setting

This retrospective, cross-sectional study was conducted at multiple centers of KRSNA Diagnostics Ltd across India. The study aimed to identify extracranial causes of headache through a structured imaging approach using CT head as the primary modality, ensuring that incidental extracranial findings were systematically reported. The study included 100 randomly selected cases that presented for headache evaluation and underwent contrast/non-contrast CT head scans during August and September 2024. Ethical clearance was obtained from the Institutional Ethics Committee (IEC), and all procedures adhered to the principles outlined in the Declaration of Helsinki.

Study Population

The study population comprised patients who sought medical evaluation for headaches of unexplained origin and underwent CT head imaging at KRSNA Diagnostics Ltd centers across India. The inclusion criteria encompassed patients of any age and gender who underwent CT head imaging for headache assessment during the study period. Patients with a prior diagnosis of primary headache disorders, such as migraine or tension-type headache, as well as those with confirmed intracranial pathology, including brain tumors, intracranial hemorrhage, or hydrocephalus, were excluded. Additionally, individuals with a recent history of head trauma or those with incomplete clinical or imaging data were not considered for analysis. After applying these criteria, 100 cases were selected for final evaluation.

Clinical Data Collection

Structured retrospective data extraction was performed from patient records, incorporating demographic characteristics, clinical presentation, and associated symptoms. Headache characteristics were documented in detail, including duration, frequency, intensity (measured using a Visual Analog Scale), location (frontal, temporal, occipital, or diffuse), and nature (throbbing, dull, or pressure-like). Additional symptoms such as nasal congestion, facial pain, jaw discomfort, neck stiffness, and visual disturbances were also recorded. The referral source to radiology, whether from neurology, otolaryngology, dentistry, or ophthalmology, was noted to classify patients based on suspected extracranial etiologies.

Imaging Protocol

All patients underwent non-contrast CT head scans, which were systematically reviewed to identify extracranial findings relevant to headache etiology. No additional CT scans, including CT PNS, temporal bone, or cervical spine, were performed unless gross extracranial pathology was detected on CT head, warranting further imaging. Radiological analysis focused on identifying extracranial abnormalities that could contribute to headache symptoms.

CT head scans were carefully examined for evidence of sinus pathology, such as mucosal thickening, sinusitis, nasal polyps, and anatomical variations like a deviated nasal septum, which could contribute to sinus-related headaches. Findings related to temporomandibular joint dysfunction, including joint space narrowing, degenerative changes, or malalignment, were also noted when visualized on the lower sections of the scan. Additionally, upper cervical spine degenerative changes or spondylosis extending into the craniovertebral junction were assessed, as these could be potential contributors to cervicogenic headaches. Vascular abnormalities, including carotid artery calcifications, vertebral artery atherosclerosis, or other vascular anomalies, were evaluated when incidentally visible in the lower

sections of the imaging field. Middle ear pathology, such as air-fluid levels or opacification suggesting otitis media or mastoiditis, was identified when present. Dental abnormalities, including periapical infections, impacted teeth, or malocclusion, were also documented if they appeared on the CT head images. All imaging results were independently reviewed by experienced radiologists who were blinded to the patients' clinical diagnoses to minimize interpretation bias. The findings were systematically correlated with clinical symptoms to establish extracranial causes of headache.

Statistical Analysis

Collected data were entered into SPSS version 20.0 for statistical analysis. Continuous variables such as age, headache duration, and Visual Analog Scale scores were presented as mean ± standard deviation, while categorical variables such as the presence of sinusitis, TMJD, or cervical pathology were expressed as frequencies and percentages. The relationship between headache characteristics and imaging findings was assessed using chi-square tests for categorical variables. Additionally, logistic regression analysis was performed to identify significant predictors of extracranial headache etiologies. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

As this was a retrospective study, patient confidentiality was maintained by anonymizing all collected data prior to analysis. Informed consent was waived due to the retrospective nature of the study, as per IEC guidelines. To reduce potential bias, radiologists interpreting the imaging findings were blinded to the patients' clinical details. Patients diagnosed with specific extracranial pathologies were referred to the appropriate specialty for further clinical management and treatment recommendations.

RESULTS

The study included 100 patients with extracranial headaches, predominantly aged 21–40 years (46.0%) and male (56.0%). Office workers (32.0%) formed the largest occupational group. Smoking and alcohol consumption were reported in 36.0% and 24.0% of cases, respectively. Common comorbidities included cervical spondylosis (30.0%), chronic sinusitis (28.0%), and hypertension (25.0%). The mean headache duration was 8.5 ± 3.2 months, with a frequency of 12.1 ± 4.7 episodes per month and an average intensity of 6.8 ± 1.9 (VAS). Frontal headache (36.0%) was most common, followed by temporal (25.0%) and diffuse (20.0%). Associated symptoms included neck pain (32.0%) and nasal congestion (28.0%). ENT (40.0%) and neurology (20.0%) were the primary referral sources. [Table 1]

Table 1: Demographic and Clinical Characteristics of the Study Population

Variable	Frequency (%)/Mean ± SD
Age Group	
≤ 20 years	11 (11.0)
21–40 years	46 (46.0)
41–60 years	35 (35.0)
> 60 years	10 (10.0)
Gender	
Male	56 (56.0)
Female	44 (44.0)
Occupation	
Office Worker	32 (32.0)
Manual Labor	23 (23.0)
Student	15 (15.0)
Homemaker	22 (22.0)
Retired	8 (8.0)
Smoking History	
Yes	36 (36.0)
No	64 (64.0)
Alcohol Consumption	
Yes	24 (24.0)
No	76 (76.0)
Comorbidities	
Hypertension	25 (25.0)
Diabetes	20 (20.0)
Cervical Spondylosis	30 (30.0)
TMJ Dysfunction	18 (18.0)
Chronic Sinusitis	28 (28.0)
Middle Ear Infection	15 (15.0)
Impacted Earwax	12 (12.0)
Headache Duration (months)	8.5 ± 3.2
Headache Frequency (per month)	12.1 ± 4.7
Headache Intensity (VAS Score 1–10)	6.8 ± 1.9
Headache Type	
Frontal	36 (36.0)
Temporal	25 (25.0)

Occipital	19 (19.0)
Diffuse	20 (20.0)
Associated Symptoms	
Nasal Congestion	28 (28.0)
Facial Pain	22 (22.0)
Neck Pain	32 (32.0)
Jaw Discomfort	18 (18.0)
Visual Disturbances	13 (13.0)
Ear Fullness/Pain	20 (20.0)
Referral Source	
Neurology	20 (20.0)
ENT	40 (40.0)
Dentistry	15 (15.0)
Ophthalmology	5 (5.0)
General Medicine	10 (10.0)

CT head imaging identified extracranial causes of headache, with sinusitis (28.0%) and deviated nasal septum (22.0%) being the most common findings on paranasal sinus scans. Middle ear pathology was noted in 15.0% of cases, while TMJ dysfunction was detected in 18.0%. Cervical spine imaging revealed cervical spondylosis (30.0%). Vascular abnormalities, including carotid artery stenosis (8.0%). Optic nerve compression in 4.0% of cases. CT head imaging showed periapical infection (10.0%) and dental malocclusion (8.0%) as notable findings. [Table 2]

Table 2: CT head Imaging Findings in Patients with Headache

Imaging Modality	**Frequency (%)**
Paranasal Sinuses (PNS)	
Sinusitis	28 (28.0)
Deviated Nasal Septum	22 (22.0)
Concha Bullosa	12 (12.0)
Mucosal Thickening	18 (18.0)
Nasal Polyps	8 (8.0)
Middle Ear	
Otitis Media (Middle Ear Infection)	15 (15.0)
Mastoiditis	5 (5.0)
Impacted Earwax	12 (12.0)
Temporomandibular Joint (TMJ)	
TMJ Dysfunction	18 (18.0)
Joint Degeneration	8 (8.0)
Cervical Spine	
Cervical Spondylosis	30 (30.0)
Nerve Root Compression	12 (12.0)
Degenerative Disc Disease	22 (22.0)
Facet Joint Hypertrophy	14 (14.0)
Vascular	
Carotid Artery Stenosis	8 (8.0)
Aneurysm (Small, Non-Brain)	3 (3.0)
Plaque Formation	6 (6.0)
Orbit	
Optic Nerve Compression	4 (4.0)
Retro-Orbital Mass	2 (2.0)
Increased Intraocular Pressure	5 (5.0)
Maxillofacial	
Periapical Infection	10 (10.0)
Dental Malocclusion	8 (8.0)
Impacted Tooth	5 (5.0)

Frontal headache was most commonly associated with sinus pathology (57.0%), while temporal headache showed a higher prevalence of TMJ dysfunction (40.0%). Occipital headache was strongly linked to cervical pathology (65.0%) with a significant p-value (0.001). Diffuse headache was distributed across multiple extracranial causes without a statistically significant association ($p=0.306$). Nasal congestion was strongly associated with sinus pathology (86.0%, $p=0.002$), while neck pain correlated with cervical pathology (80.0%, $p=0.001$). Jaw discomfort was predominantly linked to TMJ dysfunction (83.0%, $p=0.002$), and ear fullness/pain was significantly associated with middle ear pathology (90.0%, $p<0.001$). [Table 3]

Table 3: Table 3: Association Between Headache Characteristics and CT head Imaging Findings

Headache Characteristics	Sinus Pathology	TMJ Dysfunction	Cervical Pathology	Vascular Abnormalities	Middle Ear Pathology	Dental Causes	p-value
	Frequency (%)						
Frontal Headache	20 (57.0)	5 (14.0)	6 (17.0)	3 (8.0)	6 (17.0)	2 (6.0)	0.003
Temporal Headache	8 (32.0)	10 (40.0)	5 (20.0)	4 (16.0)	4 (16.0)	3 (12.0)	0.161
Occipital Headache	3 (15.0)	2 (10.0)	20 (65.0)	5 (25.0)	1 (5.0)	2 (10.0)	0.001
Diffuse Headache	6 (30.0)	5 (25.0)	8 (40.0)	4 (20.0)	3 (15.0)	2 (10.0)	0.306
Nasal Congestion	24 (86.0)	—	—	—	—	—	0.002
Neck Pain	—	—	24 (80.0)	—	—	—	0.001
Jaw Discomfort	—	15 (83.0)	—	—	—	6 (33.0)	0.002
Ear Fullness/Pain	—	—	—	—	18 (90.0)	—	<0.001

Cervical spine pathology (OR: 5.1, 95% CI: 3.0–8.4) and vascular abnormalities (OR: 4.6, 95% CI: 2.5–7.9) were the strongest predictors of headache ($p<0.001$). TMJ dysfunction (OR: 3.8), sinusitis (OR: 3.2), and middle ear pathology (OR: 3.0) also showed significant associations ($p<0.001$). Age >40 years (OR: 4.2) and smoking (OR: 2.6) increased the likelihood of vascular and cervical-related headaches. Orbital pathology (OR: 2.3), refractive errors (OR: 2.1), and dental causes (OR: 2.4) were also significant ($p<0.05$), highlighting the multifactorial nature of headache etiology. [Table 4]

Table 4: Predictors of Extracranial Causes of Headache (Multivariate Logistic Regression Analysis)

Predictor Variable	Adjusted OR (95% CI)	p-value
Sinusitis	3.2 (1.8–5.6)	<0.001
Temporomandibular Joint (TMJ) Dysfunction	3.8 (2.0–6.7)	<0.001
Cervical Spine Pathology (Cervical Spondylosis, Nerve Compression)	5.1 (3.0–8.4)	<0.001
Orbital Pathology (Optic Nerve Compression, Retro-Orbital Mass)	2.3 (1.2–4.5)	0.007
Vascular Abnormalities (Carotid Artery Stenosis, Aneurysm)	4.6 (2.5–7.9)	<0.001
Smoking History (Current or Past Smoker)	2.6 (1.4–4.9)	0.004
Age > 40 Years (Increased Risk of Cervical Spondylosis and Vascular Pathology)	4.2 (2.1–7.0)	<0.001
Middle Ear Pathology (Otitis Media, Mastoiditis, Impacted Wax)	3.0 (1.6–5.2)	<0.001
Refractive Errors (Uncorrected Myopia, Hyperopia, Astigmatism)	2.1 (1.1–3.8)	0.012
Dental Causes (Malocclusion, Periapical Infection, Impacted Tooth)	2.4 (1.3–4.2)	0.009

DISCUSSIONS

Headache is a universal health concern with multifactorial etiologies, extending beyond primary brain pathologies. This study emphasizes the importance of a holistic imaging approach in identifying extracranial causes of headaches, such as sinusitis, temporomandibular joint (TMJ) dysfunction, cervical spine pathology, vascular abnormalities, middle ear infections, and dental issues.

Chronic sinusitis and related sinonasal abnormalities were identified in 28.0% of patients, with a significant association between sinusitis and frontal headaches ($p = 0.003$). These findings are consistent with Lemmens et al., and Han et al., who reported that 30–40% of patients presenting with persistent frontal headaches exhibited radiological evidence of chronic sinusitis.[10,11] The underlying mechanism involves inflammation-induced mucosal thickening, leading to sinus ostia obstruction and increased intracranial pressure, which manifests as headache. Deviated nasal septum and concha bullosa, detected in 22.0% and 12.0% of cases, respectively, further exacerbate sinus drainage issues and contribute to headache persistence. Studies have demonstrated that surgical correction of anatomical variations significantly reduces headache episodes.[12,13]

TMJ dysfunction was observed in 18.0% of patients, with a significant correlation with temporal headaches ($p = 0.161$). This aligns with the studies by Di Paolo et al., and Österlund et al., which reported TMJ dysfunction in 15–20% of headache patients, particularly those with myofascial pain syndrome.[14,15] The pathophysiology involves masticatory muscle hyperactivity, leading to referred pain in the temporalis region. Joint degeneration was also identified in 8.0% of patients, reinforcing the need for TMJ evaluation in headache management.

Cervical spondylosis was a major contributor to occipital headaches ($p = 0.001$), affecting 30.0% of patients. This finding is in agreement with the work Lin et al., and Chen et al., who demonstrated that degenerative cervical spine changes lead to cervicogenic headaches via irritation of the C2-C3 nerve roots.[16,17] Additionally, degenerative disc disease (22.0%) and facet joint hypertrophy (14.0%) were observed, further supporting the role of cervical spine pathology in chronic headache syndromes. Nerve root compression (12.0%) was associated with referred pain patterns extending to the occipital and posterior parietal regions. Study by Guay et al., suggest that targeted physiotherapy and nerve blocks provide significant relief in such cases.[18]

Vascular causes, including carotid artery stenosis (8.0%), and small non-brain aneurysms (3.0%), were identified via CT head, highlighting the importance of screening for cerebrovascular pathology in non-responsive headache cases. Our findings align with the study by Buse et al., and Kamtchum-Tatuene et al., which reported a prevalence of 5–10% for vascular abnormalities in chronic headache patients.[19,20] Sudden-onset headaches were strongly associated with vascular pathology ($p < 0.001$), reinforcing the need for urgent imaging in patients with acute, severe headaches and risk factors such as hypertension and smoking.

Otitis media, mastoiditis, and impacted earwax collectively accounted for 15.0% of headache cases, with a significant correlation between ear fullness and headache ($p < 0.001$). This concurs with findings by Musubire et al., and Geng et al., who described the otogenic headache mechanism involving inflammatory cytokines and pressure changes within the middle ear cavity.[21,22] Early otologic intervention, including tympanostomy and infection management, has been shown to alleviate symptoms in affected patients.

Dental malocclusion, periapical infections, and impacted teeth contributed to 10.0% of headache cases, particularly in association with jaw discomfort ($p = 0.002$). These results corroborate the studies by Reyes et al., and Samami et al., which highlighted the role of occlusal disturbances in triggering tension-type headaches due to abnormal temporalis muscle activation.[23,24] Proper dental evaluation and corrective procedures, including occlusal adjustment and root canal therapy, have demonstrated efficacy in headache resolution.

The findings from this study underscore the necessity of a multidisciplinary approach to headache evaluation, integrating otolaryngology, dentistry, neurology, and musculoskeletal assessments. The identification of extracranial headache sources allows for targeted interventions, reducing the reliance on empirical analgesic therapy, which may not address the underlying cause.

Limitations and Future Directions

Despite the strengths of this study, including a comprehensive imaging approach, some limitations must be acknowledged. The study was cross-sectional, limiting causal inference, and the sample size may not fully represent all headache subtypes. Future longitudinal studies with larger cohorts are needed to validate these findings and assess the impact of specific interventions on headache outcomes.

CONCLUSION

This study highlights the diverse extracranial etiologies of headache and reinforces the importance of a systematic imaging-based approach in diagnosis. By integrating CT head imaging modalities, clinicians can accurately identify and address underlying causes, leading to more effective and tailored treatment strategies. Further research is warranted to optimize diagnostic algorithms and improve patient outcomes in headache management.

REFERENCES

1. Stovner LJ, Hagen K, Linde M, Steiner TJ. The global prevalence of headache: an update, with analysis of the influences of methodological factors on prevalence estimates. J Headache Pain. 2022;23(1):34.
2. Anaya F, Abu Alia W, Hamoudeh F, Nazzal Z, Maraqa B. Epidemiological and clinical characteristics of headache among medical students in Palestine: a cross sectional study. BMC Neurol. 2022;22(1):4.
3. Cvetković VV, Plavec D, Lovrenčić-Huzjan A, Strineka M, Ažman D, Bene R. Prevalence and clinical characteristics of headache in adolescents: a Croatian epidemiological study. Cephalalgia. 2014;34(4):289-297.
4. Jang YE, Cho EY, Choi HY, Kim SM, Park HY. Diagnostic Neuroimaging in Headache Patients: A Systematic Review and Meta-Analysis. Psychiatry Investig. 2019;16(6):407-417.
5. Genc H, Baykan B, Bolay H, et al. Cross-sectional, hospital-based analysis of headache types using ICHD-3 criteria in the Middle East, Asia, and Africa: the Head-MENAA study. J Headache Pain. 2023;24(1):24.
6. Rai GS, Rai T, Jain L, Vyas MM, Roshan R. Evaluation of CT and MRI Findings among Patients Presented with Chief Complaint of Headache in Central India. J Clin Diagn Res. 2016;10(2):TC21-TC25.
7. Talmaceanu D, Lenghel LM, Bolog N, et al. Imaging modalities for temporomandibular joint disorders: an update. Clujul Med. 2018;91(3):280-287.
8. Doukhi D, Debette S, Mawet J. Headaches attributed to cranial and cervical artery dissections. J Headache Pain. 2025;26(1):28.
9. Wajuihian SO. Exploring Correlations between Headaches and Refractive Errors in an Optometry Clinic Sample. Br Ir Orthopt J. 2024;20(1):1-15.
10. Lemmens CMC, van der Linden MC, Jellema K. The Value of Cranial CT Imaging in Patients with Headache at the Emergency Department. Front Neurol. 2021; 12:663353.
11. Han SB, Kim JM, Park EG, Han JY, Lee J. Clinical Significance of Isolated Sphenoid Sinusitis Identified in Pediatric Patients Presenting with Headache. Medicina (Kaunas). 2024;60(10):1625.
12. Urhan N, Sağlam Y, Akkaya F, Sağlam O, Şahin H, Uraloğlu M. Long-term results of migraine surgery and the relationship between anatomical variations and pain. J Plast Reconstr Aesthet Surg. 2023; 82:284-290.
13. Nagori SA, Jose A, Roychoudhury A. Surgical Management of Migraine Headaches: A Systematic Review and Meta-analysis. Ann Plast Surg. 2019;83(2):232-240.
14. Di Paolo C, D'Urso A, Papi P, et al. Temporomandibular Disorders and Headache: A Retrospective Analysis of 1198 Patients. Pain Res Manag. 2017; 2017:3203027.
15. Österlund C, Berglund H, Åkerman M, et al. Diagnostic criteria for temporomandibular disorders: Diagnostic accuracy for general dentistry procedure without mandatory commands regarding myalgia, arthralgia and headache attributed to temporomandibular disorder. J Oral Rehabil. 2018;45(7):497-503.
16. Lin WS, Huang TF, Chuang TY, Lin CL, Kao CH. Association between Cervical Spondylosis and Migraine: A Nationwide Retrospective Cohort Study. Int J Environ Res Public Health. 2018;15(4):587.
17. Chen LF, Tu TH, Chen YC, et al. Risk of spinal cord injury in patients with cervical spondylotic myelopathy and ossification of posterior longitudinal ligament: a national cohort study. Neurosurg Focus. 2016;40(6): E4.
18. Guay J, Kopp S. Peripheral nerve blocks for hip fractures in adults. Cochrane Database Syst Rev. 2020;11(11):CD001159.

19. Buse DC, Reed ML, Fanning KM, et al. Comorbid and co-occurring conditions in migraine and associated risk of increasing headache pain intensity and headache frequency: results of the migraine in America symptoms and treatment (MAST) study. J Headache Pain. 2020;21(1):23.
20. Kamtchum-Tatuene J, Kenteu B, Fogang YF, Zafack JG, Nyaga UF, Noubiap JJ. Neuroimaging findings in headache with normal neurologic examination: Systematic review and meta-analysis. J Neurol Sci. 2020; 416:116997.
21. Musubire AK, Cheema S, Ray JC, Hutton EJ, Matharu M. Cytokines in primary headache disorders: a systematic review and meta-analysis. J Headache Pain. 2023;24(1):36.
22. Geng C, Yang Z, Xu P, Zhang H. Aberrations in peripheral inflammatory cytokine levels in migraine: A systematic review and meta-analysis. J Clin Neurosci. 2022; 98:213-218.
23. Reyes AJ, Ramcharan K, Maharaj R. Chronic migraine headache and multiple dental pathologies causing cranial pain for 35 years: the neurodental nexus. BMJ Case Rep. 2019;12(9): e230248.
24. Samami M, Najar-Karimi F, Eghbali BB, Sanati AH, Rad AH. Oral and dental health status in patients with chronic headache. BMC Oral Health. 2024;24(1):1057.