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Evaluation of nasal obstruction in nasal septum deviations using objective and subjective methods

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Ethics Committee Approval
The study was approved by the Ethics Committee of University of Health Sciences, Sancaktepe Sehit Prof. Dr. Ilhan Varank Hospital (Approval No: 218629386, Date: June 23, 2023).
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Abstract

Background/Aim: Nasal septum deviation (NSD) is a prevalent cause of nasal obstruction, significantly impairing quality of life. Although various subjective and objective assessment tools exist, the correlation between these methods remains insufficiently investigated. This study aimed to evaluate the relationship between septal deviation morphology and peak nasal inspiratory flow (PNIF) measurements, and to determine the correlation between objective PNIF values and subjective Nasal Obstruction Symptom Evaluation (NOSE) scores.
Methods: Between July and September 2023, 52 patients diagnosed with NSD and nasal obstruction, along with 20 healthy controls, were enrolled. Patients were classified into three groups (A, B, and C) based on the degree of nasal obstruction. PNIF measurements and NOSE scores were obtained from all participants.
Results: The mean NOSE score and PNIF value in the study group were 59.33 (27.19) and 76.73 (38.76) l/min, respectively, while the mean PNIF value in the control group was 145.5 (17.01) l/min. Statistically significant differences were found in PNIF and NOSE scores between groups. A strong correlation was observed between PNIF and NOSE scores (P=0.004).
Conclusion: The combined use of objective PNIF measurements and subjective NOSE assessments offers a comprehensive evaluation of nasal obstruction due to septal deviation, improving diagnostic accuracy and clinical decision-making.

Keywords: nasal, septum, deviation, inspiratory, flow

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Introduction

The nose plays a critical role in warming, humidifying, and filtering inspired air, while also acting as a protective barrier for the lower respiratory tract. It significantly contributes to respiratory resistance by influencing nasal airflow dynamics. The airflow characteristics within the nasal cavity vary depending on the respiratory phase and activity level. At rest, inspiration typically demonstrates laminar flow, whereas expiration tends to be more turbulent. During physical exertion, turbulence increases substantially [1].

Nasal obstruction has a considerable impact on quality of life and can result from various anatomical and environmental factors. The nasal septum is integral to airflow regulation, and its deviation is a leading cause of nasal obstruction [2]. Multiple diagnostic tools, both subjective and objective, are available for its evaluation.

It is widely utilized in both clinical and research settings to assess nasal obstruction severity and monitor treatment outcomes [3-7]. This study aimed to assess the impact of septal deviation morphology on PNIF measurements and to investigate the correlation between PNIF and NOSE scores. PNIF measures the maximum inspiratory airflow through the nasal passages, providing an objective evaluation of nasal patency.

Materials and methods

This prospective controlled study was conducted between July and September 2023. Fifty-two patients presenting with nasal obstruction symptoms and diagnosed with NSD were included. The study group comprised 21 females and 31 males, with a mean age of 33.36 (10.69) years (range: 18–64). The control group consisted of 11 females and 9 males, with a mean age of 36.9 (11.3) years (range: 20–64). Exclusion criteria included respiratory infections, bronchial asthma, chronic lung diseases, acute or chronic sinusitis, nasal polyposis, allergic rhinitis, and smoking.

Informed consent was obtained from all participants in accordance with the 1996 Helsinki Declaration. Ethical approval was granted by SBU Sancaktepe Sehit Prof. Dr. Ilhan Varank SUAM (Approval No: 218629386, Date: June 23, 2023).

Nasal obstruction was subjectively assessed using the NOSE scale (Table 1), a validated five-item questionnaire scored on a five-point Likert scale, yielding a total score of 0–100 [8]. The Turkish version, validated in 2018, is reliable for assessing patients with NSD. PNIF measurements were performed in a room maintained at 20–22°C and 25–35% humidity, repeated three times in the sitting position, with the highest value recorded (Figure 1). Disinfected masks were used. The control group comprised age- and gender-matched healthy volunteers. Nasal examinations included anterior rhinoscopy and nasal endoscopy with a 0° telescope. Patients were classified by septal deviation type (Figure 2) [9]:

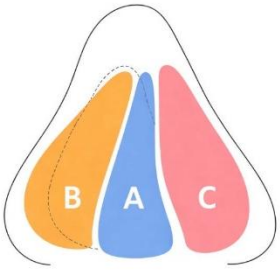
Group A: Obstruction of one-third of the nasal cavity.
Group B: Obstruction of two-thirds.
Group C: Complete obstruction.

Statistical analysis

Statistical analysis performed using statistical package SPSS software (Version 25.0, SPSS Inc., Chicago, IL, USA). The normal distribution for each continuous variable was checked with Kolmogorov Smirnov and Histograms, and all numerical data expressed as a median (minimum-maximum) or rate. The categorical variables between the groups were analyzed using the Chi-Square test. One Way ANOVA test used for normally distributed data and the Kruskal Wallis test for non-normally distributed data. As the variance analysis was significant, comparisons made using the Post-hoc Tukey test or the Mann-Whitney U test. Correlations tested with Spearman's correlation test.

Figure 1: PNIF measurement methodology

Figure 2: Classification of septal deviation types



Results

The study group had mean NOSE and PNIF values of 59.33 (27.19) and 76.73 (38.76) l/min, respectively. The control group's mean PNIF was 145.5 (17.01) l/min (Table 2). The difference in PNIF values between the groups was statistically significant (P=0.004) (Figure 3, 4).

Significant differences were also found among Groups A, B, and C in PNIF values: P=0.004 (A vs. B), P=0.003 (A vs. C), and P=0.002 (B vs. C). A strong correlation was identified between PNIF and NOSE scores (P=0.004). Statistically significant differences in NOSE scores were also observed between Groups A and C, and between Groups B and C (Table 3, Figure 5).

Table 1: NOSE scale

Over the past month, how much of a problem was:	Not a problem	Very mild problem	Moderate problem	Fairly bad problem	Severe problem
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

Figure 3: PNIF values for Groups A, B, and C.

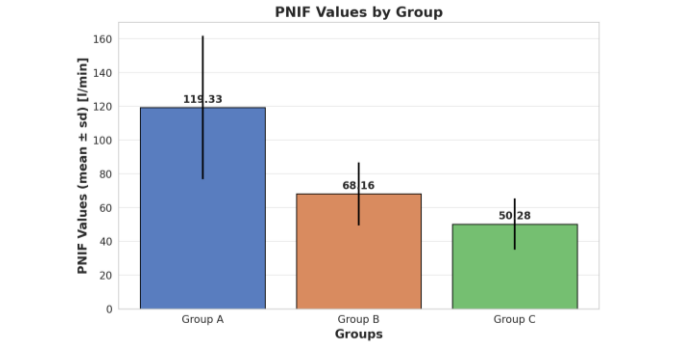


Figure 4: NOSE scores for Groups A, B, and C.

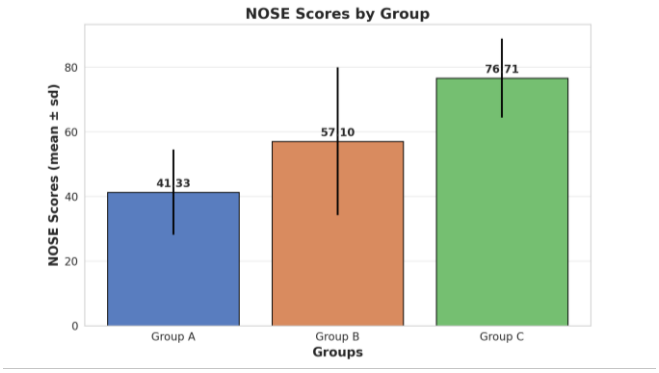


Figure 5: Grouped bar chart showing NOSE scores and PNIF values by deviation types.

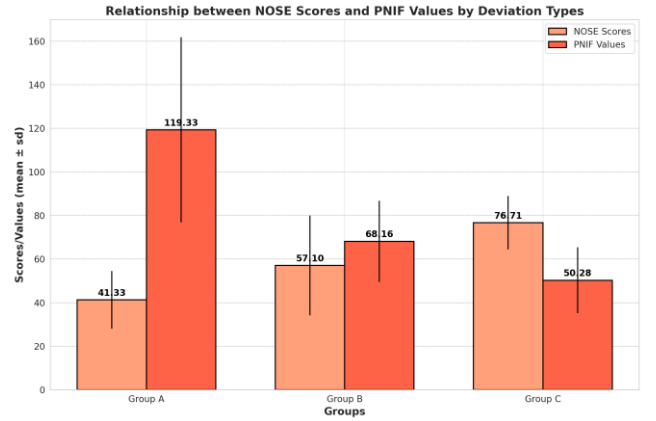


Table 2: Demographics and NOSE/PNIF scores

Group	Gender (F/M)	*P*-value	Age mean (SD)	*P*-value	NOSE mean (SD)	PNIF mean (SD)	*P*-value
Study Group	21/31	>0.05	33.36 (10.69)	>0.05	59.33 (27.19)	76.73 (38.76)	0.007
Control Group	11/9	>0.05	36.9 (11.3)	>0.05	-	145.5 (17.01)	-

Table 3: NOSE and PNIF scores by deviation types

Group	NOSE mean (SD)	*P*-value (NOSE)	PNIF mean (SD) [l/min]	*P*-value (PNIF)
A (n=15)	41.33 (13.19)	Ref	119.33 (42.5)	Ref
B (n=19)	57.10 (22.87)	0.004 (A vs B)	68.16 (18.64)	<0.05
C (n=18)	76.71 (12.2)	0.003 (A vs C)	50.28 (15.1)	0.002 (A vs C)

Discussion

Nasal obstruction is one of the most common complaints encountered in ENT practice, with NSD being the most frequent underlying pathology. Traumas during intrauterine development, birth, or early childhood can affect septal growth and lead to deviations, while genetic factors may also play a role [4, 5].

Assessment of nasal obstruction involves both subjective scales and objective techniques. PNIF is recognized for its low cost, portability, and ease of use, making it an attractive option in clinical practice [9, 10]. Previous studies on the correlation between objective and subjective assessments have yielded conflicting results [11, 12]. Some report weak correlations, suggesting that each method measures different aspects of obstruction [13, 14]. Our findings demonstrate a significant correlation between PNIF and NOSE scores, supporting their complementary use for a more comprehensive assessment.

Conclusion

The combined use of PNIF and NOSE provides a thorough evaluation of nasal obstruction severity in patients with NSD. This approach facilitates more precise diagnosis, enhances treatment monitoring, and improves overall patient care. Future research should involve larger populations and investigate the integration of PNIF with advanced imaging modalities.

References

1. Özcan M. Anatomy and Physiology of the Nose. In: Koç C, ed. Diseases of the Ear, Nose, Throat, and Head and Neck Surgery. 3rd ed. Ankara: Güneş Tıp Kitabevleri; 2019:459-64.
2. Valero A, Navarro AM, Del Cuvillo A, et al. Position paper on nasal obstruction: evaluation and treatment. J Investig Allergol Clin Immunol. 2018;28:67-90.
3. Marro M, Mondina M, Stoll D, de Gabory L. French validation of the NOSE and RhinoQOL questionnaires in the management of nasal obstruction. Otolaryngol Head Neck Surg. 2011;144:988-93.
4. Mozzanica F, Urbani E, Atac M, et al. Reliability and validity of the Italian nose obstruction symptom evaluation (I-NOSE) scale. Eur Arch Otorhinolaryngol. 2013;270:3087-94.
5. Oktay MF, Ege SS. Nasal obstructions. Clin Dev. 2012;25:37-9.
6. Ottaviano G, et al. Peak Nasal Inspiratory Flow and Peak Expiratory Flow. Allergy. 2006;61(4):537-41.
7. Salihoglu M, Cekin E, Altundag A, Cesmeci E. Examination versus subjective nasal obstruction in the evaluation of the nasal septal deviation. Rhinology. 52nd ed. Istanbul: Otolaryngology Department of GATA Haydarpasa Training Hospital, Istanbul Surgery Hospital; 2014:122-6. doi: 10.4193/Rhino13.057.
8. Stewart MG, Witsell DL, Smith TL, et al. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) Scale. Otolaryngol Head Neck Surg. 2004;130(2):157-63.
9. Onerci Celebi O, Araz Server E, Yigit O, Longur ES. Adaptation and validation of the Turkish version of the Nasal Obstruction Symptom Evaluation scale. Int Forum Allergy Rhinol. 2018;8(1):72-6.
10. Ottaviano G, Fokkens WJ. Measurements of nasal airflow and patency: A critical review with emphasis on the use of peak nasal inspiratory flow in daily practice. Allergy. 2016;71(2):162-74.
11. Comparison of rhinometric measurements methods in intranasal pathology. 2003;41(2):65-8.
12. Cuddihy PJ, Eccles R. The use of nasal spirometry as an objective measure of nasal septal deviation and the effectiveness of septal surgery. Clin Otolaryngol Allied Sci. 2003;28(4):325-30.
13. Xavier R, Azeredo-Lopes S, Menger DJ, de Carvalho HC, Spratley J. Objective measurement and patient-reported evaluation of the nasal airway: Is correlation dependent on symptoms or on nasal airflow? Clin Otolaryngol. 2021 Jul;46(4):744-51. doi: 10.1111/coa.13726.
14. Yepes-Nuñez JJ, Bartra J, Muñoz-Cano R, et al. Assessment of nasal obstruction: correlation between subjective and objective techniques. Allergol Immunopathol (Madr). 2013;41(6):397-401.

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Determinants of infantile hypertrophic pyloric stenosis among infants attended in tertiary referral hospital, Addis Ababa, Ethiopia

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Ethics Committee Approval
Ethical clearance was obtained from the department research ethical committee and Addis Ababa University medical faculty college of health sciences institutional review board (IRB). A formal letter was written to the registrar office from the department of pediatrics and child health to get permission to retrieve the charts.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Infantile hypertrophic pyloric stenosis (IHPS) is a common surgical condition in early infancy, affecting approximately 2 per 1,000 live births. Despite its prevalence, limited data are available regarding the factors contributing to its development. This study aimed to identify determinants associated with IHPS among infants treated at Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia, in 2021.
Methods: A retrospective, hospital-based case-control study was conducted from June to September 2021. A total of 466 infants—233 cases and 233 controls—were randomly selected. Data were collected using a structured checklist via the Open Data Kit (ODK) platform and analyzed using SPSS version 25. Bivariable and multivariable binary logistic regression analyses were performed to identify significant predictors of IHPS. Statistical significance was set at $P<0.05$, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported.
Results: Five independent determinants of IHPS were identified: male sex (AOR=2.09; 95% CI: 1.38–3.17), first-born status (AOR=2.02; 95% CI: 1.36–3.00), cesarean delivery (AOR=1.74; 95% CI: 1.05–2.89), bottle feeding (AOR=6.08; 95% CI: 2.85–12.98), and blood group O (AOR=2.40; 95% CI: 1.05–5.49).
Conclusion: Male sex, first-born status, cesarean delivery, bottle feeding, and blood group O were significantly associated with IHPS. These findings suggest that both genetic and environmental factors contribute to its development. Promoting exclusive breastfeeding is recommended unless contraindicated. Further research is warranted to explore additional etiological factors and inform preventive strategies.

Keywords: infantile hypertrophic pyloric stenosis, IHPS, determinants, case-control study, Ethiopia

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Introduction

Infantile hypertrophic pyloric stenosis (IHPS) is a gastrointestinal disorder primarily affecting infants, characterized by hypertrophy of the pyloric muscle, which leads to partial gastric outlet obstruction. Clinically, IHPS presents with projectile, non-bilious vomiting, a palpable olive-shaped mass in the mid-epigastrium, and occasionally visible gastric peristalsis during feeding. Diagnosis is typically confirmed via ultrasonography, which allows direct visualization of the thickened pylorus. The standard treatment is pyloromyotomy, performed either through a periumbilical incision or laparoscopically, with excellent outcomes and minimal complications [1].

Although the clinical features and management of IHPS are well-established, its etiology remains poorly understood. Evidence suggests a multifactorial origin, involving both genetic and environmental influences. Male infants are disproportionately affected, and a maternal family history significantly increases risk—particularly among male offspring. Additional familial patterns include increased incidence in twins and associations with blood groups B and O [2].

Environmental exposures such as early administration of macrolide antibiotics (e.g., erythromycin, azithromycin) and formula feeding have also been implicated. Preterm birth is another potential risk factor, though its role remains unclear [3, 4].

Understanding these risk factors is essential for early identification and prevention. This study investigates the determinants of IHPS among infants in Ethiopia, aiming to inform clinical strategies and contribute to the broader body of pediatric gastroenterological research.

Materials and methods

This retrospective case-control study aimed to identify risk factors associated with infantile hypertrophic pyloric stenosis (IHPS) in a hospital-based setting. Medical records of infants admitted to Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia, between January 2018 and December 2022 were reviewed.

Study Population and Case Definition

Cases were defined as infants diagnosed with IHPS based on clinical presentation and confirmed via ultrasonography. A total of 233 cases were identified.

Control Group Selection

An equal number of controls (n=233) were selected from infants admitted during the same period for conditions unrelated to gastrointestinal obstruction or congenital anomalies. Controls were matched to cases by age (±2 weeks) and sex to reduce confounding. Randomization was performed using a computer-generated sequence applied to the hospital admission registry. Infants with incomplete records or diagnoses potentially related to IHPS (e.g., feeding intolerance, unexplained vomiting) were excluded.

Data Collection and Variables

Data were collected using a structured checklist, capturing: Demographics: age at admission, sex, birth order, Birth history: gestational age, birth weight, mode of delivery, Feeding practices: exclusive breastfeeding, formula feeding, mixed feeding, Family history: IHPS in siblings or parents, Medication exposure: erythromycin or azithromycin within the first two weeks of life, Blood group: ABO and Rh typing, Clinical data: comorbidities, symptom duration before admission

Data abstraction was performed by trained pediatric residents under supervision, and any discrepancies were resolved through consensus.

Statistical Analysis

Data were analyzed using SPSS version 25.0. Descriptive statistics summarized case and control characteristics. Bivariate logistic regression identified variables associated with IHPS (P<0.20), which were then included in a multivariate logistic regression model. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. Statistical significance was set at P<0.05.

Ethical Considerations

Ethical approval was obtained from the Department of Research Ethical Committee. The Institutional Review Board (IRB) of Addis Ababa University waived the need for informed consent. Access to patient charts was granted by the hospital registrar's office. All procedures adhered to institutional and ethical guidelines.

Results

A total of 466 infants were included: 233 IHPS cases and 233 controls. The median age at presentation was 38 days for cases and 23 days for controls. Most IHPS cases presented between 1 and 5 months of age. Male infants constituted 63.9% of both groups, and urban residency was predominant (69.3%).

Clinical Characteristics

All IHPS cases presented with vomiting, and most showed signs of dehydration. Visible gastric peristalsis and a palpable olive-shaped mass were noted in some cases. Congenital anomalies were less frequent among IHPS cases (5.2%) compared to controls (38.2%). No cases reported maternal smoking or a family history of IHPS (Table 1).

Risk Factors

Multivariate logistic regression analysis revealed five independent risk factors significantly associated with IHPS. Male infants were more than twice as likely to develop IHPS compared to females (adjusted odds ratio [AOR]=2.09; 95% confidence interval [CI]: 1.38–3.17). First-born infants had a twofold increased risk (AOR=2.02; 95% CI: 1.36–3.00). Cesarean delivery was associated with a modest increase in risk (AOR=1.74; 95% CI: 1.05–2.89). Bottle feeding showed the strongest association, with infants who were formula-fed being over six times more likely to develop IHPS compared to those exclusively breastfed (AOR=6.08; 95% CI: 2.85–12.98). Additionally, infants with blood group O had a significantly higher risk (AOR=2.40; 95% CI: 1.05–5.49) (Table 2).

Table 1. Clinical Features of Infants with IHPS at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia (n=466)

Variable	Controls n (%)	Cases n (%)	Total n (%)
Vomiting	68 (29.2)	233 (100)	301 (64.6)
No Vomiting	165 (70.8)	0 (0)	165 (35.4)
Dehydration	32 (13.7)	160 (68.7)	192 (41.2)
No Dehydration	201 (86.3)	73 (31.3)	274 (58.8)
Visible Peristalsis	12 (5.2)	51 (21.9)	63 (13.5)
No Visible Peristalsis	221 (94.8)	182 (78.1)	403 (86.5)
Olive-Shaped Mass	0 (0)	91 (39.1)	91 (19.5)
No Olive-Shaped Mass	233 (100)	142 (60.9)	375 (80.5)
Congenital Anomaly	89 (38.2)	12 (5.2)	101 (21.7)
No Congenital Anomaly	144 (61.8)	221 (94.8)	365 (78.3)

Table 2. Binary and Multivariate Logistic Regression of Risk Factors Associated with IHPS

Variable	Cases n (%)	Controls n (%)	COR (95% CI)	AOR (95% CI)	*P*-value
Sex					
Male	166 (71.2)	132 (56.7)	1.89 (1.29–2.78)	2.09 (1.38–3.17)	0.01*
Female	67 (28.8)	101 (43.3)	1.0	1.0	—
Birth Order					
First-born	136 (58.4)	90 (38.6)	2.22 (1.53–3.22)	2.02 (1.36–3.00)	0.001*
Second-born and above	97 (41.6)	143 (61.4)	1.0	1.0	—
Mode of Delivery					
Cesarean Section	62 (26.6)	36 (15.5)	1.98 (1.25–3.14)	1.74 (1.05–2.89)	0.033*
Vaginal Delivery	171 (73.4)	197 (84.5)	1.0	1.0	—
Feeding Practice					
Exclusive Breastfeeding	185 (79.4)	223 (95.7)	1.0	1.0	—
Formula Feeding	48 (20.6)	10 (4.3)	5.78 (2.84–11.75)	6.08 (2.85–12.98)	<0.001*
Blood Group					
A	54 (23.2)	50 (21.5)	1.54 (0.70–3.37)	0.77 (0.30–1.90)	0.06
B	48 (20.6)	44 (18.9)	1.55 (0.70–3.45)	1.54 (0.65–3.65)	
AB	14 (6.0)	20 (8.6)	1.0	1.0	0.12
O	19 (8.2)	47 (20.2.8)	1.94 (0.92-4.10)	2.4 (1.05, 5.49)	0.038*

* Statistically significant at p-value<0.05

Discussion

The study identified male sex, first-born status, cesarean delivery, bottle feeding, and blood group O as independent determinants of IHPS. These findings are consistent with previous studies conducted in Ethiopia, China, Cameroon, and Canada, which have reported a higher prevalence of IHPS among male infants [5–8]. The sex-modified inheritance pattern proposed by Mitchell and Risch [9] may explain this predisposition, although the precise genetic mechanisms remain unclear.

The increased risk among first-born infants aligns with meta-analyses and international literature [1, 3], possibly reflecting differences in maternal experience, hormonal factors, or feeding practices during initial pregnancies.

Cesarean delivery was associated with a higher likelihood of IHPS, potentially due to delayed initiation of breastfeeding. Studies have shown that infants born via cesarean section are less likely to be breastfed early [10], and since breastfeeding is protective against IHPS, this delay may contribute to increased risk.

Bottle feeding demonstrated the strongest association with IHPS, consistent with findings from Canada, Australia, Italy, and the United States [5, 11–13]. Proposed mechanisms include the absence of pyloric-relaxing hormones in formula, elevated plasma gastrin levels, and reduced gastric motility in formula-fed infants.

The association between blood group O and IHPS supports earlier studies from the UK, Iraq, and Denmark [14–16]. One hypothesis involves increased production of alkaline phosphatase in response to fatty meals, which may influence pyloric muscle activity in individuals with blood groups O and B.

Recommendations

Healthcare professionals should maintain heightened clinical awareness when evaluating infants who present with risk factors identified in this study. Promoting exclusive breastfeeding is particularly important, given its strong protective effect against IHPS. Public health messaging should be culturally sensitive and avoid prescriptive language, recognizing that feeding choices may be influenced by medical, social, or economic factors.

Obstetric and pediatric care teams should support vaginal delivery when medically appropriate and encourage timely initiation of breastfeeding following both vaginal and cesarean births. Further research is warranted to explore the potential role of macrolide antibiotics in IHPS development and to investigate genetic predispositions that may inform risk stratification and preventive strategies.

Conclusion

Male sex, first-born status, cesarean delivery, bottle feeding, and blood group O were independently associated with IHPS. These findings underscore the multifactorial nature of IHPS and highlight the importance of early recognition and preventive strategies.

Although macrolide use was not significant in multivariate analysis, its association in univariate analysis warrants further investigation.

References

1. Zhu J, Zhu T, Lin Z, Qu Y, Mu D. Perinatal risk factors for infantile hypertrophic pyloric stenosis: A meta-analysis. J Pediatr Surg. 2017;52(9):1389–97.
2. Chung E. Infantile hypertrophic pyloric stenosis: Genes and environment. Arch Dis Child. 2008;93(12):1003–4.
3. Tadesse A. Infantile hypertrophic pyloric stenosis: A retrospective study from a tertiary hospital in Ethiopia. East Cent Afr J Surg. 2014;19(1):120–4.
4. Eberly MD, Eide MB, Thompson JL, Nylund CM. Azithromycin in early infancy and pyloric stenosis. Pediatrics. 2015;135(3):483–8.
5. Krogh C, Biggar RJ, Fischer TK, Lindholm M, Wohlfahrt J, Melbye M. Bottle-feeding and the risk of pyloric stenosis. Pediatrics. 2012;130(4):e943–9.
6. Li J, Gao W, Zhu J, Zuo W, Liu X. Epidemiological and clinical characteristics of 304 patients with infantile hypertrophic pyloric stenosis in Anhui Province of East China, 2012–2015. J Matern Fetal Neonatal Med. 2018;31(20):2742–7.
7. Lulseged D. Infantile hypertrophic pyloric stenosis in a children's hospital: A retrospective study. Ethiop Med J. 1986;24(4):169–73.
8. Ndongo R, Tolefac PN, Tambo FFM, Abanda MH, Ngowe MN, Fola O, et al. Infantile hypertrophic pyloric stenosis: A 4-year experience from two tertiary care centres in Cameroon. BMC Res Notes. 2018;11(1):18–22.
9. Mitchell LE, Risch N. The genetics of infantile hypertrophic pyloric stenosis: A reanalysis. Am J Dis Child. 1993;147(11):1203–11.
10. Svenningsson A, Svensson T, Akre O, Nordenskjöld A. Maternal and pregnancy characteristics and risk of infantile hypertrophic pyloric stenosis. J Pediatr Surg. 2014;49(8):1226–31.
11. Wayne C, Hung JHC, Chan E, Sedgwick I, Bass J, Nasr A. Formula-feeding and hypertrophic pyloric stenosis: Is there an association? A case-control study. J Pediatr Surg. 2016;51(5):779–82.
12. Pisacane A, De Luca U, Criscuolo L, Vaccaro F, Valiante A, Inglese A, et al. Breastfeeding and hypertrophic pyloric stenosis: Population-based case-control study. BMJ. 1996;312(7033):745–6.
13. McAteer JP, Ledbetter DJ, Goldin AB. Role of bottle feeding in the etiology of hypertrophic pyloric stenosis. JAMA Pediatr. 2013;167(12):1143–9.
14. Dodge JA. ABO blood groups and infantile hypertrophic pyloric stenosis. BMJ. 1967;4(5582):781–2.
15. Hagos C, Mengistu H. Congenital (infantile) hypertrophic pyloric stenosis (IHPS). Ethiop J Pediatr Child Health. 2006;3(1):5–8.
16. Rasmussen L, Green A, Hansen LP. The epidemiology of infantile hypertrophic pyloric stenosis in a Danish population, 1950–84. Int J Epidemiol. 1989;18(2):413–7.

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Early clinical and radiological outcomes of cases undergoing cementless total hip arthroplasty

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Ethics Committee Approval
Ethical approval for the study was obtained from the Samsun University Non-Interventional Clinical Research Ethics Committee (Approval No: 2025/24/39, Date: December 22, 2025). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Cementless total hip arthroplasty was developed to eliminate the disadvantages of cemented systems and to provide long-term biological fixation. It is widely used in the treatment of advanced coxarthrosis. This study aimed to evaluate early clinical and radiological outcomes of patients who underwent cementless primary total hip arthroplasty (THA) for different etiological reasons and to discuss the findings in light of the literature.

Methods: This retrospective study evaluated 56 hips of 53 patients who underwent cementless primary THA and had regular clinical and radiological follow-up between August 1991 and November 1995. The mean follow-up duration was 16.9 months. Clinical evaluation was performed using the Modified Harris Hip Score (mHHS). Radiological evaluations were performed according to the criteria recommended by the American Hip Society for cementless prostheses. Heterotopic ossification (HO) was assessed using the Brooker classification.

Results: The mean mHHS was 29 before surgery and 88.8 after surgery, and this increase was statistically significant (P<0.001). Good or very good clinical outcomes were achieved in 83.8% of hips. Radiological examination showed preserved stability in the vast majority of femoral and acetabular components. Acetabular component migration was detected in 2 (3.5%) hips, and femoral component migration in 2 (3.5%) hips. Activity-related thigh pain was reported in 10 hips (17.8%). Intraoperative femoral fractures occurred in 6 hips (10.7%). HO was detected in 13 hips (23.2%), mostly Brooker grade I–II. Dislocation, deep infection, and deep vein thrombosis each occurred in 1 hip (1.78%).

Conclusion: Cementless THA is a reliable surgical method that yields successful early clinical and radiological outcomes when applied with appropriate patient selection and correct surgical technique. Larger series and longer follow-up are required to evaluate long-term outcomes.

Keywords: cementless total hip arthroplasty, clinical and radiological outcomes, heterotopic bone

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Introduction

The hip joint is one of the major load-bearing joints in the human body and is subjected to forces averaging up to six times body weight during daily activities [1]. Structural abnormalities of the hip joint caused by degenerative, traumatic, or inflammatory diseases may lead to pain, restricted motion, and functional loss, adversely affecting daily activities and quality of life [1-3]. Therefore, effective and durable functional solutions are essential in the treatment of advanced hip pathologies [2, 3].

Total hip arthroplasty (THA) has been performed successfully for many years to relieve pain and restore function when conservative treatment is insufficient, and it is considered a gold-standard surgical option for advanced coxarthrosis [4-6]. Cemented systems were long regarded as the standard approach; however, cement-related mechanical loosening, particle-induced osteolysis, and technical challenges during revision surgery have been reported over time [7]. In response, cementless THA systems based on biological fixation were developed.

The aim of cementless systems is to achieve sufficient primary mechanical stability in the early period and to obtain durable biological fixation through osseointegration at the bone–prosthesis interface over the long term [8-10]. Implant designs have been improved with respect to surface coatings, porosity, and geometry, and successful clinical and radiological outcomes have been reported with cementless THA [11-13]. Although cementless THA may offer advantages in implant survival in selected patient groups, early stability, thigh pain, component migration, and heterotopic ossification remain debated. Accordingly, detailed evaluation of the early clinical and radiological performance of cementless systems is warranted.

This study aimed to evaluate early clinical and radiological outcomes of patients who underwent cementless primary THA for different etiological reasons in our clinic and to discuss the findings in light of the literature.

Materials and methods

Participants

In this retrospective study, cementless primary THA was performed on 60 hips of 57 patients diagnosed with coxarthrosis due to various etiological causes between August 1991 and November 1995. Considering the follow-up duration, 56 hips of 53 patients were included in the analysis. Of the 56 hips evaluated, 34 (60.7%) belonged to female patients and 22 (39.3%) to male patients. The mean age was 52 (range: 30–75) years, and the mean follow-up period was 16.9 (range: 6–36) months. Primary (idiopathic) coxarthrosis was present in 24 hips, and secondary coxarthrosis in 32 hips. Inclusion criteria were cementless primary THA for various etiological reasons, adequate clinical and radiological follow-up data, and a minimum follow-up of 6 months.

Study Design and Procedures

This study was designed as a retrospective observational study and was conducted in accordance with the Declaration of Helsinki. Ethics approval was obtained from the Samsun University Non-Interventional Clinical Research Ethics Committee (Approval No: 2025/24/39, Date: December 22, 2025).

Cementless fixation principles were applied in all procedures, and primary stability was achieved using the press-fit method. Forty-one hips were operated on in the full lateral decubitus position via a posterolateral incision, and 15 hips were operated on in the supine or lateral decubitus position via a lateral incision. The standard press-fit technique was used for primary coxarthrosis. In patients with secondary coxarthrosis due to developmental dysplasia of the hip (DDH), surgical modifications were required to address acetabular bony defects. In dysplastic hips, acetabular roof reconstruction was performed using an autograft from the femoral head in 7 hips, and medial acetabular defects were filled with a chip graft harvested from the femoral head in 3 hips.

Implants included Omnifit PSL acetabular cups, Omniflex AD titanium-coated stems, and Omniflex H.A. stems (Osteonics) (n=41), as well as Harris/Galante porous acetabular cups and Zimmer anatomical femoral stems (n=15). Although different implant designs were used, cementless press-fit fixation was the standard principle across all procedures. Due to the limited sample size and retrospective design, subgroup analyses comparing implant designs with respect to thigh pain or secondary stability were not performed. All patients received antibiotic prophylaxis and deep vein thrombosis (DVT) prophylaxis with low molecular weight heparin.

Clinical assessment was performed preoperatively and postoperatively using the Modified Harris Hip Score (mHHS) [14]. Clinical and radiological follow-up was performed at 6 weeks, 3 months, 6 months, and 1 year postoperatively. Standard anteroposterior and lateral radiographs of both hips were obtained from a distance of 1 meter, and all measurements were performed on these images. Preoperative osteoporosis was assessed radiologically using the Singh index, and proximal femoral cortical structure was evaluated using the morphological cortical index. Postoperative radiological evaluation followed the criteria recommended by the American Hip Society for cementless prostheses. Radiolucent lines and osteolysis were documented using the DeLee and Charnley zones for the acetabular component and the Gruen zones for the femoral component [15]. HO was graded according to the Brooker classification [16]. Patients were monitored for early and late complications. Functional outcomes were assessed clinically, and component position, stability, and the bone–prosthesis relationship were assessed radiologically.

Statistical analysis

Demographic and clinical characteristics were summarized using descriptive statistics. Continuous variables are presented as mean (SD) and median (minimum–maximum), according to distributional characteristics. The Wilcoxon test was used to compare preoperative and postoperative quantitative values, and the McNemar test was used to analyze categorical variables. The first (Q1) and third (Q3) quartiles were reported to describe distribution across quartiles. Categorical variables are presented as number (n) and percentage (%).

Results

Descriptive data are presented in Table 1. The mean age of the patients was 51.3 (11.6) years. Of the cases, 60.7% were female and 39.3% were male. Secondary coxarthrosis (57.1%) was more common than primary coxarthrosis (42.9%).

Table 2 summarizes early complications after cementless THA. Postoperative dislocation occurred in 1 hip (1.78%) and required cup revision due to insufficient acetabular anteversion. Intraoperative femoral fractures were observed in 6 hips (10.7%): four type I fractures (cerclage required in two cases), one type II fracture, and one type III fracture; the type II and type III fractures were treated with cerclage fixation. HO developed in 13 hips (23.2%), predominantly Brooker grade I. HO was more frequent in hips operated via the lateral approach than the posterolateral approach and was more common in male patients. Thigh pain was reported in 10 hips (17.8%) during follow-up. DVT and early deep infection were each observed in 1 hip (1.78%).

Table 1. Descriptive statistics

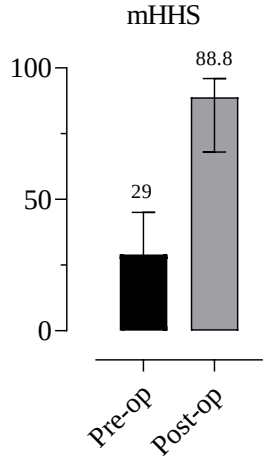
Variable	Mean (SD)	Median (IQR)
Age (years)	51.3 (11.6)	53 (48–58)
	n	%
Gender		
Male	22	39.3
Female	34	60.7
Diagnosis		
Primary coxarthrosis	24	42.9
Secondary coxarthrosis	32	57.1

Table 2. Postoperative complications (per hip, n=56)

Complication	n	%
Intraoperative femoral fracture	6	10.7
Activity-related thigh pain	10	17.9
Dislocation	1	1.8
Deep infection	1	1.8
Deep vein thrombosis	1	1.8
Heterotopic ossification (any)	13	23.2
Brooker grade I	9	16.1
Brooker grade II	3	5.4
Brooker grade III	1	1.8
Brooker grade IV	0	0

Figure 1 shows that the preoperative mHHS median was 29 (range: 8–45), and the postoperative score was 88.8 (range: 68–96). Postoperative mHHS scores increased significantly compared with preoperative values (P<0.001).

Figure 1. Preoperative and postoperative mHHS scores.



MHHs: Modified Harris Hip Score

Radiological Findings

Radiological evaluation at 12 months showed sclerotic areas in acetabular zone III and femoral zones II, III, IV, and V in one patient with coxarthrosis secondary to bilateral DDH who underwent right-sided THA. At 24 months, one patient with coxarthrosis secondary to bilateral DDH who underwent left-sided THA showed sclerotic areas in acetabular zones II and III and femoral zones I–VII. At 24 months, another patient with coxarthrosis secondary to bilateral DDH who underwent right-sided THA showed sclerotic areas in acetabular zones I–III and femoral zones II–V. In one patient followed for 24 months, a radiolucent area greater than 1–2 mm was detected around the acetabular component; radiolucent areas were noted around the screws, and sclerotic areas were present in femoral zones I, III, IV, and V. This patient experienced hip dislocation on postoperative day 2 and underwent cup revision. In 2 patients, sclerotic areas were observed only around the femoral component in zones II–V.

Acetabular component migration occurred in 2 patients (3.5%). In a patient who underwent THA for post-traumatic coxarthrosis, 4 mm vertical and 3 mm horizontal migration was detected at 18 months. In another patient, 4 mm vertical and 3 mm horizontal migration was detected at 24 months; this patient was the case with postoperative day-2 dislocation requiring cup revision. Femoral component migration assessment demonstrated 3 mm vertical migration in 2 patients, both of whom had intraoperative type II and type III femoral fractures.

The acetabular cup angle was measured on postoperative anteroposterior radiographs and evaluated for surgical suitability. The cup angle was 35°–55° in 44 hips, 20°–32° in 10 hips, 60° in one hip, and 72° in one hip.

Discussion

In this study, we evaluated early clinical and radiological outcomes after cementless primary total hip arthroplasty (THA). Overall, cementless primary THA was associated with marked early functional recovery, radiological stability in most components, and complication patterns that—when managed appropriately—did not appear to translate into persistent clinical impairment during the available follow-up. Although implant designs and surface technologies have evolved substantially over time, the debate regarding cemented versus cementless fixation persists. Nonetheless, cementless THA has gained wide acceptance, particularly due to favorable long-term fixation and survivorship reported in selected series [17-21].

The press-fit technique and biologically active surface principles used in this cohort remain central to contemporary cementless arthroplasty practice [22]. While the implants used represent earlier generations of modern designs, the fundamental biological mechanism targeted—osseointegration—has not changed [23]. From this perspective, the present data provide clinically relevant insight into the durability of core cementless concepts when applied with appropriate technique and patient selection.

The favorable functional recovery observed at the final follow-up is consistent with prior reports of good-to-excellent outcomes after cementless THA. Lord reported good or excellent outcomes in 87.5% of patients followed for 1–7 years without aseptic loosening [24]. Similarly, Kim et al. [25] reported very good or good outcomes in 88% of patients at mid-term follow-up. Other series have likewise documented high hip scores at follow-up, supporting reliable functional restoration with cementless fixation [19-21, 26]. The general concordance between radiographic assessments and clinical recovery in the current cohort is also in line with the concept that achieving early mechanical stability is a prerequisite for successful biological fixation [8-10].

Postoperative thigh pain remains a clinically important issue after cementless THA and is variably reported in the literature [27-30]. Proposed mechanisms include stem–canal

mismatch, distal micromotion, and fibrous tissue formation, which may contribute to subsidence and pain, although the exact pathophysiology remains incompletely defined [31, 32]. In this series, thigh pain was activity-related and improved with rest, suggesting a self-limited course in many cases. Notably, pain was more frequently observed among patients with radiographic migration, raising the possibility that early pain may serve as a clinical signal of mechanical concerns. However, given the relatively short follow-up, causality and long-term implications cannot be established definitively.

Intraoperative femoral fracture is a recognized complication of cementless THA [33]. Reported rates vary widely across series, reflecting differences in patient selection, bone quality, anatomy, and surgical technique [29, 30, 33-35]. In the current study, fractures appeared more frequent in hips with developmental dysplasia of the hip (DDH), which is consistent with the challenging proximal femoral anatomy and canal morphology in this population [35]. Excessive force during preparation or attempts to maximize press-fit fixation may further increase fracture risk [33, 37]. Contemporary evidence indicates that risk is influenced more by patient factors and technical considerations—such as bone quality, cortical thickness, age, sex, and complex femoral anatomy—than by implant design alone [38-40]. The lack of an apparent sustained adverse effect on early clinical status in this cohort likely reflects timely intraoperative recognition and stabilization (e.g., cerclage fixation), as recommended [34].

Heterotopic ossification (HO) is another well-recognized sequela after THA, with a broad reported incidence and variable clinical relevance [16, 41]. In most cases, low-grade HO is considered clinically benign, whereas higher grades may compromise function and range of motion [42]. The multifactorial etiology includes patient-related susceptibility and procedural factors such as surgical approach, operative trauma, infection, and biological predisposition [41, 43]. In this study, HO was more commonly observed after the lateral approach than the posterolateral approach, consistent with reports describing approach-related differences in HO formation [44-46]. HO also appeared more frequent in men, consistent with prior literature [41, 47]. Importantly, the predominance of lower Brooker grades suggests that the clinical impact of HO in this cohort was limited; thus, HO severity—rather than its mere presence—should be prioritized when interpreting functional implications.

Periprosthetic joint infection remains a serious complication after THA, with reported rates varying across settings and eras [27, 48-51]. Data have suggested higher infection rates in some contexts where structural grafts are used, potentially related to longer operative times or increased tissue handling [52]. In this series, femoral head autograft was used in a limited number of cases without subsequent infection, supporting the adequacy of operative conditions and perioperative prophylaxis in the present cohort.

Dislocation after THA is typically multifactorial and strongly linked to component positioning, patient factors, surgical approach, and surgeon experience [53-59]. Early dislocations are frequently attributed to malposition, and stability can often be restored with appropriately targeted revision [60, 61]. In this cohort, the dislocation was attributed to inadequate acetabular anteversion and was managed with cup revision, emphasizing the importance of acetabular orientation and biomechanical restoration [55]. Although some literature associates the posterior approach with higher dislocation risk, this risk can be mitigated substantially with correct component orientation, soft-tissue repair, and experience [55, 62, 63]. The low dislocation frequency in this cohort supports the view that technical execution is a key determinant.

Venous thromboembolism (VTE) remains a preventable but clinically meaningful risk after arthroplasty. Evidence consistently shows markedly higher symptomatic event rates without prophylaxis, whereas contemporary pharmacologic strategies reduce clinically evident deep vein thrombosis and pulmonary embolism to low levels in routine practice [64, 65]. The low frequency of clinically detected events in this series is consistent with the effectiveness of structured prophylaxis protocols.

Limitations

This study has several limitations, including its retrospective design, the relatively small sample size, and the short follow-up period, which preclude definitive conclusions regarding long-term fixation success and implant survivorship. The single-center nature may also limit generalizability. In addition, because implant groups were unequal (n=41 vs. n=15) and the overall sample was limited, meaningful comparative analyses of implant-specific associations (e.g., thigh pain by stem design) could not be performed.

Conclusion

When applied with appropriate patient selection and correct surgical technique, cementless THA provides favorable early clinical and radiological outcomes. Functional recovery and complication patterns were broadly consistent with the literature. Longer-term, adequately powered studies are needed to evaluate sustained fixation and implant survival.

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References

1. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am. 1969;51(4):737-55.
2. Seibert R, Marcellin-Little DJ, Roe SC, DePuy V, Lascelles BDX. Comparison of body weight distribution, peak vertical force, and vertical impulse as measures of hip joint pain and efficacy of total hip replacement. Vet Surg. 2012;41(4):443-7.
3. Uluçay C, Ozler T, Güven M, Akman B, Kocadal AO, Altıntaş F. Etiology of coxarthrosis in patients with total hip replacement. Acta Orthop Traumatol Turc. 2013;47:330-3.
4. Evans JT, Evans JP, Walker RW, Blom AW, Whitehouse MR, Sayers A. How long does a hip replacement last? A systematic review and meta-analysis of case series and national registry reports with more than 15 years of follow-up. Lancet. 2019;393(10172):647-54.
5. De Martino I, De Santis V, D'Apolito R, Sculco PK, Cross MB, Gasparini G. The Synergy cementless femoral stem in primary total hip arthroplasty at a minimum follow-up of 15 years. Bone Joint J. 2017;99-B(1):29-36.
6. Vidalain JP. Twenty-year results of the cementless Corail stem. Int Orthop. 2011;35:189-94.
7. Maloney WJ, Harris WH. Comparison of hybrid and uncemented total hip arthroplasty. J Bone Joint Surg Am. 1990;72:1349-52.
8. Engh CA, Bobyn JD, Glassman AH. Porous-coated hip replacement. J Bone Joint Surg Am. 1987;69:45-55.
9. Maheshwari AV, Ranawat AS, Ranawat CS. The use of hydroxyapatite on press-fit tapered femoral stems. Orthopedics. 2008;31:882-4.

10. Delaunay C. Effect of hydroxyapatite coating on the radio-clinical results of a grit-blasted titanium alloy femoral taper. A case-control study of 198 cementless primary total hip arthroplasty with the Alloclassic system. Orthop Traumatol Surg Res. 2014;100:739-44.
11. Kanto M, Fukunishi S, Fukui T, Nishio S, Fujihara Y, Okahisa S, et al. Radiological evaluation of the relationship between cortical hypertrophy and stress shielding after total hip arthroplasty using a cementless stem. Arthroplast Today. 2020;6:894-900.
12. Aldinger PR, Jung AW, Breusch SJ, Ewerbeck V, Parsch D. Survival of the cementless Spotorno stem in the second decade. Clin Orthop Relat Res. 2009;467:2297-304.
13. Kitamura S, Hasegawa Y, Iwasada S, Yamauchi K, Kawamoto K, Kanamono T, et al. Catastrophic failure of cementless total hip arthroplasty using a femoral component without surface coating. J Arthroplasty. 1999;14(8):918-24. doi: 10.1016/S0883-5403(99)90004-9.
14. Nilsdotter A, Bremander A. Measures of hip function and symptoms: Harris hip score (HHS), HOOS, OHS, Lequesne index, and AAOS hip and knee questionnaire. Arthritis Care Res (Hoboken). 2011;63 Suppl 11:S200-7.
15. Goodman SM, Springer B, Guyatt G, Abdel MP, Dasa V, George M, et al. 2017 ACR/AAHKS guideline for perioperative management of antirheumatic medication in patients with rheumatic diseases undergoing elective total hip or knee arthroplasty. Arthritis Care Res (Hoboken). 2017;69(8):1111-24. doi: 10.1002/acr.23274.
16. Hug KT, Alton TB, Gee AO. In Brief: Brooker classification of heterotopic ossification after total hip arthroplasty. Clin Orthop Relat Res. 2015;473(6):2154-7.
17. Civinini R, D'Arienzo M, Innocenti M 2nd. A ten-year follow-up of the Reflection cementless acetabular component. J Bone Joint Surg Br. 2008;90:570-3.
18. Lehil MS, Bozic KJ. Trends in total hip arthroplasty implant utilization in the United States. J Arthroplasty. 2014;29:1915-8.
19. Meding JB, Keating EM, Ritter MA. Minimum ten-year follow-up of a straight-stemmed, plasma-sprayed, titanium-alloy, uncemented femoral component in primary total hip arthroplasty. J Bone Joint Surg Am. 2004 Jan;86(1):92-7. doi: 10.2106/00004623-200401000-00014.
20. Sinha RK, Dungy DS, Yeon HB. Primary total hip arthroplasty with a proximally porous-coated femoral stem. J Bone Joint Surg Am. 2004;86:1254-61.
21. Lachiewicz PF, Soileau ES, Bryant P. Second-generation proximally coated titanium femoral component: minimum 7-year results. Clin Orthop Relat Res. 2007;465:117-21.
22. Yamako G, Chosa E, Totoribe K, Hanada M, Masuhara K. Cementless total hip replacement: past, present, and future. J Orthop Sci. 2010;15(2):121-30.
23. Karuppal R. Biological fixation of total hip arthroplasty: facts and factors. J Orthop. 2016;13(3):190-2.
24. Lord GA. Plastic wear: polyethylene wear in cementless total hip arthroplasty. In: Abstracts of the XIII World Congress of SICOT; 1990; Montreal, Canada. Abstract No. 746. p. 14.
25. Kim YH, Kim VE. Uncemented porous-coated anatomic total hip replacement: results at six years in a consecutive series. J Bone Joint Surg Br. 1993;75(1):6-13.
26. Zhen P, Liu J, Li X, Lu H, Zhou S. Primary total hip arthroplasty using an uncemented Wagner SL stem in elderly patients with Dorr type C femoral bone. J Orthop Surg Res. 2019;14:377.
27. Forster-Horvath C, Egloff C, Valderrabano V, Nowakowski AM. The painful primary hip replacement: review of the literature. Swiss Med Wkly. 2014;144:w13974.
28. Lavernia C, D'Apuzzo M, Hernandez VH, Lee DJ. Patient-perceived outcomes in thigh pain after primary arthroplasty of the hip. Clin Orthop Relat Res. 2005;441:268-73.
29. Callaghan JJ, Dysart SH, Savory CG. The uncemented porous-coated anatomic total hip prosthesis: two-year results of a prospective consecutive series. J Bone Joint Surg Am. 1988 Mar;70(3):337-46.
30. Jakim I, Barlin C, Sweet MB. RM isoelastic total hip arthroplasty: a review of 34 cases. J Arthroplasty. 1988;3(3):191-9.
31. Baert IAC, Lluch E, Van Glabbeek F, Nuyts R, Rufai S, Tuynman J, et al. Short stem total hip arthroplasty: potential explanations for persistent post-surgical thigh pain. Med Hypotheses. 2017;107:45-50.
32. Fumero S, Dettoni A, Gallinaro M, Crova M. Thigh pain in cementless hip replacement: clinical and radiographic correlations. Ital J Orthop Traumatol. 1992;18:167-72.
33. Ponzio DY, Shahi A, Park AG, Purtill JJ. Intraoperative proximal femoral fracture in primary cementless total hip arthroplasty. J Arthroplasty. 2015;30:1418-22.
34. Bonnin MP, Neto CC, Aitsiselmi T, Murphy CG, Bossard N, Roche S. Increased incidence of femoral fractures in small femurs and women undergoing uncemented total hip arthroplasty—why? Bone Joint J. 2015;97-B:741-8.
35. Lamb JN, Matharu GS, Redmond A, Judge A, West RM, Pandit HG. Risk factors for intraoperative periprosthetic femoral fractures during primary total hip arthroplasty: an analysis from the National Joint Registry for England and Wales and the Isle of Man. J Arthroplasty. 2019;34:3065-73.
36. Zhang Z, Zhuo Q, Chai W, Ni M, Li H, Chen J. Clinical characteristics and risk factors of periprosthetic femoral fractures associated with hip arthroplasty: a retrospective study. Medicine (Baltimore). 2016;95(35):e4751.
37. Schwartz BE, Della Valle AG, Rosenberg AG, Galante JO. Intraoperative femoral fractures during total hip arthroplasty. J Am Acad Orthop Surg. 2017;25(6):428-36.
38. Thien TM, Chatziagorou G, Garellick G, Furnes O, Havelin LI, Mäkelä K, et al. Periprosthetic femoral fracture within two years after total hip replacement. J Bone Joint Surg Am. 2014;96(19):e167.
39. Watts CD, Abdel MP, Lewallen DG, Berry DJ. Increased risk of periprosthetic femoral fracture with a unique cementless stem design. Clin Orthop Relat Res. 2015;473(6):2045-53.
40. Abdel MP, Houdek MT, Watts CD, Lewallen DG. Intraoperative periprosthetic femoral fractures during primary total hip arthroplasty. J Bone Joint Surg Am. 2019;101(12):1095-102.
41. Zhu Y, Zhang F, Chen W, Zhang Q, Liu S, Zhang Y. Incidence and risk factors for heterotopic ossification after total hip arthroplasty: a meta-analysis. Arch Orthop Trauma Surg. 2015;135:1307-14.
42. Rothman RH, Hozack WJ. Heterotopic ossification. In: Complications of total hip arthroplasty. W.B. Saunders; 1988. p. 82-8.
43. Warren SB. Heterotopic ossification after total hip replacement. Orthop Rev. 1990;19(7):603-11.
44. Hürlimann M, Schiapparelli FF, Rotigliano N, Testa E, Amsler F, Hirschmann MT. Influence of surgical approach on heterotopic ossification after total hip arthroplasty: is minimally invasive better? A case-control study. BMC Musculoskelet Disord. 2017;18:27.
45. Pavlou G, Salhab M, Murugesan L, Jallad S, Petsatodis G, West R, et al. Risk factors for heterotopic ossification in primary total hip arthroplasty. Hip Int. 2012;22:50-5.
46. Morrey BF, Adams RA, Cabanela ME. Comparison of heterotopic bone after anterolateral, transtrochanteric and posterior approaches for total hip arthroplasty. Clin Orthop Relat Res. 1984;188:160-7.
47. Maloney WJ, Krushell RJ, Jasty M, Harris WH. Incidence of heterotopic ossification after total hip replacement: effect of fixation of the femoral component. J Bone Joint Surg Am. 1991;73(2):191-3.
48. Charnley J. Total prosthetic replacement for advanced coxarthrosis. In: Comptes Rendus de la Reunion de la SICOT (10th International Congress); 1966; Paris, France. p. 311-9.
49. Comba F, Zanotti G. State-of-the-art diagnosis and surgical treatment of acute periprosthetic joint infection following primary total hip arthroplasty. EFORT Open Rev. 2018;3:434-41.
50. Merollini KM, Crawford RW, Whitehouse SL, Graves N. Surgical site infection prevention following total hip arthroplasty in Australia: a cost-effectiveness analysis. Am J Infect Control. 2013;41:803-9.
51. Konigsberg BS, Della Valle CJ, Ting NT, Qiu F, Sporer SM. Acute hematogenous infection following total hip and knee arthroplasty. J Arthroplasty. 2014;29:469-72.
52. Schutzer SF, Harris WH. Deep wound infection after total hip replacement under contemporary aseptic conditions. J Bone Joint Surg Am. 1988 Jun;70(5):724-7.
53. Charnley J, Lupić Z. The nine- and ten-year results of the low friction arthroplasty of the hip. Clin Orthop Relat Res. 1973;95:9-25.
54. Khan AM, Brankenbury PH, Reynolds ISR, Robinson JR. Dislocation following total hip replacement. J Bone Joint Surg Br. 1981;63:214-8.
55. Dargel J, Oppermann J, Brüggemann GP, Eysel P. Dislocation following total hip replacement. Dtsch Arztebl Int. 2014;111:884-90.
56. Woo RY, Morrey BF. Dislocation after total hip arthroplasty. J Bone Joint Surg Am. 1982;64:1295-306.
57. Sariali E, Lazennec JY, Khiami F, Gorin M. Mathematical evaluation of jumping distance in total hip arthroplasty. J Bone Joint Surg Am. 2012;94(21):1941-7.
58. Hailer NP, Weiss RJ, Stark A, Kärrholm J, Söderman P. Influence of femoral head size on dislocation and revision rates after total hip arthroplasty. Acta Orthop. 2014;85(5):442-7.
59. Howie DW, Holubowycz OT, Middleton R. Large femoral heads decrease the incidence of dislocation after total hip arthroplasty. J Bone Joint Surg Am. 2012;94(12):1095-102.
60. Abdel MP, Berry DJ, Lewallen DG. Intraoperative and early postoperative dislocation after total hip arthroplasty. J Arthroplasty. 2016;31(9):198-203.
61. Parvizi J, Picinic E, Sharkey PF. Revision total hip arthroplasty for instability: surgical techniques and principles. J Bone Joint Surg Am. 2011;93(12):1134-42.
62. Kwon MS, Kuskowski M, Mulhall KJ, Macaulay W, Brown TE, Saleh KJ. Does surgical approach affect total hip arthroplasty dislocation rates? Clin Orthop Relat Res. 2006;447:34-8.
63. Hedlundh U, Ahnfelt L, Hybbinette CH, Wallinder L, Weckström J. Surgical experience related to dislocations after total hip arthroplasty. J Bone Joint Surg Br. 1996 Mar;78(2):206-9.
64. Falck-Ytter Y, Francis CW, Johanson NA, Curley C, Dahl OE, Schulman S, et al. Prevention of VTE in orthopedic surgery patients: antithrombotic therapy and prevention of thrombosis, 9th ed: ACCP evidence-based clinical practice guidelines. Chest. 2012;141(2 Suppl):e278S-e325S. doi: 10.1378/chest.11-2404.
65. Anderson DR, Morgano GP, Bennett C, Dentali F, Francis CW, Garcia DA, et al. American Society of Hematology 2019 guidelines for management of venous thromboembolism: prevention of venous thromboembolism in surgical hospitalized patients. Blood Adv. 2019;3(23):3898-944. doi: 10.1182/bloodadvances.2019000975.

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Can we trust chatbots for tacrolimus? A STROBE-aligned multimodel benchmark of large language models for drug information in kidney transplantation

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Abstract

Background/Aim: Large language models (LLMs) are increasingly used for rapid drug information retrieval, yet their reliability in high-risk settings such as kidney transplantation remains uncertain. Immunosuppressants have narrow therapeutic indices and clinically consequential drug–drug interactions (DDIs), making even small factual errors potentially harmful.

Methods: We performed a cross-sectional, head-to-head benchmark of four LLMs (GPT-5.1, GPT-4.1, Gemini, Claude) using 150 standardized prompts derived from KDIGO transplant guidance and pharmacology reference standards. Prompts covered four domains: drug mechanism/explanation, major DDIs, dosing principles/therapeutic drug monitoring, and toxicity profiles. Each model produced 150 responses (600 total). Responses were blinded, randomized, and independently scored by two transplant pharmacists and one senior transplant physician using a three-tier rubric: accurate/actionable (Score 2), safe but non-actionable generalization (Score 1), and factual error/hallucination (Score 0). Disagreements were resolved by consensus. Primary outcomes were overall accuracy (Score 2 proportion) and unsafe error rate (Score 0 proportion).

Results: Inter-rater agreement was excellent (Cohen's κ=0.88). Overall accuracy ranged from 85.3% to 91.3% across models, with low unsafe error rates (1.3%–4.7%). Across domains, highest performance was observed for foundational mechanism questions, while dosing principles and major DDIs generated more Score-1 responses (safe but insufficient detail).

Conclusion: LLMs demonstrated high—but not fail-safe—performance for kidney transplant pharmacology. Given residual unsafe errors and variability in actionable specificity, LLM outputs should be used only as adjunctive support with pharmacist/physician verification prior to clinical decisions.

Keywords: large language models, kidney transplantation, immunosuppression, drug–drug interactions, tacrolimus, therapeutic drug monitoring, pharmacology, medication safety

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Introduction

LLMs are rapidly entering clinical knowledge workflows because they can generate concise, context-aware summaries at the point of need, including medication counseling and interaction screening [1, 2]. However, multiple evaluations caution that fluent outputs can still contain hallucinated facts, incomplete actionable detail, and bias—limitations that are especially consequential in high-stakes medication decisions [3-5]. Roustan et al. [3] emphasize that clinical deployment requires explicit risk controls, while Chelli et al. [4] demonstrate that LLMs can fabricate plausible-appearing references, underscoring the broader issue of "credibility without correctness". In parallel, Omar et al. [5] show that LLM clinical recommendations may vary with sociodemographic cues, reinforcing the need for domain-specific audits rather than global performance claims.

Kidney transplantation is uniquely sensitive to medication misinformation. Maintenance immunosuppression typically relies on calcineurin inhibitors (CNIs; tacrolimus/cyclosporine), antimetabolites (mycophenolate), and corticosteroids, with narrow therapeutic windows and substantial pharmacokinetic variability [6]. Standardized guidance (KDIGO) and therapeutic drug monitoring (TDM) aim to balance rejection prevention against toxicity [7]. Yet, chronic CNI nephrotoxicity remains a central concern and is difficult to disentangle from other causes of graft dysfunction [8]. Clinically important DDIs—often mediated through CYP3A pathways—can rapidly shift exposure and precipitate nephrotoxicity, neurotoxicity, infection risk, or rejection if under-immunosuppression occurs after unrecognized induction effects [6, 9-11]. For example, azole antifungals (e.g., fluconazole) and non-dihydropyridine calcium channel blockers (e.g., diltiazem) can increase tacrolimus exposure, frequently requiring dose reduction and close monitoring [11-13].

Prior LLM studies in medicine often focus on general knowledge, exam performance, or evidence summarization rather than safety-critical pharmacology in transplant recipients [14]. Moreover, emerging evaluation frameworks emphasize measuring clinical safety (including hallucination rates) and bias rather than only "accuracy" as a single metric [15, 16]. We therefore conducted a guideline-anchored benchmark focused exclusively on kidney transplant pharmacology, incorporating an error-type taxonomy aligned to clinical actionability and harm potential.

Materials and methods

Study Design and Reporting Framework

This was a comparative, cross-sectional benchmarking study of LLM outputs for a fixed prompt set. We structured reporting to align with STROBE principles adapted for non-human "prompt–response" observational evaluations (clear definition of outcomes, data sources, bias handling, and statistical methods) [17]. Figure 1 depicts the study workflow.

Large Language Models and Query Environment

We evaluated four LLMs: GPT-5.1, GPT-4.1, Gemini, and Claude. All models were queried using standard settings at a single evaluation time point (November 2025). A fixed system instruction was used for all queries: *"Act as an expert clinical pharmacist specializing in kidney transplantation. Provide concise, evidence-based answers"*. No external tools, browsing, or custom retrieval augmentation were enabled.

Prompt Set Development and Ground Truth

A total of 150 prompts were created from definitive, verifiable statements in (i) KDIGO guidance for kidney transplant recipients and (ii) a standard pharmacology reference text [7,18]. Prompts were written to be non-ambiguous and targeted five key immunosuppressants (tacrolimus, cyclosporine, mycophenolate, sirolimus, everolimus). Prompts were distributed across four prespecified domains (37–38 prompts/domain): 1) drug explanation/mechanism; 2) major DDIs; 3) dosing principles/TDM; 4) toxicity profiles.

Outcome Definitions and Scoring

Each response was scored using a three-tier rubric:

- **Score 2 (Accurate/actionable):** complete and correct per ground truth; includes clinically actionable elements when required (e.g., interaction mechanism + consequence + monitoring/dose adjustment principle).
- **Score 1 (Safe generalization):** correct but incomplete, vague, or non-actionable (e.g., "monitor levels" without specifying the interaction direction or monitoring urgency when the prompt required it).
- **Score 0 (Factual error/hallucination):** incorrect pharmacology, incorrect interaction direction, erroneous monitoring target, or fabricated facts that could plausibly lead to harm.

Bias Mitigation, Blinding, and Adjudication

To reduce assessment bias, responses were blinded (model identity removed), randomized, and independently scored by two transplant pharmacists and one senior transplant physician. Disagreements were resolved by consensus. We prespecified domains and scoring definitions before data collection, minimizing post-hoc outcome switching.

Ethics

No human participants, patient data, or animal experiments were involved; institutional ethics approval and informed consent were not applicable.

Statistical Analysis

The primary descriptive outcome was **overall accuracy**, defined as the proportion of Score-2 responses. Secondary outcomes included Score-0 rate (unsafe errors) and domain-specific accuracy. Inter-rater agreement was measured using Cohen's κ. Model performance distributions were compared using χ^2 tests (two approaches: (i) 3-category distribution across Score 0/1/2; (ii) dichotomized accuracy vs non-accuracy). Two-sided *P*-values <0.05 were considered statistically significant. Analyses were performed in R [19].

Results

Scoring Reliability

Inter-rater agreement was excellent (Cohen's κ=0.88), supporting stable application of the scoring rubric.

Overall Performance and Error Profile

Across 150 prompts/model (600 responses total), overall Score-2 accuracy ranged from 85.3% to 91.3% (Table 1). Unsafe errors (Score 0) were uncommon (1.3%–4.7%). Comparing the full 3-category score distributions across models showed no statistically significant difference (χ^2=6.09, df=6, p=0.413) (Table 3). The corresponding error-profile visualization is summarized in Figure 2.

Figure 1. STROBE-aligned workflow diagram for prompt development, LLM querying, blinding, scoring, and adjudication.

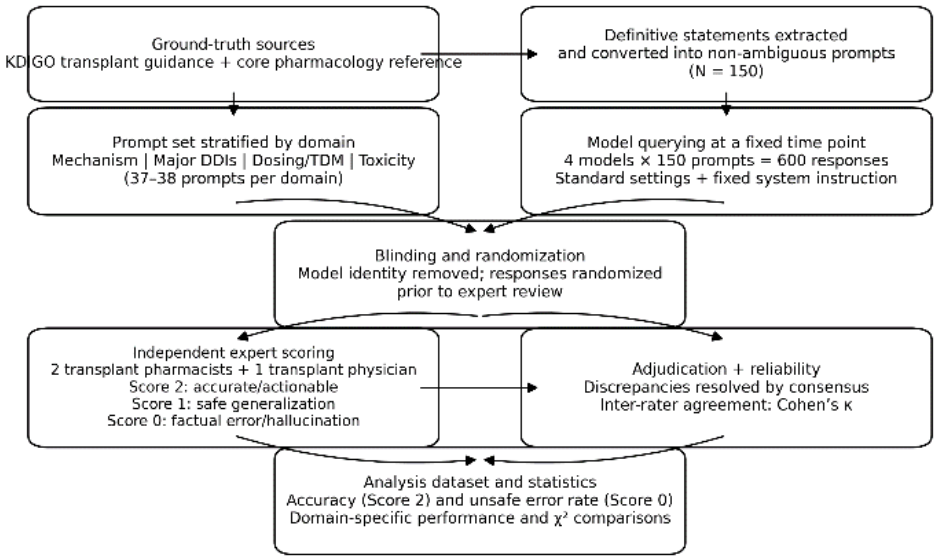


Table 1. Overall accuracy and error profile by model (n=150 prompts/model)

LLM	Score 2 Accurate, n (%)	95% CI (Wilson)	Score 1 Safe generalization, n (%)	Score 0 Factual error, n (%)	Unsafe rate (Score 0, %)
GPT-5.1	137 (91.3)	85.7–94.9	11 (7.3)	2 (1.3)	1.3
GPT-4.1	131 (87.3)	81.1–91.7	12 (8.0)	7 (4.7)	4.7
Gemini	128 (85.3)	78.8–90.1	18 (12.0)	4 (2.7)	2.7
Claude	130 (86.7)	80.3–91.2	13 (8.7)	7 (4.7)	4.7

Table 2. Domain-specific accuracy (Score 2) by model

Domain	GPT-5.1 (n/N, %)	GPT-4.1 (n/N, %)	Gemini (n/N, %)	Claude (n/N, %)
Drug explanation/mechanism	36/37 (97.3)	36/38 (94.7)	34/37 (91.9)	36/38 (94.7)
Major DDIs	35/37 (94.6)	33/38 (86.8)	31/37 (83.8)	32/38 (84.2)
Dosing principles/TDM	33/37 (89.2)	32/38 (84.2)	30/37 (81.1)	31/38 (81.6)
Toxicity profiles	31/37 (83.8)	32/38 (84.2)	32/37 (86.5)	32/38 (84.2)

Table 3. χ^2 comparisons across models

Comparison	Test structure	χ^2	df	*P*-value
Overall (Score 0/1/2 distribution)	4 models × 3 categories	6.09	6	0.413
Overall (Accurate vs non-accurate)	4 models × 2 categories	2.77	3	0.428
Drug explanation (Accurate vs non-accurate)	4 × 2	1.07	3	0.784
Major DDI (Accurate vs non-accurate)	4 × 2	2.51	3	0.473
Dosing principles (Accurate vs non-accurate)	4 × 2	1.14	3	0.767
Toxicity (Accurate vs non-accurate)	4 × 2	0.13	3	0.988

Table 4. Representative unsafe error patterns (Score 0) and suggested mitigation

Error pattern	Why it is high-risk in kidney transplantation	Example prompt type	Recommended safeguard
Incorrect numeric targets (TDM)	May trigger inappropriate dose escalation/reduction → rejection or toxicity	"Target tacrolimus trough beyond 6 months"	Require cross-check with guideline/protocol + pharmacist sign-off
Wrong interaction direction	Mismanagement of inhibitor/inducer effects → supratherapeutic or subtherapeutic exposure	"Tacrolimus + azole/diltiazem"	Use an interaction compendium and confirm expected directionality
Mechanistic conflation (CNI vs mTORi)	Misleads toxicity monitoring priorities	"Sirolimus mechanism vs tacrolimus"	Restrict LLM use to explanatory support; verify mechanisms in reference text
Over-generalized "consult protocol" framed as definitive	Creates false reassurance and delays monitoring	"Dose adjustment required?"	Enforce response template requiring: interaction, direction, urgency of monitoring

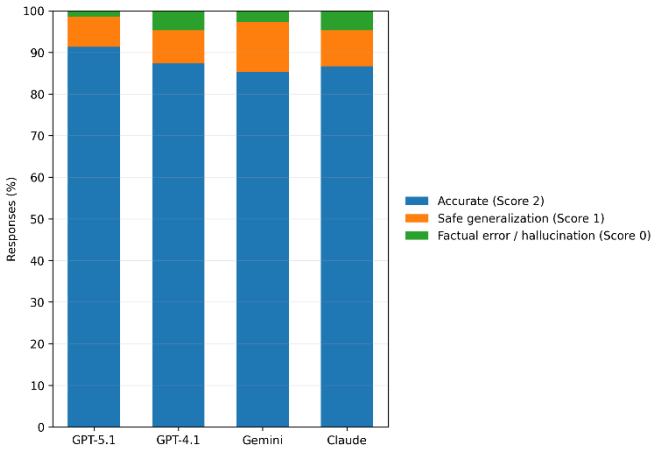
Domain-Specific Performance

Domain-specific accuracies are shown in Table 2 and Figure 3. Performance was highest for drug explanation-mechanism questions and lower for dosing principles and major DDIs, largely due to increased Score-1 (safe but non-actionable) responses in those domains. Across models, χ^2 tests did not demonstrate statistically significant differences in domain accuracies (Table 3), but clinically meaningful variation in unsafe error rates persisted (Table 1).

Patterns of Unsafe Errors

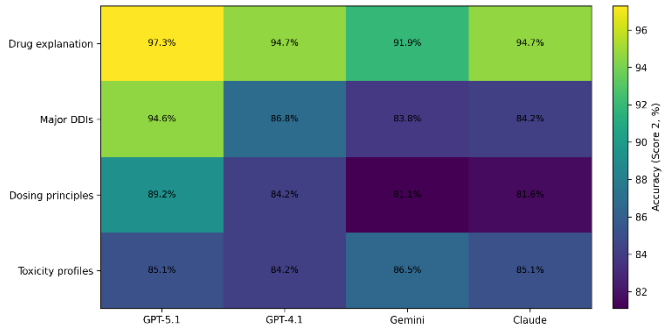
Unsafe errors (Score 0) primarily involved (i) incorrect numeric targets or ranges when a specific guideline-anchored value was requested, (ii) incorrect interaction directionality (e.g., claiming decreased tacrolimus exposure with an inhibitor), or (iii) mechanistic conflation between CNIs and mTOR inhibitors. Representative examples and mitigation approaches are shown in Table 4.

Figure 2. Overall score distribution (Score 2/1/0) by model (stacked bars).



Legend: Stacked bar chart with each bar representing one model and the proportion of responses in Score 2 (accurate/actionable), Score 1 (safe generalization), and Score 0 (factual error/hallucination). Values correspond to Table 1.

Figure 3. Domain-specific accuracy heatmap (Score 2%) across models.



Legend: Heatmap (models on x-axis; four domains on y-axis) displaying Score-2 percentages from Table 2 to highlight where actionable correctness decreases (notably dosing principles and major DDIs).

Discussion

Principal Findings

In this guideline-anchored benchmark, all four LLMs achieved high overall accuracy for kidney transplant pharmacology, with low—but non-zero—unsafe error rates. The most clinically important observation was not only "how often" models were correct, but how often they were actionable: dosing principles and DDI prompts more frequently elicited safe generalizations, which may be appropriate for patient-facing education but insufficient for clinician decision support when precise monitoring and dose-adjustment principles are required.

Comparison With Prior Literature

Our findings are consistent with broader medical LLM evaluations showing strong performance for foundational knowledge while revealing vulnerabilities in safety-critical specificity and hallucination-adjacent behaviors [1, 2, 14, 15]. Tang et al. [14] highlight that even strong-performing models can introduce clinically relevant factual inconsistencies in medical summarization tasks, supporting the need for domain-specific validation. Roustan et al. [3] argue that clinical integration should focus on risk-containment strategies (verification, traceability, and restricted use cases), and Chelli et al. [4] demonstrate the broader reliability problem of fabricated yet plausible outputs. Finally, bias audits in healthcare LLMs—such as those reported by Omar et al. [5] and operationalized by Templin et al. [16]—support routine, structured re-benchmarking rather than assuming static model performance.

Clinical Implications

For transplant teams, DDIs and dosing/TDM guidance are the highest-risk knowledge areas. Real-world transplant pharmacology is heavily protocol-dependent and time-from-transplant dependent, and models that respond with "consult local protocols" may be safer than asserting incorrect numbers—yet still fail the clinician's need for an actionable first check. This matters because common interactions (e.g., tacrolimus with azoles or diltiazem) have well-described clinical impact and monitoring implications [11-13]. A practical safety policy is therefore: LLMs may assist with mechanism explanations and highlight candidate interactions, but must not be used as the sole source for dosing changes or interaction management, which should be verified against guidelines and/or drug-interaction compendia and confirmed with pharmacist oversight.

Strengths

Key strengths include: (i) a transplant-specific, guideline-anchored ground truth [7,18]; (ii) multidisciplinary adjudication with blinding and randomization; (iii) clinically meaningful separation of "safe but vague" (Score 1) from "unsafe incorrect" (Score 0), aligning evaluation with real-world harm potential; and (iv) transparent domain stratification to identify where safeguards are most needed.

Limitations and Potential Biases

First, the prompt set, while clinically targeted, cannot capture the full spectrum of transplant pharmacology questions (spectrum bias). Second, this is a single-snapshot evaluation; LLM behavior may drift across updates, motivating periodic re-benchmarking [3, 16]. Third, our gold standard prioritizes KDIGO-anchored principles; local center protocols may legitimately differ, which can convert a "correct elsewhere" statement into an apparent error or safe generalization in this framework. Fourth, the inclusion of simulated next-generation models (GPT-4.1, GPT-5.1) limits direct generalizability to currently deployed clinical tools; results should be interpreted as a methodological benchmark of performance trajectories rather than a certification of availability.

Future Directions

Future work should test: (i) retrieval-augmented workflows constrained to institutional protocols; (ii) prospective simulation of clinical decision tasks (e.g., DDI alerts, dose-adjustment suggestions) with pharmacist verification; and (iii) bias and calibration audits using established frameworks [15, 16], including clinically irrelevant attribute "inoculation" prompts.

Conclusion

LLMs demonstrated high performance for kidney transplant pharmacology but retained a measurable unsafe error rate and frequent non-actionable generalization in dosing and DDI domains. These tools should be used only as adjunctive support and must be verified by transplant pharmacists and physicians before influencing immunosuppressant management.

References

1. Sallam M. ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns. Healthcare (Basel). 2023;11(6):887. doi:10.3390/healthcare11060887.
2. Wang L, Wan Z, Ni C, Song Q, Li Y, Clayton E, et al. Applications and Concerns of ChatGPT and Other Conversational Large Language Models in Health Care: Systematic Review. J Med Internet Res. 2024;26:e22769. doi:10.2196/22769.
3. Roustan D, Bastardot F. The Clinicians' Guide to Large Language Models: A General Perspective With a Focus on Hallucinations. Interact J Med Res. 2025;14:e59823. PMID:39874574.
4. Chelli M, Descamps J, Lavoué V, Trojani C, Azar M, Deckert M, et al. Hallucination Rates and Reference Accuracy of ChatGPT and Bard for Systematic Reviews: Comparative Analysis. J Med Internet Res. 2024 May 22;26:e53164. doi: 10.2196/53164. PMID: 38776130; PMCID: PMC11153973.
5. Omar M, Soffer S, Agbareia R, Bragazzi NL, Apakama DU, Horowitz CR, et al. Sociodemographic biases in medical decision making by large language models. Nat Med. 2025 Jun;31(6):1873-81. doi: 10.1038/s41591-025-03626-6. Epub 2025 Apr 7. PMID: 40195448.
6. Halloran PF. Immunosuppressive drugs for kidney transplantation. N Engl J Med. 2004;351(26):2715-29. doi:10.1056/NEJMra033540. PMID:15616206.
7. Kidney Disease: Improving Global Outcomes (KDIGO) Transplant Work Group. KDIGO clinical practice guideline for the care of kidney transplant recipients. Am J Transplant. 2009;9 Suppl 3:S1-S155. doi:10.1111/j.1600-6143.2009.02834.x. PMID:19845597.
8. Naesens M, Kuypers DRJ, Sarwal M. Calcineurin inhibitor nephrotoxicity. Clin J Am Soc Nephrol. 2009;4(2):481-508. doi:10.2215/CJN.04800908. PMID:19218475.
9. Kahan BD. Therapeutic drug monitoring of immunosuppressant drugs in clinical practice. Clin Ther. 2002;24(3):330-50. PMID:11952020.

10. Lange NW, Salerno DM, Berger K, Tsapepas DS. Using known drug interactions to manage supratherapeutic calcineurin inhibitor concentrations. Clin Transplant. 2017;31(11):e13098. doi:10.1111/ctr.13098. PMID:28856745.
11. Moradi O, Karimzadeh I, Davani-Davari D, Shafiekhani M, Sagheb MM, Raees-Jalali GA. Drug-Drug Interactions among Kidney Transplant Recipients in The Outpatient Setting. Int J Organ Transplant Med. 2020;11(4):185-95. PMID: 33335699; PMCID: PMC7726842.
12. He J, Yu Y, Yin C, Liu H, Zou H, Ma J, et al. Clinically significant drug-drug interaction between tacrolimus and fluconazole in stable renal transplant recipient and literature review. J Clin Pharm Ther. 2020 Apr;45(2):264-9. doi: 10.1111/jcpt.13075. Epub 2019 Nov 22. PMID: 31756280.
13. Susomboon T, Kunlamas Y, Vadcharavivad S, Vongwiwatana A. The effect of the very low dosage diltiazem on tacrolimus exposure very early after kidney transplantation: a randomized controlled trial. Sci Rep. 2022 Aug 21;12(1):14247. doi: 10.1038/s41598-022-18552-7. PMID: 35989346; PMCID: PMC9393165.
14. Tang L, Sun Z, Idnay B, et al. Evaluating large language models on medical evidence summarization. NPJ Digit Med. 2023;6(1):158. PMID:37162998.
15. Asgari E, Montaña-Brown N, Dubois M, Khalil S, Balloch J, Yeung JA, et al. A framework to assess clinical safety and hallucination rates of LLMs for medical text summarisation. NPJ Digit Med. 2025 May 13;8(1):274. doi: 10.1038/s41746-025-01670-7. PMID: 40360677; PMCID: PMC12075489.
16. Templin T, Fort S, Padmanabham P, Seshadri P, Rimal R, Oliva J, et al. Framework for bias evaluation in large language models in healthcare settings. NPJ Digit Med. 2025 Jul 7;8(1):414. doi: 10.1038/s41746-025-01786-w. PMID: 40624264; PMCID: PMC12234702.
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. Lancet. 2007;370(9596):1453-7. PMID:18064739.
18. Brunton LL, Hilal-Dandan R, Knollmann BC, eds. Goodman & Gilman's The Pharmacological Basis of Therapeutics. 14th ed. New York: McGraw-Hill Education; 2022.
19. R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing; 2023.

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Efficacy of infiltrative anesthesia for extraction of endodontically treated mandibular molars: A randomized controlled trial

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Ethics Committee Approval
Ethical approval was obtained (Clinical Research Ethics Committee, 14567952-050/465; Ministry of Health, Medicine, and Medical Devices Agency, 66175679- 514.11.01- E.67415). All subjects were recruited from the Necmettin Erbakan University, Faculty of Dentistry, Oral and Maxillofacial Surgery Department.
We accept the data sharing policy of Journal of Surgery and Medicine which is categorized under "expects data sharing". The data can be found in doi: 10.6084/m9.figshare.25826032
NCT06439186 (ClinicalTrials.gov ID)
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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Abstract

Background/Aim: In most dental curricula, it has been taught that infiltrative anesthesia (IA) is not sufficient for the extraction of lower molars and that an inferior alveolar nerve block (IANB) is required instead. This study compared the effectiveness of IANB and IA for the extraction of mandibular molars that had previously undergone root canal treatment.

Methods: Patients older than 18 years who had a mandibular molar with previously completed root canal treatment were included. Patients who were allergic to local anesthetics, those with severely mobile teeth, those with severe pain due to acute infection, and those using psychotropic drugs were excluded. Sixty subjects were randomly divided into the study (n=30) and control (n=30) groups. An anesthetic solution containing 20 mg/mL lidocaine and 0.0125 mg/mL epinephrine was used. In the study group, only vestibular and lingual IA were used. In the control group, IANB was performed. The teeth were extracted following the standard procedure. The pain experienced during extraction was compared between the study and control groups.

Results: There was no significant difference in extraction pain between the two anesthesia techniques (P=0.836). The gender of the patient and whether the tooth to be extracted was a first or second molar did not affect pain (P=0.953 and P=0.900, respectively).

Conclusion: Buccal and lingual IA can be used to extract the mandibular molars in certain cases. Teaching dental students that IA can be used instead of IANB in some mandibular molar extractions may provide them with comfort and confidence in clinical practice.

Keywords: local infiltration anesthesia, inferior alveolar block, tooth extraction

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Introduction

The most commonly used local anesthetic techniques for tooth extraction are infiltration anesthesia (IA) and inferior alveolar nerve block (IANB) [1].

IA is a simple method that can be used to extract all maxillary teeth, mandibular incisors, and premolars. Traditionally, IANB is used in the mandibular molar region because of the presence of thick buccal cortical bone, which hinders the infiltration of anesthetic solutions, making IA inadequate [2]. On the other hand, IANB has a high failure rate, reported to be as high as 20–25%, and can also lead to various complications, such as trismus, hematoma, and facial nerve palsy [3]. All of these possibilities put considerable stress on dental students.

Given the complexity of the IANB technique, some researchers have proposed alternative approaches; however, these methods have not gained widespread popularity primarily because they require specialized equipment, such as specific syringes, needles, or computer-controlled systems [4].

On the other hand, it is widely acknowledged that performing buccal and lingual IA is typically sufficient in most cases during implant surgery in the posterior region of the mandible [5]. From the anesthesia perspective, the only difference between inserting a dental implant and extracting a tooth is the presence of tooth pulp. Therefore, we hypothesized that a devitalized mandibular molar can be thought of as a dental implant and can be extracted using IA alone without the need for IANB.

In this study, we aimed to compare the efficacy of IANB and IA applied with lidocaine for the extraction of previously root canal-treated mandibular first and second molars.

Materials and methods

The study was implemented as a prospective, randomized, and non-blinded clinical trial. Ethical approval was obtained (Clinical Research Ethics Committee, 14567952-050/465; Ministry of Health, Medicine, and Medical Devices Agency, 66175679-514.11.01-E.67415). All subjects were recruited from the Necmettin Erbakan University, Faculty of Dentistry, Oral and Maxillofacial Surgery Department.

The inclusion criteria were as follows: the patients should be over 18 years old, the tooth to be extracted should be a mandibular first or second molar, and the tooth to be extracted should have undergone root canal treatment. The exclusion criteria were as follows: local anesthetic allergy, severely mobile teeth, and severe pain due to an acute infection. Patients who use psychotropic drugs that may alter their perception of pain were also excluded from the study.

Written informed consent forms, which described the procedure to be performed and provided explanations of the clinical benefits and potential complications, were obtained from all subjects. All anesthesia and extraction procedures were performed by the same surgeon.

Sixty subjects (27 males and 33 females) who met the criteria were selected. They were randomized according to their identification numbers and divided into two equal groups. In both groups, 2 mL of a local anesthetic solution containing 20 mg/mL lidocaine and 0.0125 mg/mL epinephrine was used (Jetokain, Adeka, Samsun/Türkiye).

The control group (n=30) underwent conventional IANB, commonly referred to as the "Halstead" technique. For this purpose, 1.5 mL of anesthetic solution was injected around the mandibular foramen. The syringe was then withdrawn slightly, and approximately 0.2 mL of solution was administered for lingual nerve anesthesia [1]. The remaining 0.3 mL of solution was infiltrated into the vestibule to anesthetize the vestibular gingiva.

In the study group (n=30), 1.5 mL of anesthetic solution was infiltrated on the vestibular side, and a 0.5 mL solution was infiltrated on the lingual side of the tooth to be extracted.

In both groups, after waiting for approximately five minutes, one tooth was extracted from each patient in the usual manner, using straight elevators and dental forceps. Forty of the teeth were first molars and twenty were second molars. A visual analog scale (VAS) was used to compare the pain experienced during extraction. It was a 100 mm horizontal line with “no pain” at the left end and “the worst pain imaginable” at the right end.

Statistical analysis

Statistical analysis was performed using IBM SPSS v22. Because the data did not follow a normal distribution, the non-parametric Mann-Whitney U test was used to compare groups. The statistical significance level was set at P <0.05. Pain experienced during tooth extraction was compared between the study and control groups, between genders, and between first and second molars.

Results

All participants remained in the study. The study group ranged from 19 to 62 years (mean: 40.07 [12.32]), while the control group ranged from 20 to 73 years (mean: 35.57 [12.88]). All tooth extractions were completed without complications. There were no significant differences in pain experienced during extraction between the study and control groups (Table 1), between genders (Table 2), or between the first and second molars (Table 3).

Table 1: Comparison of pain levels between the control and study groups.

Group	n	Mean pain score	*P*-value
Control group	30	2.17 (1.45)	0.836
Study group	30	2.51 (2.01)	

Table 2: Comparison of pain levels according to the gender

Gender	n	Mean pain score	*P*-value
Female	33	2.38 (1.87)	0.953
Male	27	2.29 (1.62)	

Table 3: Comparison of pain levels in the first and second molars

Tooth	n	Mean pain score	*P*-value
First molar	40	2.35 (1.78)	0.900
Second molar	20	2.32 (1.73)	

Discussion

Dental schools insist on teaching and training students in the conventional IANB technique for mandibular molars. Most clinicians continue this habit after they finish dental school. In this study, we compared the effectiveness of IANB and IA in the extraction of devitalized mandibular molars to reduce the number of cases in which clinicians had to perform IANB. IANB is relatively difficult to perform and is prone to complications. The failure rate can be as high as 15-20% and repeating the injection may not be effective in addressing this issue [6, 7]. It may be

accompanied by complications, such as pain during injection, trismus, facial paralysis, hematoma, needle breakage, diplopia, temporary blindness, and ophthalmoplegia [1, 8, 9].

IA is widely employed in the maxilla because of its ability to achieve adequate pulpal anesthesia through the diffusion of anesthetic solution into cancellous bone [10]. However, in the mandible, thicker and denser cortical bone presents a challenge for the anesthetic solution to effectively reach the inferior alveolar nerve, particularly in the molar region. As a result, block anesthesia is the preferred method for extracting the mandibular molars, for which IANB has traditionally been used [11].

The idea of anesthetising mandibular molars using IA alone is not a new one. Jung et al. reported that the use of buccal and lingual IA with lidocaine in vital mandibular first molars achieved pulpal anesthesia in 32-67% of patients [12]. When articaine was used, the success rate increased to 57-92%.

In a double-blind study of 60 subjects, Robertson et al. [13] performed buccal IA using lidocaine and articaine in the mandibular first molars. The reported success rates varied from 45% to 67% with lidocaine and 75% to 92% with articaine.

Bataineh and Alwarafi [14] conducted a comparative study between IANB and IA, assessing the efficacy of articaine for mandibular first molar extractions in a group of 52 subjects. They reported no significant differences between the two anesthesia methods. Corbett et al. found that the effectiveness of buccal and lingual articaine infiltration for pulp anesthesia of the first molar was comparable to that of an IANB carried out using lidocaine [15].

Jung et al. [12] conducted a study on 35 mandibular first molars by performing IA and IANB procedures using articaine. They reported that both methods yielded comparable success rates, leading to the conclusion that IA could be a valuable alternative.

Studies that utilized articaine for the extraction of mandibular molar teeth and compared IANB with IA claimed that articaine diffuses into the bone more effectively than other local anesthetics. As a result, it can increase the success rate of pulpal anesthesia in mandibular teeth [14].

Although articaine offers superior potency and duration of anesthesia when compared to lidocaine, some authors contend that articaine may have higher neurotoxicity levels and, therefore, should not be preferred in IANB [16]. Documented and repeated allergies to lidocaine are rare, and it remains the gold standard in dental local anesthesia, to which all new local anesthetics are compared [17].

We used lidocaine in both techniques and did not limit tooth extractions to the mandibular first molars. This is important because it has been claimed that the thickness of the buccal cortical bone in mandibular second molars is greater than that in first molars; consequently, the success rate of IA is more likely in first molars [13]. However, we demonstrated that the efficacy of IA was similar and sufficient in both molars.

The idea of this study was that only IA is sufficient, and IANB is not needed when placing dental implants in the mandibular molar region. The local anesthetic used in IA effectively numbs the bone surrounding the roots, although penetrating the pulp is more challenging.

We aimed to eliminate the pulp factor, but neither electrical pulp tests nor heat tests could provide conclusive results regarding the complete devitalization of the entire pulp. This decision required the support of devices such as a laser Doppler flowmeter and pulse oximeter which were obviously impractical [18].

Therefore, we included mandibular first and second molars that had previously undergone root canal treatment to confirm that the tooth to be extracted was non-vital. Local anesthesia failure is up to eight times more common in symptomatic teeth, as noted by others [12]. Thus, we excluded teeth with severe pain caused by a periradicular acute infection.

We employed the visual analogue scale (VAS), a widely used method for assessing pain that demonstrates high reliability and validity [19]. Gender is recognized as a significant factor in the pharmacodynamics and pain perception of local anesthesia [20].

While some studies argue that women tend to experience higher levels of pain, others report the opposite or claim that gender has no effect on anesthetic efficacy or injection discomfort [21, 22]. Therefore, we compared the pain scores of females and males and found that gender had no impact on the results.

The effectiveness of IA depends on the ability of the anesthetic solution to infiltrate the bone. Since the thickness of the buccal bone of the first and second molars may differ, we compared them but found no difference.

The most important limitation of our study is that it focused on mandibular molars that underwent root canal treatment. By expanding the study group, the study shows that teeth with devitalized pulp due to other reasons, such as a prolonged caries process, can also be extracted with infiltrative anesthesia.

Conclusion

IA is a simple and comfortable technique that virtually eliminates the risk of nerve damage and minimizes the risk of intravenous injection. We suggest that buccal and lingual IA can be used instead of IANB for the extraction of mandibular molars that have previously undergone root canal treatment and perhaps for otherwise devitalized molars. Dental students should be informed that such a practice is available.

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References

1. Malamed SF. Handbook of Local Anesthesia. 6th ed. St. Louis: Elsevier Health Sciences; 2004.
2. Wong MK, Jacobsen PL. Reasons for local anesthesia failures. J Am Dent Assoc. 1992;123:69-73.
3. Chevalier V, Arbab-Chirani R, Tea SH, Roux M. Facial palsy after inferior alveolar nerve block: case report and review of the literature. Int J Oral Maxillofac Surg. 2010;39:1139-42.
4. Shabazfar N, Daubländer M, Al-Nawas B, Kämmerer PW. Periodontal intraligament injection as alternative to inferior alveolar nerve block—meta-analysis of the literature from 1979 to 2012. Clin Oral Investig. 2014;18:351-8.
5. Göçmen G, Özkan Y. Comparison of the efficacy of local infiltration and mandibular block anesthesia with articaine for harvesting ramus grafts. J Oral Maxillofac Surg. 2016;74:2143-50.
6. Johnson TM, Badovinac R, Shaefer J. Teaching alternatives to the standard inferior alveolar nerve block in dental education: outcomes in clinical practice. J Dent Educ. 2007;71:1145-52.
7. AlHindi M, Rashed B, AlOtaibi N. Failure rate of inferior alveolar nerve block among dental students and interns. Saudi Med J. 2016;37:84-9.

8. Torrente-Castells E, Gargallo-Albiol J, Rodríguez-Baeza A, Berini-Aytés L, Gay-Escoda C. Necrosis of the skin of the chin: a possible complication of inferior alveolar nerve block injection. J Am Dent Assoc. 2008;139:1625-30.
9. Choi EH, Seo JY, Jung BY, Park W. Diplopia after inferior alveolar nerve block anesthesia: report of 2 cases and literature review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;107:e21-4.
10. Kanaa MD, Whitworth JM, Corbett IP, Meechan JG. Articaine and lidocaine mandibular buccal infiltration anesthesia: a prospective randomized double-blind cross-over study. J Endod. 2006;32:296-8.
11. Palti DG, Almeida CM, Rodrigues AC, Andreo JC, Lima JEO. Anesthetic technique for inferior alveolar nerve block: a new approach. J Appl Oral Sci. 2011;19:11-5.
12. Jung IY, Kim JH, Kim ES, Lee CY, Lee SJ. An evaluation of buccal infiltrations and inferior alveolar nerve blocks in pulpal anesthesia for mandibular first molars. J Endod. 2008;34:11-3.
13. Robertson D, Nusstein J, Reader A, Beck M, McCartney M. The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth. J Am Dent Assoc. 2007;138:1104-12.
14. Bataineh AB, Alwarafi MA. Patient's pain perception during mandibular molar extraction with articaine: a comparison study between infiltration and inferior alveolar nerve block. Clin Oral Investig. 2016;20:2241-50.
15. Corbett IP, Kanaa MD, Whitworth JM, Meechan JG. Articaine infiltration for anesthesia of mandibular first molars. J Endod. 2008;34:514-8.
16. Gaffen AS, Haas DA. Retrospective review of voluntary reports of nonsurgical paresthesia in dentistry. J Can Dent Assoc. 2009;75:579.
17. Wilson AW, Deacock S, Downie IP, Zaki G. Allergy to local anaesthetic: the importance of thorough investigation. Br Dent J. 2000;188:120-2.
18. Alghaithy RA, Qualtrough AJE. Pulp sensibility and vitality tests for diagnosing pulpal health in permanent teeth: a critical review. Int Endod J. 2017;50:135-42.
19. Nusstein JM, Beck M. Comparison of preoperative pain and medication use in emergency patients presenting with irreversible pulpitis or teeth with necrotic pulps. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003;96:207-14.
20. Vallerand AH, Polomano RC. The relationship of gender to pain. Pain Manag Nurs. 2000;1:8-15.
21. Gallatin J, Nusstein J, Reader A, Beck M, Weaver J. A comparison of injection pain and postoperative pain of two intraosseous anesthetic techniques. Anesth Prog. 2003;50:111-20.
22. Tófoli GR, Ramacciato JC, Volpato MC, Meechan JG, Ranali J, Groppo FC. Anesthetic efficacy and pain induced by dental anesthesia: the influence of gender and menstrual cycle. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;103:e34-8.

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Case report
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The relationship between hyperphagia and increased intracranial pressure: A new look at obesity treatment

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Abstract

Some diseases that progress with excessive intracranial pressure, such as pseudotumor cerebri, are associated with obesity. A 64-year-old female who was admitted to the hospital with a complaint of weight gain was diagnosed with pseudotumor cerebri. She had had a lumboperitoneal shunt for 10 years, and it had stopped working. It was challenging to determine whether the shunt tip, observed between abdominal fat layers and obscured by pseudomembranes, had become functionally shortened due to the patient's weight gain and had failed to reach the peritoneal cavity, or whether long-standing pseudomembrane obstruction had impaired drainage of cerebrospinal fluid. The latter situation may have led to increased intracranial pressure, subsequently triggering hyperphagia and contributing to the patient's further weight gain. Based on this clinical example, demonstrating that excessive intracranial pressure is associated with hyperphagia may inform novel approaches to obesity management.

Keywords: hyperphagia, mastication, intracranial pressure, obesity

Introduction

The rising prevalence of obesity necessitates research to clarify its etiopathogenesis and guide effective treatment strategies. Cerebrospinal fluid flow and intracranial pressure disorders have been shown to affect the prevalence of headache and visual functions. However, the relationship of these disorders with obesity, which affects metabolic and hormonal factors, has also been noted in recent studies [1]. Some investigations have focused on using the mechanical functions of mastication in the rehabilitation and treatment of cranial pain and some postoperative comorbidities [2]. However, individuals with certain diseases that are accompanied by increased intracranial pressure, such as idiopathic intracranial hypertension and pseudotumor cerebri, are generally overweight or obese [3]. Treatment typically involves weight management in conjunction with medical and surgical interventions aimed at reducing intracranial pressure [1, 3].

Based on the mechanical-functional connection of headache and mastication and diseases in which headache is associated with obesity for endocrine-metabolic reasons, a connection between headache-mastication-hyperphagia and being overweight or even obese has been proposed [3]. This situation is contrary to the classical view that the benefits of weight control can be used to manage headache; treatment for headache is promising for a permanent solution to the management of obesity.

Here, we focus on a 64-year-old female who presented with weight gain and gastrointestinal system symptoms. She was diagnosed with pseudotumor cerebri and had had a lumboperitoneal (LP) shunt for 10 years. We determined that the shunt remained in the subcutaneous tissue and resulted in the dysfunction.

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Informed Consent
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Conflict of Interest
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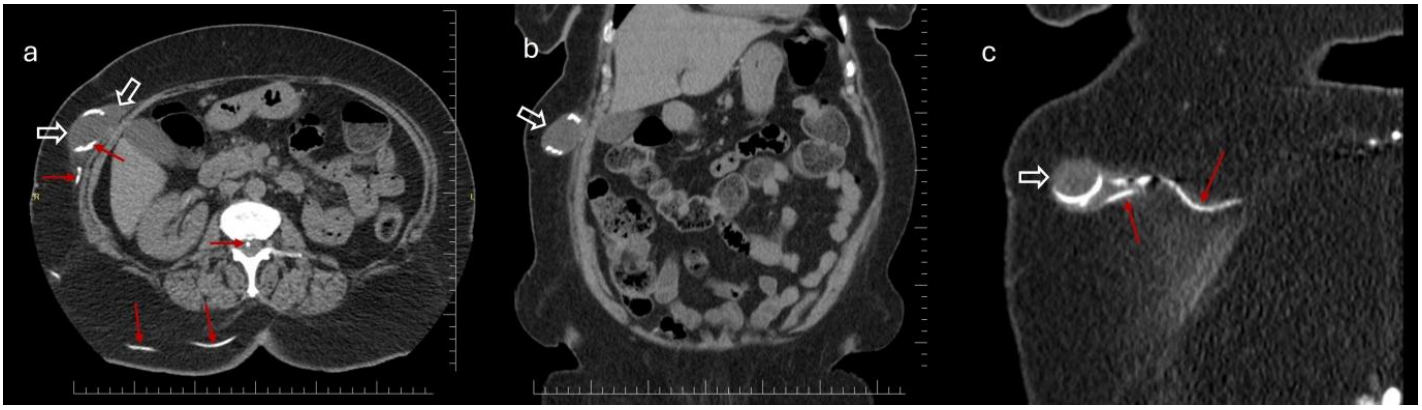
Figure 1. Unenhanced abdominal computed tomography. a) axial section, b) coronal section, c) sagittal section. Shunt dysfunction due to the shunt tube migrating to a subcutaneous location in the abdomen. Cystic lesion in the subcutaneous tissue (open arrow). Lumboperitoneal shunt tube (red arrow).



Case presentation

The patient's medical history included hypertension, cardiac arrhythmia, papilledema, pseudotumor cerebri, and an LP shunt inserted 10 years ago. She also stated that she had had a pacemaker inserted 3 years ago. She had been examined for hyperglycemic symptoms for a few months, and had experienced increasing episodes of headaches and increasing gastrointestinal system symptoms for the last few years. Her primary complaints were dyspeptic complaints, indigestion-constipation, and weight gain.

Although no other intraabdominal abnormality was detected upon ultrasonography, the distal end of the LP shunt was subcutaneously terminated. We observed a cystic formation measuring 6 cm in diameter at its tip. In abdominal computerized tomography (CT), the density of the linear catheter entering the spinal canal at the level of the L2 vertebra and a cyst approximately 6 cm in diameter around the catheter in the subcutaneous tissue in the right subcostal area were noted. The catheter did not have an intraperitoneal extension (Figure 1). In the brain CT, the 3rd ventricle, lateral ventricle, and hemispheric cortical sulci were slightly widened secondary to atrophy.

Although the patient's rate of weight gain could not be determined due to the limitations of the anamnesis, the patient's Body Mass Index was 32. The increase in the prevalence of gastrointestinal symptoms and the emergence of hyperglycemia, along with her weight gain, the presence of cardiac disease, and the accompanying headache and shunt dysfunction, all suggested that the patient might be suffering from intracranial pressure-related issues. Therefore, the patient was referred to a center specializing in gastrointestinal conditions with recommendations to receive treatment to reduce her intracranial pressure and address her dysfunctional shunt.

Discussion

Some diseases that progress with excessive intracranial pressure, such as pseudotumor cerebri, are associated with obesity [4, 5]. Weight loss has been shown to support the management of conditions such as idiopathic intracranial hypertension [3]. Moreover, genetic disorders such Prader-Willi syndrome have been linked to hyperphagia. Recent studies have proposed therapeutic approaches targeting neuropsychiatric and endocrinological factors in obesity management [6].

This case study suggests that elevated intracranial pressure may affect eating behavior, mastication function, and headache perception, potentially contributing to weight gain [7]. Demonstrating a link between excess intracranial pressure and hyperphagia can pave the way for new developments to improve, or perhaps even change, the obesity treatment spectrum.

References

1. Wang MTM, Bhatti MT, Danesh-Meyer HV. Idiopathic intracranial hypertension: Pathophysiology, diagnosis and management. J Clin Neurosci. 2022;95:172-9. doi: 10.1016/j.jocn.2021.11.029.
2. Jarc N, Scheiwe C, Plachta DTT, Schmoor C, Gierthmuehlen PC, Gierthmuehlen M. Assessment of postoperative pain, dysesthesia, and weather sensitivity after pterional and temporal neurosurgical approaches. J Neurosurg. 2023;140(5):1406-13. doi: 10.3171/2023.8.JNS231307
3. Ottridge R, Mollan SP, Botfield H, Frew E, Ives NJ, Matthews T, et al. Randomised controlled trial of bariatric surgery versus a community weight loss programme for the sustained treatment of idiopathic intracranial hypertension: the Idiopathic Intracranial Hypertension Weight Trial (IIH:WT) protocol. BMJ Open. 2017 Sep 27;7(9):e017426. doi: 10.1136/bmjopen-2017-017426.
4. Friedman DI. The Pseudotumor Cerebri Syndrome. Neurol Clin. 2024 May;42(2):433-71. doi: 10.1016/j.ncl.2024.02.001.
5. Guzelyuz B, Taşkın HE, Kemerdere R, Kösem YÖT, Tahmazoğlu B, Çetintaş SC. Placement of lumboperitoneal shunt: Etiology of iatrogenic gastric perforation. J Surg Med. 2022;6(4):533-4. doi:10.28982/josam.982170
6. Roof E, Deal CL, McCandless SE, Cowan RL, Miller JL, Hamilton JK, et al. Intranasal Carbetocin Reduces Hyperphagia, Anxiousness, and Distress in Prader-Willi Syndrome: CARE-PWS Phase 3 Trial. J Clin Endocrinol Metab. 2023 Jun 16;108(7):1696-708. doi: 10.1210/clinem/dgad015.
7. Perry SK, Emrick JJ. Trigeminal somatosensation in the temporomandibular joint and associated disorders. Front Pain Res (Lausanne). 2024 May 9;5:1374929. doi: 10.3389/fpain.2024.1374929. Erratum in: Front Pain Res (Lausanne). 2024 Jul 05;5:1454278. doi: 10.3389/fpain.2024.1454278.

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Case report
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A rare osseous mass of the middle ear: Endoscopic management of a middle ear osteoma – A case report

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Abstract

Middle ear osteomas are extremely rare benign tumors of the temporal bone and are most commonly associated with conductive hearing loss due to ossicular chain involvement. We report the case of a 24-year-old female who presented with left-sided hearing loss, intermittent otalgia, and taste disturbance. Radiological evaluation revealed a well-defined bony lesion within the middle ear. The patient was treated successfully using an endoscopic transcanal approach. Histopathological examination confirmed the diagnosis of osteoma. Postoperative audiometry demonstrated marked hearing improvement. This case highlights the rarity of middle ear osteomas and emphasizes the effectiveness of endoscopic ear surgery as a minimally invasive treatment option.

Keywords: middle ear osteoma, endoscopic ear surgery, conductive hearing loss, ossicular chain

Introduction

Osteomas are benign, slow-growing bone tumors that frequently arise in the paranasal sinuses and external auditory canal [1]. Involvement of the middle ear is exceedingly rare, with only a limited number of cases reported in the literature [2, 3]. Patients usually present with conductive hearing loss caused by ossicular chain fixation, although otalgia, tinnitus, and facial nerve involvement have also been described [4]. High-resolution temporal bone computed tomography is the gold standard for diagnosis and surgical planning [5]. Endoscopic ear surgery has increasingly been adopted for selected middle ear pathologies due to improved visualization and reduced surgical invasiveness compared with conventional microscopic approaches [6]. The aim of this case report was to present the endoscopic transcanal management and clinical outcome of a rare middle ear osteoma in a young adult patient.

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Informed Consent
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Case presentation

A 24-year-old female presented with progressive hearing loss in the left ear, intermittent otalgia, and taste disturbance affecting the left side of the tongue. There was no history of chronic otitis media, trauma, or previous otologic surgery. Otoscopic examination revealed an intact tympanic membrane without signs of infection (Figure 1). Pure tone audiometry demonstrated conductive hearing loss in the left ear with a clear air–bone gap (Figure 2). High-resolution temporal bone computed tomography revealed a well-circumscribed hyperdense bony lesion within the left middle ear cavity causing ossicular chain fixation (Figure 3).

Figure 1: Preoperative endoscopic view of the left tympanic membrane demonstrating an intact membrane with preserved anatomical landmarks.

Figure 2: Preoperative pure tone audiometry showing normal hearing thresholds in the right ear and conductive hearing loss in the left ear, characterized by a significant air–bone gap.

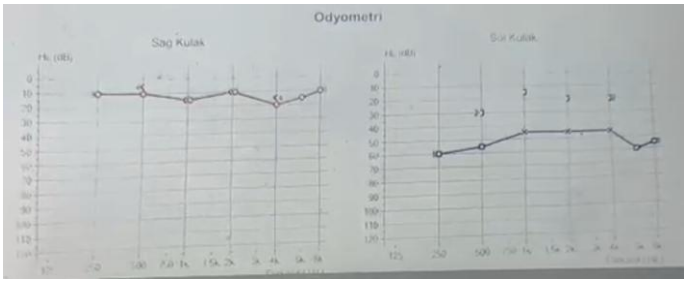


Figure 3: Preoperative axial temporal bone computed tomography image demonstrating a well-defined hyperdense osseous lesion located within the left middle ear cavity. The lesion is closely related to the ossicular chain and causes mechanical fixation. An arrow indicates the lesion.

The patient underwent endoscopic transcanal middle ear surgery under general anesthesia. Following tympanomeatal flap elevation, a bony mass consistent with an osteoma was identified in close proximity to the ossicular chain, resulting in restricted ossicular mobility (Figure 4). Intraoperatively, the osteoma was found to encase the ossicular chain without evidence of invasion, allowing preservation of the ossicles during excision. A 0-degree endoscope was used for the primary surgical steps, and a 30-degree endoscope was additionally employed to enhance visualization of the posterior mesotympanum and to confirm complete excision.

The osteoma was completely excised using an endoscopic approach, providing adequate exposure of the middle ear cavity and ossicular chain (Figure 5). Instability of the incudostapedial joint was noted intraoperatively and was reinforced using bone cement. Histopathological examination confirmed the diagnosis of osteoma. At the six-month postoperative follow-up, pure tone audiometry demonstrated marked improvement in hearing thresholds with closure of the air–bone gap (Figure 6), and the patient reported no persistent or recurrent taste disturbance.

Figure 4: Intraoperative endoscopic view demonstrating a bony mass consistent with an osteoma in close proximity to the ossicular chain.

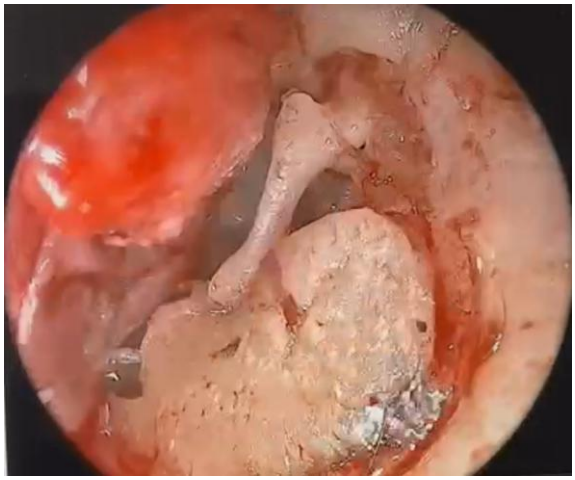


Figure 5: Intraoperative endoscopic view of the middle ear following complete excision of the osteoma.

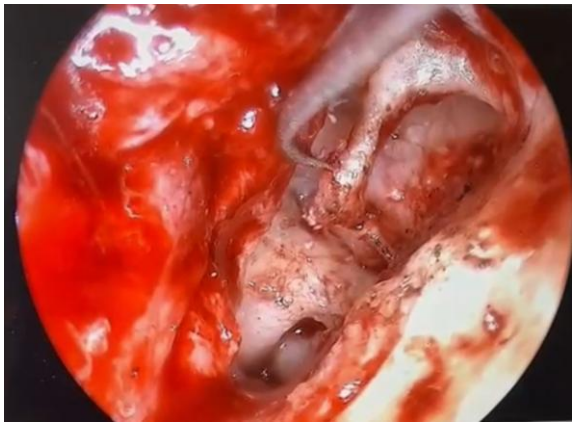
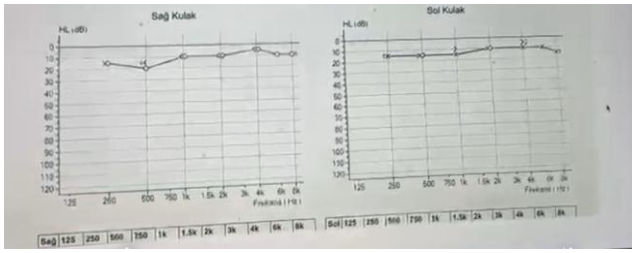


Figure 6: Six-month postoperative pure tone audiometry demonstrating closure of the preoperative air–bone gap.



Written informed consent was obtained from the patient for publication of this case report and the accompanying images. The report was prepared in accordance with the ethical standards of the institutional research committee and the Declaration of Helsinki.

Discussion

Middle ear osteomas are among the rarest benign tumors of the temporal bone. Since their first description in the literature, only a small number of cases have been reported [2, 3]. Conductive hearing loss is the most common presenting symptom and typically results from ossicular chain fixation [4]. Additional symptoms may occur depending on tumor size and anatomical location. In the present case, taste disturbance was a notable complaint, which can be explained by the close relationship of middle ear structures to the chorda tympani nerve. The complete resolution of taste disturbance observed at the six-month follow-up supports functional preservation of the chorda tympani nerve, consistent with reports describing recovery when the nerve is anatomically preserved during middle ear surgery [7-9].

The differential diagnosis of a well-defined osseous lesion confined to the middle ear cavity includes middle ear osteoma, ossifying fibroma, osteoid osteoma/osteoblastoma, tympanosclerosis with ossicular fixation, and other rare fibro-osseous lesions [10-13]. Lesions originating from the external auditory canal, such as exostoses and external canal osteomas, are typically localized to the bony canal and only exceptionally extend into the middle ear; therefore, they are generally distinguished by their site of origin on high-resolution temporal bone CT [10, 11]. Ossifying fibroma may demonstrate a more expansile growth pattern and can show mixed radiological density rather than the uniformly hyperdense, sharply circumscribed appearance typical of osteoma [12]. Osteoid osteoma is often characterized by disproportionate otalgia and may show a nidus on CT imaging, findings that were absent in our case [13]. In the present patient, the lesion's sharply circumscribed homogeneous hyperdense appearance on high-resolution CT, together with histopathological confirmation, supported the diagnosis of a middle ear osteoma and helped exclude other middle ear fibro-osseous entities [10-13]. Histopathologically, osteomas are generally classified as compact (ivory) or cancellous (spongiotic/trabecular) types. Compact osteomas are reported more frequently in temporal bone lesions and tend to be denser, which may increase the technical difficulty of surgical excision, whereas spongiotic osteomas may be removed more easily due to their trabecular architecture [9].

Traditionally, microscopic surgical approaches have been used; however, endoscopic ear surgery offers superior visualization and reduced invasiveness [6]. In particular, endoscopes with different viewing angles may improve exposure of blind spots around the ossicular chain and the incudostapedial joint. In our case, a 0-degree endoscope was used for the main surgical steps, while a 30-degree endoscope was additionally employed to improve visualization of the posterior mesotympanum and other partially hidden areas behind the lesion. This angled view facilitated safe dissection along a clear surgical plane and helped confirm complete excision while preserving ossicular integrity. Favorable hearing outcomes following endoscopic excision have been reported, supporting endoscopic transcanal surgery as an effective minimally invasive option for middle ear osteomas [9].

Conclusion

Middle ear osteomas should be considered in the differential diagnosis of unexplained unilateral conductive hearing loss. Endoscopic transcanal surgery represents a safe and effective treatment option with excellent visualization and favorable functional outcomes.

References

1. Nielsen GP, Rosenberg AE. Update on bone-forming tumors of the head and neck. Head Neck Pathol. 2007;1:87-93.
2. Greinwald JH, Simko EJ. Diagnosis and management of middle ear osteomas. Ear Nose Throat J. 1998;77:134-9.
3. Cho YS, Kim JH, Hong SH, Chung WH. A huge osteoma of the middle ear. Int J Pediatr Otorhinolaryngol. 2005;69:1569-74.
4. Temirbekov D, Celikyurt C. Middle ear osteoma causing Eustachian tube obstruction. J Otol. 2020;15:161-5.
5. Yoon YS, Yoon YJ, Lee EJ. Incidentally detected middle ear osteoma. Am J Otolaryngol. 2014;35:524-8.
6. Presutti L, Gioacchini FM, Alicandri-Ciufelli M. Endoscopic ear surgery. Otolaryngol Clin North Am. 2016;49:1255-67.
7. Gyo K, Aoyagi M, Kojima H, Sakurai Y, Iwasaki S, Takahashi M. Taste disturbance following middle ear surgery. Acta Otolaryngol. 1996;116:107-10.
8. Uzun C, Adali MK, Koten M, Karasalihoglu AR. Evaluation of taste disturbance after middle ear surgery. Otol Neurotol. 2003;24:943-6.
9. Kuwabara M, Matsumoto Y, Motegi M, Chikamatu K. A case of spongiotic osteoma arising in the supratubal recess. Cureus. 2025;17:e82860.
10. Swartz JD, Harnsberger HR. The temporal bone: imaging of benign lesions. Radiol Clin North Am. 1998;36:819-53.
11. Harnsberger HR, Wiggins RH 3rd. Diagnostic Imaging: Head and Neck. 3rd ed. Philadelphia: Elsevier; 2016.
12. Waldron CA. Fibro-osseous lesions of the jaws. J Oral Maxillofac Surg. 1993;51:828-35.
13. Sires BS, Hengerer AS, Rosenberg SI. Osteoid osteoma of the temporal bone: case report and literature review. Otolaryngol Head Neck Surg. 1990;102:288-92.

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Brown tumor as an indication of a rare parathyroid carcinoma: A diagnostic challenge

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Abstract

Parathyroid carcinoma is an exceptionally rare cause of primary hyperparathyroidism, comprising less than 1% of cases. Its presentation often overlaps with benign etiologies, thereby posing significant diagnostic challenges. We present a case of a 70-year-old male with a history of prostate cancer who presented with profound hypercalcemia and markedly elevated parathyroid hormone. Imaging revealed lytic rib lesions consistent with osteitis fibrosa cystica (brown tumor). Surgical resection of a parathyroid mass confirmed parathyroid carcinoma. Postoperatively, the patient experienced symptomatic hypocalcemia due to non-adherence with calcium supplementation. This case highlights the need for clinical suspicion of parathyroid carcinoma in cases of severe hypercalcemia and skeletal manifestations and the importance of postoperative management in preventing complications such as hungry bone syndrome.

Keywords: Brown tumor, parathyroid carcinoma, severe hypercalcemia, osteitis fibrosa cystica, parathyroidectomy, hungry bone syndrome

Introduction

Parathyroid carcinoma accounts for less than 1% of primary hyperparathyroidism (pHPT) cases and may occur sporadically or in association with genetic syndromes such as Hyperparathyroidism-Jaw Tumor (HPT-JT) and Familial Isolated Hyperparathyroidism (FIHP); both of these syndromes are linked to mutations in the CDC73 gene [1, 2]. Parathyroid carcinoma often presents with severe hypercalcemia and nonspecific symptoms, including bone pain, kidney stones, and fatigue.

This report describes a 70-year-old male with a history of prostate cancer who presented with severe hypercalcemia and a rib lesion initially suspected to be metastatic disease. Further evaluation revealed a case of osteitis cystica fibrosa (brown tumor) secondary to parathyroid carcinoma. This case underscores the importance of a thorough evaluation of hypercalcemia, especially in patients with known malignancy.

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Case presentation

A 70-year-old male with a history including prostate cancer (post-prostatectomy), bipolar disorder, thyroid disorder, and polysubstance use presented with recurrent dizziness. Labs revealed elevated calcium (14.1 mg/dL; corrected 13.5 mg/dL), elevated parathyroid hormone (PTH) (470.7 pg/mL), and renal impairment (BUN 52, creatinine 1.6 mg/dL). TSH was suppressed at 0.25. A chest X-ray identified a left mid-lung pleural-based mass, prompting a CT scan. That scan revealed no pulmonary mass but uncovered a heterogeneous 2.5 × 1.2 cm lesion in the left thyroid gland and erosion of the right sixth posterior rib (Figure 1). Given the patient's history of prostate cancer, bone metastasis was initially suspected. A thyroid ultrasound (Figure 2) revealed a solid, hypoechoic TIRADS-5 nodule (1.7 × 1.5 cm). A nuclear medicine parathyroid scan (Figure 3) revealed increased uptake in the left parathyroid. A biopsy of the rib lesion confirmed osteitis fibrosa cystica (brown tumor) (Figure 4).

The patient underwent a left parathyroidectomy and hemithyroidectomy. His PTH dropped postoperatively from 169.9 pg/mL to 13.0 pg/mL. Pathology confirmed parathyroid carcinoma with metastasis to the ipsilateral thyroid.

Ten days post-op, the patient returned complaining of anxiety, paresthesia, muscle cramps, and increased sensitivity to the cold, likely due to hypocalcemia as a result of non-compliance with calcium supplements. He was counseled and monitored closely. He has since recovered uneventfully.

Figure 1. CT Chest showing rib lesion with cortical erosion (arrow).

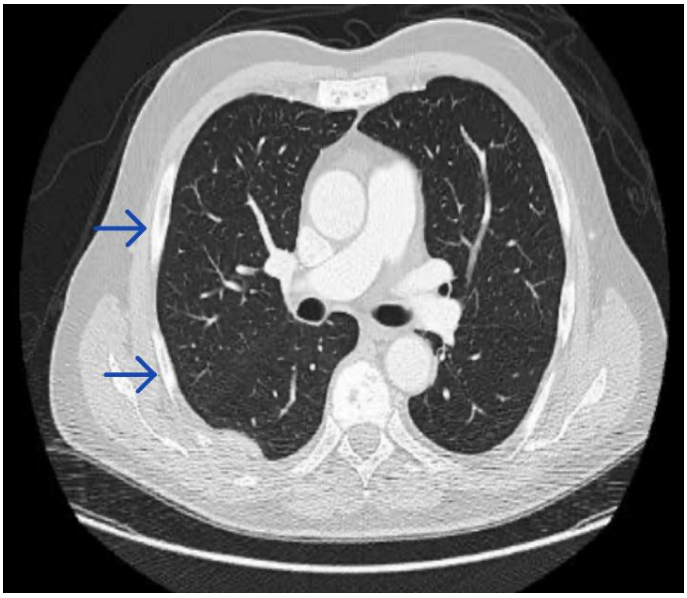


Figure 2. Thyroid ultrasound showing hypoechoic nodule in the left mid-gland.

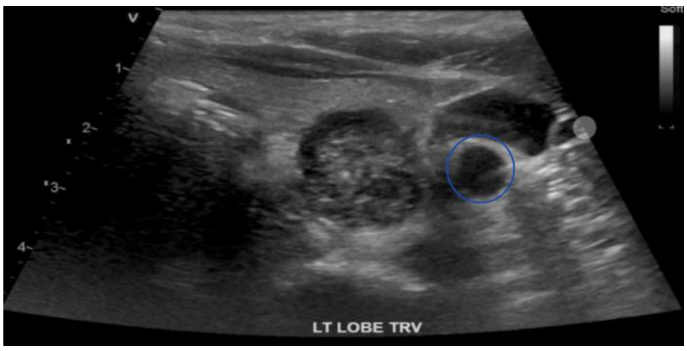


Figure 3. Nuclear medicine scan with increased uptake in left parathyroid.

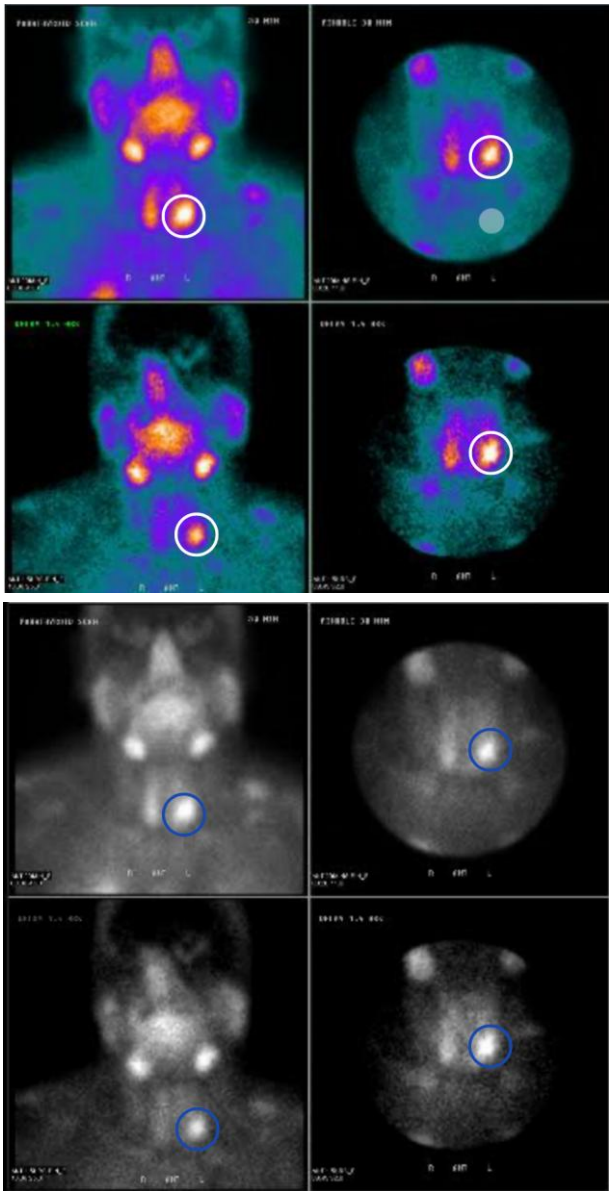
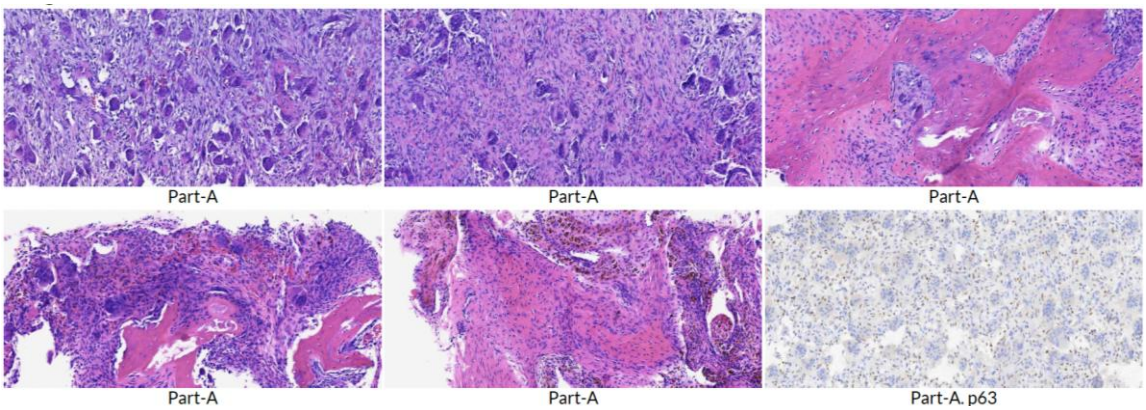


Figure 4. Histology from rib biopsy confirming osteitis fibrosa cystica.



Discussion

Diagnosis and preoperative considerations

Parathyroid carcinoma should be considered in pHPT patients with calcium levels above 14 mg/dL and PTH levels above five times the upper limit of normal [3, 4]. Although rare, brown tumors can mimic metastatic lesions, especially in patients with a history of malignancy [5]. Imaging localized this lesion, and a biopsy confirmed brown tumor. Imaging techniques, such as ultrasounds and 99mTc sestamibi scans, are helpful for diagnosing parathyroid carcinoma and localizing the lesion. However, such techniques do not assist with assessing the malignant potential of the tumor.

Treatment and surgical approach

Surgical resection remains the primary treatment for parathyroid carcinoma. En bloc resection, including the adjacent thyroid and surrounding tissue, is associated with improved outcomes [6]. Our patient underwent this approach.

Postoperative management

Hypocalcemia, including hungry bone syndrome, is a frequent complication of parathyroidectomy. Early recognition and compliance with supplementation are crucial to avoid morbidity.

Recurrence and palliative care

Recurrence rates are high (49–60%), primarily due to incomplete removal or failure to excise the parathyroid tumor [7]. Vigilant follow-up is essential. For inoperable recurrence, calcimetics and bisphosphonates may help control hypercalcemia [8]. Most patients with parathyroid carcinoma ultimately succumb to complications related to hypercalcemia rather than the tumor itself [9].

Conclusion

This case highlights the diagnostic challenges of parathyroid carcinoma, especially when it manifests with brown tumors mimicking metastatic disease. Severe hypercalcemia and skeletal lesions warrant consideration of parathyroid carcinoma, even in patients with other malignancies. Early diagnosis, complete surgical resection, and diligent postoperative care are critical for optimal outcomes.

References

1. Owen RP, Silver CE, Pellitteri PK, Shaha AR, Devaney KO, Werner JA, et al. Parathyroid carcinoma: a review. Head Neck. 2011 Mar;33(3):429-36. doi: 10.1002/hed.21376.
2. Simonds WF. Genetics of Hyperparathyroidism Including Parathyroid Cancer. Endocrinology and metabolism clinics of North America. 2017 Jun 1 [cited 2023 Nov 7];46(2):405–18.
3. Schoretsanitis G, Daskalakis M, Melissas J, Tsiftsis DD. Parathyroid carcinoma: clinical presentation and management. American Journal of Otolaryngology. 2008 Sep 25;30(4):277–80
4. Yabanoglu H, Arer IM, Ozarslan F. Parathyroid Cancer: Review of Uncommon Disease. Acta Endocrinol (Buchar). 2024 Apr-Jun;20(2):212-221. doi: 10.4183/aeb.2024.212.
5. Jacquet-Francillon N, Prevot N. Brown tumors in nuclear medicine: a systematic review. Ann Nucl Med. 2023 May;37(5):255-270. doi: 10.1007/s12149-023-01832-1.
6. Roser P, Leca BM, Coelho C, Schulte KM, Gilbert J, Drakou EE, et al. Diagnosis and management of parathyroid carcinoma: a state-of-the-art review. 2023 Apr 1;30(4).
7. Alnajmi RAY, Ali DS, Khan AA. Persistence and Recurrence of Primary Hyperparathyroidism. Best Practice & Research Clinical Endocrinology & Metabolism. 2025 Mar;39(2):101986.
8. El-Hajj Fuleihan G, Clines GA, Hu MI, Marcocci C, Murad MH, Piggott T, et al. Treatment of Hypercalcemia of Malignancy in Adults: An Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab. 2023 Feb 15;108(3):507-28. doi: 10.1210/clinem/dgac621.
9. Rodrigo JP, Hernandez-Prera JC, Randolph GW, Zafereo ME, Hartl DM, Silver CE, et al. Parathyroid cancer: An update. Cancer Treat Rev. 2020 Jun;86:102012. doi: 10.1016/j.ctrv.2020.102012.

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Simultaneous laparoscopic TAPP repair and varicocelectomy in a recurrent left inguinal hernia patient: A video case report

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Abstract

Recurrent inguinal hernias and varicoceles are common surgical conditions; however, their concurrent presentation and simultaneous laparoscopic management are rarely reported. A 34-year-old male presented with swelling and discomfort in the left groin and scrotum. He had a history of open anterior mesh repair for a left inguinal hernia four years prior. Physical examination and ultrasonography confirmed a recurrent left indirect inguinal hernia and grade II varicocele. The patient was scheduled for simultaneous laparoscopic transabdominal preperitoneal (TAPP) hernia repair and varicocelectomy. Dense adhesions related to the prior anterior hernia repair were carefully dissected. A 3D polypropylene mesh was placed and fixed in the preperitoneal space, followed by peritoneal closure with a V-Loc™ suture. The dilated pampiniform plexus veins were clipped and divided using LigaSure™, sparing the testicular artery. The procedure was completed without complications, and the patient was discharged the next day with a VAS score near zero. This video case demonstrates that simultaneous laparoscopic TAPP repair and varicocelectomy can be safely performed in selected patients with dual pathology. This combined approach minimizes operative burden, avoids multiple incisions, and optimizes patient recovery.

Keywords: laparoscopic hernia repair, TAPP, varicocelectomy, recurrent inguinal hernia, minimally invasive surgery

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Introduction

The inguinal hernia is one of the most common surgical conditions worldwide, with a lifetime risk estimated at 27% in men and 3% in women [1]. While surgeons frequently use open anterior mesh repair for primary inguinal hernias, they often require a different approach for recurrent cases due to fibrotic changes and distorted anatomy. In such scenarios, laparoscopic techniques—particularly the transabdominal preperitoneal (TAPP) approach—offer superior visualization of the myopectineal orifice and effective access to the preperitoneal space [2, 3].

Varicocele, defined as abnormal dilatation of the pampiniform venous plexus, affects approximately 15% of men in the general population and up to 40% of those with infertility [4]. The gold standard treatment is microsurgical subinguinal varicocelectomy, which has the lowest recurrence and complication rates [5]. However, laparoscopic varicocelectomy remains a valid alternative in cases requiring intra-abdominal access or bilateral treatment [6].

Despite the high prevalence of both pathologies, simultaneous laparoscopic management of recurrent inguinal hernia and varicocele has been rarely documented. We present a video case report of a 34-year-old male with recurrent left inguinal hernia and ipsilateral varicocele who underwent successful combined laparoscopic TAPP repair and varicocelectomy.

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Case presentation

A 34-year-old male presented to our outpatient clinic with complaints of swelling and a dragging sensation in the left groin, accompanied by intermittent scrotal discomfort. His medical history included a left inguinal hernia repair performed four years earlier using an open anterior mesh technique. He had no chronic illnesses and was not on any regular medications.

On physical examination, a reducible bulge was noted in the left inguinal region, and prominent scrotal veins were palpable on the left side. Scrotal Doppler ultrasonography revealed a grade II varicocele, with dilated pampiniform plexus veins measuring 4.6 mm and demonstrating prolonged reflux during the Valsalva maneuver. Additionally, superficial soft tissue ultrasound identified a 16 × 8 mm segment of omental fatty tissue protruding through a 6 mm fascial defect in the left inguinal area, consistent with an indirect recurrent hernia. There were no signs of incarceration or strangulation. Based on these findings, the patient was scheduled for a simultaneous laparoscopic transabdominal preperitoneal (TAPP) hernia repair and varicocelectomy.

Under general anesthesia, pneumoperitoneum was established and laparoscopic access was achieved via a 10 mm infraumbilical trocar. Intraoperative exploration confirmed the presence of a left-sided indirect hernia protruding laterally to the inferior epigastric vessels. The right inguinal canal was inspected and found to be intact.

The lateral peritoneum on the left was incised, and the preperitoneal space was developed. Dense adhesions were encountered around the spermatic cord due to the prior open repair, with the cord notably displaced medially. These adhesions were carefully dissected to isolate the cord elements and mobilize the hernia sac.

Following reduction of the hernia, attention was turned to the varicocele. The pampiniform venous plexus was skeletonized, and dilated veins were clipped and divided using a LigaSure™ vessel sealing device, with careful preservation of the testicular artery and lymphatics.

A 15 × 10 cm 3D polypropylene mesh was placed over the myopectineal orifice and fixed using a tacker device at the pubic tubercle and the anterior abdominal wall. The peritoneum was closed with a barbed V-Loc™ suture, and meticulous hemostasis was confirmed. No drain was inserted, and all trocar sites were closed in standard fashion.

The total operative time was 90 minutes. No intraoperative or postoperative complications occurred. The patient reported minimal postoperative pain, with a Visual Analog Scale (VAS) score near zero, and was discharged uneventfully on postoperative day one. Although no routine postoperative imaging was obtained, the patient reported complete resolution of symptoms at the clinical follow-up.

Written informed consent was obtained from the patient for both the surgical procedure and the publication of this case report, including the accompanying video.

Operative Video Description

The accompanying video demonstrates the key surgical steps of a simultaneous laparoscopic transabdominal preperitoneal (TAPP) repair and varicocelectomy in a patient with a recurrent left indirect inguinal hernia and ipsilateral grade II varicocele.

Step 1: Port Placement and Exploration

After insufflation via a 10 mm infraumbilical trocar, two additional trocars were placed under direct vision in the left and right lower quadrants. The initial inspection confirmed a left-sided indirect hernia lateral to the inferior epigastric vessels, and an intact right inguinal canal.

Step 2: Peritoneal Incision and Preperitoneal Dissection

Dense adhesions related to the previous open anterior repair were encountered, which posed a risk of cord or vascular injury. We, therefore, combined sharp and blunt dissection to safely expose the cord structures. This step highlights the importance of maintaining a clear laparoscopic view when dealing with recurrent hernias.

Step 3: Varicocelectomy

With the preperitoneal space opened, the dilated pampiniform venous plexus was identified. The veins were dissected free, clipped proximally and distally, and then divided using a LigaSure™ vessel sealing system. Care was taken to preserve the testicular artery and lymphatic channels. The pampiniform plexus was carefully dissected and exposed to allow selective clipping of the dilated vessels while preserving the testicular artery and lymphatic channels. This artery-sparing approach minimizes the risk of testicular atrophy and postoperative hydrocele, key teaching points when performing laparoscopic varicocelectomy.

Step 4: Mesh Placement and Fixation

A 15 × 10 cm 3D polypropylene mesh was introduced into the preperitoneal space. It was fixed using a tacker to the pubic tubercle medially and the anterior abdominal wall laterally, which adequately covered the myopectineal orifice. A 3D polypropylene mesh was selected to provide optimal anatomical conformity in the recurrent setting, as distorted planes may increase the risk of recurrence if a flat mesh is used. The fixation points were chosen to avoid neurovascular injury.

Step 5: Peritoneal Closure and Completion

The peritoneum was closed with a continuous barbed V-Loc™ suture. Final inspection confirmed hemostasis and appropriate mesh placement. No drains were placed. Trocar sites were closed in layers.

The video illustrates the technical feasibility of addressing both pathologies laparoscopically within a single operative session, utilizing shared port sites and minimizing tissue trauma.

The full surgical procedure can be viewed in the supplementary video available at: https://www.youtube.com/watch?v=t-g4qLcy8L4.

Discussion

Recurrent inguinal hernia repair often presents technical difficulties due to scarring, altered tissue planes, and the presence of prior mesh. The TAPP approach provides excellent visualization of the myopectineal orifice, allowing surgeons to identify key landmarks and perform safe dissection despite a distorted anatomy. In this case, the laparoscopic view enabled precise reduction of the hernia sac and placement of a new mesh without disturbing the previously inserted anterior mesh. Guidelines from the European Hernia Society recommend

laparoscopic repair as the preferred approach in recurrent hernias following anterior repairs, highlighting its superiority in such settings. Registry-based analyses, such as those from the Herniamed Registry, also confirm low recurrence and complication rates with TAPP and totally extraperitoneal (TEP) in reoperative cases, further supporting this strategy [2, 3, 7].

In this case, TAPP repair allowed for the precise identification of anatomical landmarks despite the presence of dense adhesions around the spermatic cord. The laparoscopic view enabled safe reduction of the hernia sac and proper placement of a new mesh without disturbing the previously placed anterior mesh. Similar outcomes have been reported in registry-based analyses, such as the Herniamed Registry, where TAPP and TEP techniques yielded low recurrence and complication rates in reoperative settings [7].

Varicocele is one of the most common surgically correctable causes of male infertility, affecting up to 15% of men in the general population and more than one-third of those with infertility [4]. While the microsurgical subinguinal approach remains the gold standard, laparoscopic varicocelectomy offers distinct advantages in selected cases. The magnified laparoscopic view facilitates artery-sparing dissection, minimizing the risks of testicular atrophy and hydrocele formation. This approach is particularly valuable in bilateral disease, failed prior interventions, or when intra-abdominal access is already indicated, as in the present case. Although meta-analyses suggest slightly higher recurrence rates compared to microsurgery, laparoscopy often results in shorter recovery times and reduced postoperative morbidity [5].

However, laparoscopic varicocelectomy provides a valid alternative in specific clinical contexts, such as bilateral disease, failed prior interventions, or when concurrent intra-abdominal procedures are indicated. In these settings, the laparoscopic approach allows for magnified views, artery-sparing dissection, and reduced morbidity through shared port access. Meta-analyses have shown that while recurrence rates may be marginally higher with laparoscopy, operative time and recovery are often superior compared to open approaches [8].

In the present case, performing laparoscopic varicocelectomy in conjunction with TAPP repair proved advantageous by avoiding additional incisions, limiting anesthesia exposure, and achieving both therapeutic goals in a single session. This aligns with prior studies that have advocated for simultaneous laparoscopic management of dual pathologies in selected patients [9].

Performing both TAPP hernia repair and varicocelectomy in a single laparoscopic session provided significant benefits for the patient. The shared port sites minimized surgical trauma and avoided the need for additional incisions, contributing to better cosmetic outcomes and less postoperative discomfort. Combining both procedures reduced overall anesthesia exposure and shortened the total recovery period, allowing the patient to return to normal activity more quickly. From a surgical perspective, the simultaneous approach was efficient, as the peritoneal dissection required for hernia repair also facilitated access for varicocelectomy. This highlights how careful planning can optimize patient outcomes in cases with dual pathologies.

Conclusion

Despite the high prevalence of both recurrent inguinal hernia and varicocele, reports of their simultaneous laparoscopic management remain scarce. Most of the existing literature describes staged procedures, whereas combined interventions are rarely documented. Our case contributes to the growing evidence that addressing both conditions laparoscopically in a single session is feasible and safe in appropriately selected patients. This strategy not only demonstrates technical feasibility but also underscores the value of minimally invasive surgery in reducing operative burden. To our knowledge, this is one of the few reported cases of simultaneous TAPP hernia repair and laparoscopic varicocelectomy in the context of recurrent hernia, adding a novel perspective to the literature.

References

1. Kingsnorth A, LeBlanc K. Hernias: inguinal and incisional. Lancet. 2003 Nov 8;362(9395):1561-71. doi: 10.1016/S0140-6736(03)14746-0. PMID: 14615114.
2. Simons MP, Aufenacker T, Bay-Nielsen M, Bouillot JL, Campanelli G, Conze J, de Lange D, et al. M. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. Hernia. 2009 Aug;13(4):343-403. doi: 10.1007/s10029-009-0529-7.
3. Bittner R, Arregui ME, Bisgaard T, Dudai M, Ferzli GS, Fitzgibbons RJ, et al. Guidelines for laparoscopic (TAPP) and endoscopic (TEP) treatment of inguinal hernia. Surg Endosc. 2014;28(2):353–79.
4. Gorelick JI, Goldstein M. Loss of fertility in men with varicocele. Fertil Steril. 1993;59(3):613–6.
5. Cayan S, Kadioglu TC, Tefekli A, Kadioglu A, Tellaloglu S. Comparison of results and complications of high ligation surgery, laparoscopic varicocelectomy, and microsurgical subinguinal varicocelectomy. Urology. 2009;73(4):767–71.
6. Chan P. Management options of varicoceles. Indian J Urol. 2011 Jan;27(1):65-73. doi: 10.4103/0970-1591.78431
7. Köckerling F, Krüger C, Gagarkin I, Kuthe A, Adolf D, Stechemesser B, et al. What is the outcome of re-recurrent vs recurrent inguinal hernia repairs? An analysis of 16,206 patients from the Herniamed Registry. Hernia. 2020 Aug;24(4):811-9. doi: 10.1007/s10029-020-02138-1
8. Warli SM, Nabil RA, Kadar DD, Prapiska FF, Siregar GP. Comparison between the efficacy and complication of laparoscopic and microsurgical varicocelectomy: Systematic review and meta-analysis. Urol Ann. 2024 Apr-Jun;16(2):113-9. doi: 10.4103/ua.ua_3_23
9. Belkovsky M, Sarmento EO, Novaes LFC, Passerotti CC, Pontes Junior J, Maximiano LF, et al. Bilateral inguinal transabdominal pre-peritoneal laparoscopic hernioplasty associated to bilateral laparoscopic varicocelectomy in the same intervention: a feasibility study. Rev Col Bras Cir. 2023 Mar 27;50:e20233468. doi: 10.1590/0100-6991e-20233468-en