Original Research Paper

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Prevalence and Pattern of Incidental Findings in Lateral Cephalograms – A Retrospective Study

Abstract:

Background: Lateral cephalograms, routinely used in orthodontics, may reveal incidental findings that are often underreported, with previous studies showing considerable variability.

Objectives: This study aimed to assess the occurrence of such findings in a Bhopal population across age groups and genders.

Materials and methods: A retrospective cross-sectional analysis of 571 cephalograms from patients aged 14–45 years over six months was conducted. Incidental findings—including laryngeal calcifications, sellaturcica variations, and ponticulusposticus—were recorded and statistically evaluated using the Chi-square test (SPSS v25).

Results; Overall prevalence was 61.9%. Sellaturcica bridging was observed in 39.9%, laryngeal calcifications in 36.6%, and ponticulusposticus in 18.4%. Females showed higher prevalence of sellaturcica changes and laryngeal calcifications (51.5%). Laryngeal calcification demonstrated a highly significant association with age ($x^2 = 73.001$, $p < 0.001$).

Conclusion: Recognizing these variations supports accurate diagnosis and awareness of their clinical relevance.

Key words: Lateral Cephalogram, Incidental Findings, retrospective studies.

Key message: Incidental findings on lateral cephalograms are common and show age and gender related patterns. Recognizing these variations enhances diagnostic accuracy and supports better patient management in clinical practice.

Introduction:

Lateral Cephalogram has a routine application in orthodontics for analyzing skeletal and dental patterns. Cephalometric imaging can present incidental findings, which have largely remained underreported. Incidental findings on lateral cephalograms may or may not carry immediate clinical significance; however, their early detection is crucial. When anatomical variations or pathological changes are overlooked in the initial stages, they may progress, ultimately necessitating more complex interventions. Recognizing and appropriately relating these findings clinically ensures timely management and enhances overall diagnostic accuracy. [1] The reported prevalence of incidental findings demonstrates considerable disparity across studies, largely attributable to differences in the demographic profile, particularly age distribution, study design and the regional attributes of the populations investigated.

With this in the background a retrospective cross-sectional study was conducted using lateral cephalograms to determine the prevalence of incidental findings in the Bhopal population, with the following aims and objectives- To study the occurrence of incidental findings using Lateral Cephalograms in Bhopal population according to demographic variables and to determine the association of specific incidental findings with age and gender distribution.

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Materials and Method-After getting the ethical clearance from the institute (IEC number-EC256327, Date November 6, 2025) a cross-sectional, retrospective hospital-based study was conducted. The clearance from the Institutional Review Board (IRB) ensured compliance with the Declaration of Helsinki and the protection of participants' rights, dignity, privacy, and confidentiality. The sample size was calculated using G*Power 3.1.9.7 software, considering an effect size, power of 80% (1 - $\beta = 0.80$), and significance level ($\alpha = 0.05$). The final sample size determined was 300 patients.

Lateral cephalograms of patients aged 14–45 years over a six-month period were retrospectively evaluated by two independent radiologist having a 5 plus years of experience.The equipment used was CBCT Machine: CS9600, Carestream Dental.

Radiographic Software used was CS 3D Imaging Software with the following parameters- tube potential: 120 kVp, Tube current: 6.3 mA, Exposure time: 10 second. A 27-inch flat panel monitor was used for viewing and analyzing radiographs.

Following incidental findings were noted according to age and gender-

1. Morphological changes in sella turcica
2. Soft tissue calcifications mainly the laryngeal calcifications
3. Presence or absence of ponticulusposticus
4. Pneumatization of frontal sinus
5. Elongated styloid process
6. Fusion of C2–C3 vertebrae

The study included patients aged 14–45 years of either sex who had undergone lateral cephalogram imaging during the specified period. Patients with developmental anomalies of the head and neck region, those with head and neck fractures, and individuals with a history of maxillofacial surgery were excluded. Additionally, cephalograms exhibiting artefacts or demonstrating poor image quality were omitted from the analysis.

Statistical analysis :

Data was analyzed using SPSS Version 26.0 (SPSS Inc., Chicago, IL, USA). Normality of data distribution was assessed using the Kolmogorov–Smirnov test. Frequencies were evaluated, and the Chi-square test was applied to determine the prevalence and distribution of findings. Pearson's correlation was used to assess associations between age groups and morphological variants. A p-value ≤ 0.05 was considered statistically significant, with a 95% confidence interval.

Results- Table 1, demonstrates the demographic characteristics of the study participants out of total 571 lateral cephalograms, 344 were female patients and 227 were male patients with a mean age of 19.98 ± 5.19 years.

Out of 571 digital lateral cephalograms, 354 (61.9%) exhibited at least one radiographic finding, while 217 (38.1%) showed no abnormality. Sellaturcica bridging was the most common variation, identified in 228 cases (39.9%). Soft tissue calcifications were detected in 209 subjects (36.6%), and ponticulusposticus in 105 cases (18.4%). Overall, the prevalence of radiographic variations was 61.9%. (Table 2)

A statistically significant association was observed between sellaturcica bridging and gender distribution ($p < 0.001$), with females exhibiting a higher frequency of both partial and complete bridging. Laryngeal calcifications were also significantly more common in females i.e. 51.5% ($p < 0.001$). In contrast, no significant association was found between ponticulusposticus and gender ($p > 0.05$). These results indicate that sellaturcica bridging and soft tissue calcifications are more prevalent in females (Graph 1).

A total of 571 digital lateral cephalograms were evaluated across five age groups (<15, 16–20, 21–25, 26–30, and >30 years). Sella turcica bridging was absent in most subjects (60.1%) across all age groups, with no statistically significant variation among them ($\chi^2 = 6.646$, $p = 0.575$). Laryngeal calcification demonstrated a highly significant association with age ($\chi^2 = 73.001$, $p < 0.001$), showing a progressive increase from 9.6% in individuals <15 years to over 60% in those aged 26–30 years. Ponticulus posticus was absent in the majority of participants (81.6%), with no significant age-related differences ($\chi^2 = 9.716$, $p = 0.285$). (Table 3)

Table 1-Demographic Characteristics of the Study Participants (n = 571)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD	19.98 ± 5.19	—
Sex	Female	344	60.2%
	Male	227	39.8%
Total		571	100.0%

Table 2- Shows the prevalence of various incidental findings

Variable	Category	Frequency (n)	Percentage (%)
SellaTurcica	Absent	343	60.1%
	Partial Bridging	168	29.4%
	Complete Bridging	60	10.5%
Soft Tissue Calcification	Absent	362	63.4%
	Localized Calcification	209	36.6%
PonticulusPosticus	Absent	466	81.6%
	Partial	56	9.8%
	Complete	49	8.6%

Additional Radiographic Findings	Frequency (n)	Percentage (%)
Pneumatization of Frontal Sinus	9	1.6%
Elongated Styloid Process	4	0.7%
Fusion of C2–C3 Vertebrae	1	0.2%
Total	14	2.5%

Table 3: Distribution of Radiographic Findings by Age Group (n = 571)

Radiographic Finding	Age Group (years)	Frequency (n)	Percentage (%)	χ^2 value	df	p-value
SellaTurcica Bridging	<15	50	8.8	6.646	8	0.575
	16–20	120	21.0			
	21–25	200	35.0			
	26–30	110	19.3			
	>30	91	15.9			
Soft Tissue Calcification	<15	30	5.3	73.001	4	0.000*
	16–20	150	26.3			
	21–25	210	36.8			
	26–30	100	17.5			
	>30	81	14.2			
PonticulusPosticus	<15	60	10.5	9.716	8	0.285
	16–20	140	24.5			
	21–25	180	31.5			
	26–30	110	19.3			
	>30	81	14.2			

Graph 1: Gender-wise Distribution of Radiographic Findings (n = 571)

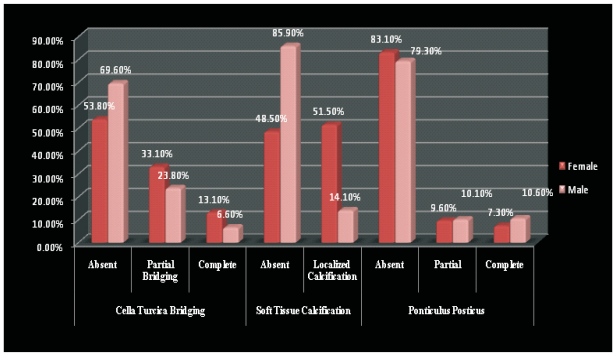

Figure 1 a showing complete sella turcica bridging, 1b laryngeal calcification , 1c complete bridging Ponticulus posticus in Lateral Cephalogram

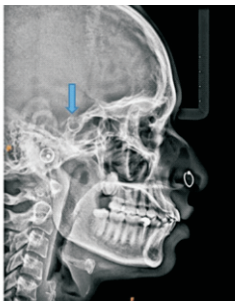

Figure 1 a

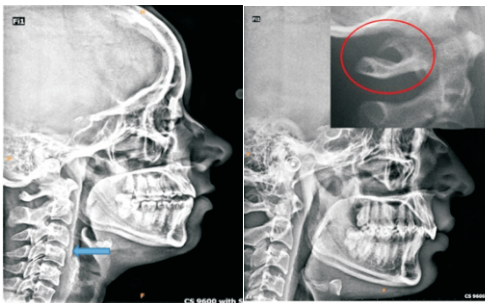

Figure 1b Figure 1c

Discussion:

The frequency of incidental findings in lateral cephalograms varies widely across studies, largely due to differences in age distribution and the geographic characteristics of the populations examined. Many incidental findings are benign, age-related, or of limited clinical significance. However, some may indicate manifestations of underlying primary lesions, systemic disorders, or clinically significant pathologic processes. Consequently, not all incidental findings necessitate further diagnostic evaluation or treatment. [2] The present study revealed an overall prevalence of incidental findings at 61.9%. In comparison, previous studies have reported considerable variability in prevalence rates. David MacDonald et al. (2023) documented a prevalence of 18.8%, Daniela Klenke et al. (2021) reported 33%, and German Hernandez et al. (2018) observed a markedly higher rate of 88.12%. These findings highlight the substantial heterogeneity in prevalence reported across different studies. [3,4,5]

The sella turcica (Figure 1a) is a saddle-shaped depression in the skull that houses the pituitary gland and displays a wide spectrum of morphological variations on radiographs. These variations have been associated with several genetically influenced dental anomalies, including hypodontia, canine impaction, and dental transposition. Because the sellaturcica,

dental epithelial progenitor cells, and maxillary, palatal, and frontonasal regions share a common neural crest–derived embryologic origin, the higher prevalence of sellaturcica bridging in individuals with palatal canine impaction is thought to reflect this shared developmental basis.[6] Present study shows overall prevalence of sella as 39.9% with partial and complete bridging in 29.4% and 10.5% respectively. A statistically significant association with gender was observed, with a predominance in females. Similar studies show considerable variability in prevalence pattern of sellaturcica. Omastova et al. (2023) reported 18.3%, Chou et al. (2021) found 62% complete and 56.9% partial bridging, while Shrestha et al. (2018) reported 11.67% complete and 23.33% partial bridging.[6,7,8]

Laryngeal cartilage (Figure 1b), being hyaline in nature, is susceptible to progressive calcification with advancing age. Such ossification is considered physiologic in the absence of clinical indicators of systemic pathology. Although these calcifications are often of limited clinical relevance, accurate differentiation from true foreign bodies is essential, as linear ossifications may mimic radiopaque foreign objects. In adults, chicken and fish bones are the most frequently encountered foreign bodies in the pharynx, whereas coins are most common in children. The region at the C6 vertebral level, posterior to the cricoid cartilage, represents the most frequent site of foreign body impaction.[9] In the present study, laryngeal calcification was observed in 36.6% of cases, showing a female predominance of 51.5% and males with (14.10%).*A highly significant association was observed between laryngeal calcification and age and gender ($p < 0.001$).* Similar trends have been reported in previous studies. Magdalena Sycińska-Dziarnowska et al. (2024) documented a prevalence of 37.8%, while NanditaShenoy et al. (2014, India) reported 28%. Mupparapu et al. (2005) noted a higher prevalence of 52.6%. [9,10,11]

Ponticulus posticus (figure 1c) is a normal anatomical variant of the atlas (C1) vertebra, located on the posterior arch near the vertebral artery. Also known as the “little posterior bridge,” “arcuate foramen,”or“Kimmerly anomaly,” is typically an incidental finding on lateral cephalograms, with an overall reported prevalence of about 16.7%. This anamoly shows variation by age and a higher incidence in females. It results from calcification of the posterior atlanto-occipital membrane of C1 vertebra and presents radiographically as complete, partial, or calcified forms. Although often asymptomatic, Ponticulus posticus may contribute to neurovascular compression, leading to headaches, migraines, dizziness, neck or shoulder pain, and various orofacial pain conditions, including temporomandibular joint (TMJ) disorders. [12,13] The present study demonstrated an overall prevalence of ponticulus posticus of 18.4%, with partial bridging observed in 9.8% of cases and complete bridging in 8.6%. No statistically significant differences were found in the prevalence of ponticulus posticus across age groups or between genders. Similar findings have been reported in previous studies. M. Monica et al. (2023) documented a prevalence of 20.9%, while D. Tripodi et al. (2019) reported 28.24%. Parita K. Chitroda et al. (2013) observed a markedly higher prevalence of 68.4%, comprising 60% partial variants and 8% complete variants. In contrast, V. Sharma et al. (2010) reported a lower prevalence of complete ponticulus posticus at 4.3%. [14,15,16,17]

In the present study, incidental findings on lateral cephalograms also included pneumatization of the frontal sinus, elongated styloid processes, and C2–C3 vertebral fusion in 9, 4, and 1 patients, respectively.

Limitations of the study: Although lateral cephalograms reliably detect complete sellaturcica bridging, they may misclassify pseudo-bridges; similar limitations apply to identifying ponticulus posticus due to the constraints of two-dimensional imaging. The present study is further limited by its modest sample size, short study duration, and single-institutional design.

Future Prospects of the study:

Establishing links between prevalence findings and their clinical significance is essential for understanding the implications of these anatomical variations. Future research with larger and more diverse populations is needed to evaluate potential associations with age, gender, and ethnicity, thereby improving diagnostic accuracy.

Conclusion:

It is essential for dentists and oral radiologists to accurately recognize and appropriately manage incidental findings to avoid unnecessary interventions. This requires a thorough understanding of the full spectrum of head and neck findings, along with their clinical relevance and potential severity. Such knowledge provides valuable insight into their significance and underlying basis, enabling oral healthcare professionals to make informed decisions regarding the need for additional diagnostic tests and appropriate management. Thus prevalence studies are the backbone of all the studies as rightly said by W. Edwards Deming 'Without data, you're just another person with an opinion'.Each radiograph tells more than the story we seek — prevalence studies reminds us to listen to the silent data within.

Data availability statement:

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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