Sandy Pamadya, Incidental Findings in Panoramic Radiographs: A Descriptive Study of Panoramic Radiographs Taken on X Hospital in Jambi City Indonesia. Journal of Health and Dental Sciences.e-ISSN 2807-3126 Vol. 04 No. 03: pp. 277-288

INCIDENTAL FINDINGS IN PANORAMIC RADIOGRAPHS: A DESCRIPTIVE STUDY OF PANORAMIC RADIOGRAPHS TAKEN AT X HOSPITAL IN JAMBI CITY, INDONESIA

(TEMUAN INSIDENTAL PADA RADIOGRAF PANORAMIK: STUDI DESKRIPTIF RADIOGRAF PANORAMIK DI RUMAH SAKIT X KOTA JAMBI INDONESIA)

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JHDS.unjani.ac.id/jite
Doi: 10.54052/jhds.v4n3.p277-288

Article History
Received:14/01/2025
Accepted: 16/01/2025

ABSTRACT

Abnormalities without symptoms can be detected through accurate diagnostic interpretation techniques in a wide range of panoramic radiographs. The number of publications describing various incidental findings on panoramic radiographs in Indonesia is still limited. This study aims to find incidental findings in panoramic radiographs. The design of this study is descriptive, using 962 panoramic radiographs. A total of two observers interpreted 481 radiographs each and recorded incidental findings into five categories, namely soft tissue calcification, elongation of the styloid process, pathological conditions of the maxillary sinus, dense bone islands, and other incidental findings. The results show that 142 panoramic radiographs (14,76%) had images of incidental findings, with descriptions of the types of incidental findings that were found are 42 radiographs (29,57%) of soft tissue calcification, 29 radiographs (20,42%) had an elongation of the styloid process,

pathological conditions of the maxillary sinus were found on 35 radiographs (24,64%), 32 radiographs (22,53%) of dense bone island, and 17 radiographs (11,97%) were categorized as other incidental findings. The percentage of incidental conclusions, which is not too high (14,76%), does not affect the fact that a dentist needs to interpret panoramic radiographs in such detail manners and be alert of various pathological conditions that appear even without clinical symptoms, and ultimately, be able to provide external referrals so that early medical intervention can be carried out in patients who needs it the most.

Keywords: incidental findings; interpretation; panoramic radiograph

ABSTRAK

Hasil interpretasi radiograf panoramik tidak jarang memperlihatkan temuan kelainan yang bukan merupakan tujuan awal dilakukannya pemeriksaan tersebut, yang sering disebut dengan temuan insidental. Kelainan tanpa gejala klinis dapat terdeteksi melalui teknik interpretasi yang baik dalam cakupan radiograf panoramik yang luas. Jumlah publikasi yang menjabarkan berbagai temuan insidental pada radiograf panoramik di Indonesia masih sangat terbatas. Tujuan penelitian ini untuk melihat temuan insidental pada radiograf panoramik, baik yang berhubungan dengan gigi maupun tidak. Penelitian dilakukan dengan metode deskriptif menggunakan radiograf panoramik sebanyak 962 radiograf panoramik digital sebagai sampel. Sebanyak dua observer menginterpretasi masing-masing 481 radiograf dan mencatat temuan insidental menjadi lima kategori, yaitu kalsifikasi jaringan lunak, elongasi processus styloid, kondisi patologis sinus maksilaris, dense bone island, serta temuan insdental lainnya. Hasil penelitian ditemukan 142 radiograf panoramik (1476%) memiliki gambaran temuan insidental, dengan deskripsi antara lain adalah 42 radiograf (29,57%) memiliki gambaran kalsifikasi jaringan lunak, 29 radiograf (20,42%) memiliki gambaran elongasi processus styloid, lalu kondisi patologis sinus maksilaris ditemukan pada 35 radiograf (24,64%), dense bone

island sebanyak 32 radiograf (22,53%), serta 17 radiograf (11,97%) masuk kategori temuan insidental lainnya. Persentase temuan insidental yang tidak terlalu tinggi, yaitu sebesar 14,76% tidak mempengaruhi kenyataan bahwa pentingnya seorang dokter gigi untuk menginterpretasi radiograf panoramik secara detail serta waspada terhadap berbagai kondisi patologis yang tampak meskipun tanpa disertai gejala klinis, dan pada akhirnya dapat memberikan rujukan eksternal agar dapat dilakukan intervensi medis lebih awal pada pasien yang membutuhkan.

***Kata kunci**: interpretasi; radiograf panoramik; temuan insidental*

INTRODUCTION

Panoramic radiographs depict many anatomical structures outside the jaw that can make interpretation more challenging. Good interpretation of panoramic radiographs begins with understanding the normal anatomy of the head and neck area (such as teeth and its supporting structures, maxilla, and mandible) and its appearance on the radiographs. The interpretation results of panoramic radiographs often produce findings of abnormalities that were not the examination's initial purpose, referred to as incidental findings. Abnormalities without symptoms (asymptomatic) can be detected through good interpretation techniques in a wide range of panoramic radiographs.[1,2,3,4]

Research by AlHarbi, Aldukhail, and Elkhateeb (2023) using a sample of 400 panoramic radiographs showed that 46,8% of radiographs had at least one incidental finding.[5] Another study by Ghassemzadeh, Sbricoli, Frigo, and Bacci (2020) showed that from 2017 panoramic radiographs observed, 529 of those had incidental findings, with the most common abnormal finding were elongation (lengthening) of the styloid process by 48,2%.[6] Incidental findings can vary from normal anatomy asymptomatic pathological conditions to malignancies that are not clinically detected. Aoun, Hayek & Nasseh (2020) reported the detection of a radiolucent lesion in the mandible of a patient, which, after other supporting examinations, turned out to be metastatic urothelial carcinoma

which had been diagnosed as cured after surgery more than 12 years ago.[7]

Based on the description above and the author's extensive panoramic radiograph data from a hospital in Jambi that has never been analyzed, the author is interested in conducting descriptive research. The study aims to evaluate the panoramic radiographs regarding incidental findings occurrences, whether directly related to the teeth or not.

METHOD

The study method is descriptive cross-sectional, describing incidental findings on panoramic radiographs from Hospital X in Jambi City from January 2018 to December 2019. This study uses the principle of total sampling to use all submitted panoramic radiographs that meet the inclusion criteria. The inclusion criteria for the sample are panoramic radiographs that were available in good condition, all anatomical landmarks that should be visible, complete with good contrast and detail, and had no or minimum distortion. As for the exclusion criteria, panoramic radiographs with extensive pathological conditions, fractures, or lesions that make it difficult to interpret the mandibular teeth and surrounding tissues were excluded. From January 2018 to December 2019 at Hospital X Jambi City, 975 panoramic radiographs were stored. Of the 975 panoramic radiographs, 13 radiographs did not meet the inclusion criteria because there were only partial images or too many image errors such as distortion, blurring, etc. The total sample of panoramic radiographs used in this study was 962.

This research was carried out by two observers assessing the panoramic radiographs, analyzing a maximum of 20 panoramic radiographs per researcher per day to avoid interpretation errors caused by eye fatigue. Hence, the research took about 5 weeks to finish. A systematic approach to interpreting the panoramic radiographs is needed to analyze the images carefully and understand the typical anatomical structures visible in the images, even if there is superimposition. The panoramic radiograph is divided into nine areas with six zones shown in Figure 1, which are teeth (zone 1), maxilla-sinus-nasal (zone 2), mandible (zone 3), TMJ (zone 4), and ramus-os. Vertebrae (zone 5), and os. Hyoid (zone 6). The incidental findings found in each zone were then categorized into 5: soft tissue calcification, elongated styloid process, pathologic condition of the maxillary sinus, dense bone island, and other incidental findings.

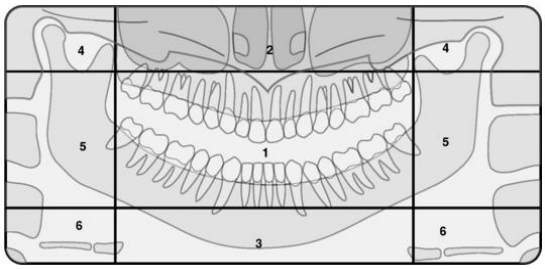

Figure 1. Panoramic radiographs interpretation zone

RESULT

The research was carried out by examining 962 panoramic radiographs by two researchers who had previously discussed calibrating perceptions, and each evaluated 481 radiographs. The results of observations of panoramic radiographs found that 142 panoramic radiographs, or 14,76% of the sample, had incidental findings. A total of 13 panoramic radiographs were found to have more than one incidental finding. Of the 142 panoramic radiographs with incidental findings, 64 (45%) were male patients, and the other 78 radiographs (55%) were female patients. Descriptions of the types of incidental findings that were found included 42 radiographs (29,57%) having images of soft tissue calcification, 29 radiographs (20,42%) having images of elongation of the styloid process, then pathological conditions of the maxillary sinus were found in 35 radiographs (24,64%), dense bone islands were 32 radiographs (22,53%), and 17 radiographs (11,97%) were in the category of other incidental findings (Look at table 2).

Table 1. The amount of panoramic radiograph samples with incidental findings

Total samples	Samples without incidental findings	Percentages	Samples with incidental findings	Percentages
962	820	85.24%	142	14.76%

Table 2. The amount of incidental findings by type

Incidental findings	Amount detected	Prevalences
Soft tissue calcification	42	29.57%
Elongated styloid process	29	20.42%
Maxillary sinus pathology	35	24.64%
Dense Bone Island	32	22.53%
Other incidental findings	17	11.97%

DISCUSSION

Digital panoramic radiographs are a routine procedure commonly used to

support diagnosis and treatment planning in dental practice. Several studies have suggested that incidental findings on dental radiographs, especially panoramic radiographs, are pretty common, with a prevalence ranging from 8,7% to 88,12%.[8] Several factors, including other characteristics of the population and sample, study design, sample size, and level of experience of the researcher, can influence the large variation in the number of incidental findings in various studies. Research that reports incidental findings with a high incidence is generally carried out by someone with more than 40 years of experience in the field, carried out over a longer period, and carried out by several observers.

Soft tissue calcification can be detected from panoramic radiographs (Fig. 1). The number of soft tissue calcifications detected in this study was the highest among others, with approximately 42 findings (29,57%), which included two lymph node calcifications (4,7%), 27 styloid ligament ossifications (64,28%), three carotid artery calcifications or atheroma plaques (7,14%), one sialolith (2,3%), five tonsillolith (11,9%), and four triticeous and thyroid cartilage calcifications (9,52%).

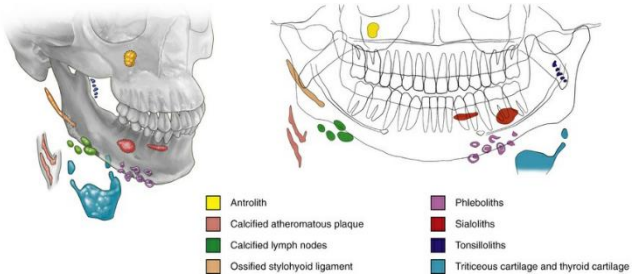

Figure 2. Schematic of locations in which soft tissue calcification can occur in panoramic radiographs.[2]

Soft tissue calcifications detected on panoramic radiographs generally do not require treatment because they are asymptomatic. However, if the findings fall into a category that carries a risk of dangerous advanced disease, a dentist must be able to detect this early. One of them is if there is calcification in the carotid arteries. The finding of calcified atheroma plaque in the carotid arteries is closely related to cardiovascular diseases. Research by Brar et al. in 2024 found that of 314 patients whose panoramic radiographs showed carotid artery calcification, 86,2% had hypertension, 57,6% had hyperlipidemia, 30,7% had diabetes mellitus, 15,5% had cerebrovascular disease, and 28,7% suffer from coronary heart disease.[9]

The second most incidental finding detected from many samples was pathological conditions in the maxillary sinus, approximately 35 radiographs (24,64%). Although panoramic radiography is not the gold standard for diagnosing

pathological conditions in the maxillary sinus, it can help detect several abnormalities, primarily if they are associated with malignancy.[10,11] Previous research by Ghassemzadeh et al. (2020) only found 6.8% incidental findings of pathological conditions in the maxillary sinus from the entire sample used. In this study, the pathological conditions of the maxillary sinus detected were all retention pseudocysts with the typical appearance of a radiopaque, round shape, and clear boundaries attached to the maxillary sinus floor, and could occur unilaterally or bilaterally. Figure 3 shows one of the pseudocyst retention images in one panoramic radiograph sample.

Figure 3. A retention pseudocyst was found in one of the panoramic radiograph samples. Notice the radiopacities inside the right maxillary sinus.

Dense bone islands were the following incidental finding, with the highest prevalence with 32 radiographs or 22,53%. Dense bone island is a sclerotic reaction or compaction of the bone that generally has no known cause, has no symptoms, and is usually not clinically visible. Dense bone islands are often found accidentally during routine radiological examinations and do not need treatment because they are generally asymptomatic and not clinically visible, with an incidence of around 2,3-9,7%.[12] Although quite a lot was found in this study, this is not in line with previous research, one of which was conducted by Syed et al. (2017) that showed in 4581 panoramic radiographs of patients aged 14 years and over, only around 3.2% or 147 radiographs detected dense bone islands.[13] Detecting dense bone islands can help treatment planning, especially in orthodontics, as a consideration in tooth movement that has dense bone islands in the periapical region.

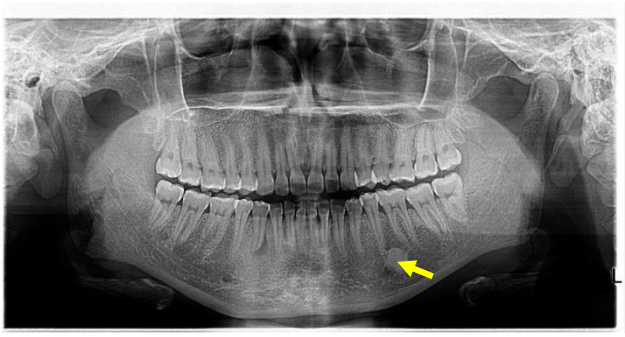

Figure 4. The dense bone island was found in one of the panoramic radiograph samples.

Elongation of the styloid process, often called Eagle's syndrome, is a condition

rarely found, at least since 1937, first discovered by an American otolaryngologist named Watt Weems Eagle, until early 2000. Since the last decade, the findings of Eagle's syndrome cases have been published, and no less than 500 scientific publications were found in the previous 20 years.[14] In this study, 29 radiographs (20,42%) were found with the condition of the elongated styloid process. These findings are similar to previous research by Swapna et al. (2021) on 300 panoramic radiographs, where 82 radiographs (27,3%) of patients were found to have an elongation of the styloid process.[15]

Detection of styloid process elongation is vital because, in symptomatic conditions, the clinical symptoms are like other conditions, such as temporomandibular joint disorders, impacted mandibular third molars, atypical orofacial pain, or glossopharyngeal neuralgia. Symptoms such as pain when opening the mouth, headaches, facial pain, etc., can arise in symptomatic styloid process elongation conditions. Therefore, dentists need to detect this abnormality to eliminate one by one the possible causes of the symptoms that are similar to each other.[16] An image of the elongation of the styloid process found in this study is shown in Figure 5.

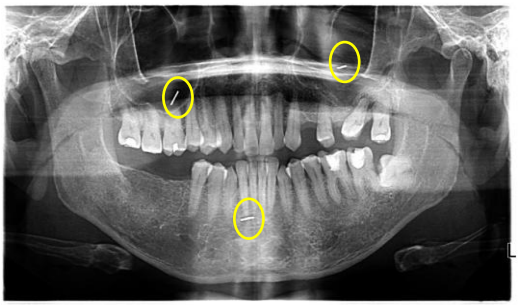

Figure 5. The elongated styloid process was found in one of the panoramic radiograph samples. Notice the yellow arrow; the edge was superimposed with a mandibular angle, and the styloid process was over 20 mm long.

The last category was other incidental findings in this study, including foreign bodies (corpus alienum), impacted supernumerary teeth, odontoma, and simple bone cysts. The total number of other incidental findings detected was 17 radiographs (11,97%). Of these 17 radiographs, the corpus alienum in the form of an implant called "susuk" was the largest of 11 radiographs. The culture of using "susuk" in Indonesia has been widespread for a long time because there is a belief in society that installing "susuk" in the facial area can improve beauty or bring good luck. Because they are not clinically visible, these "susuk" are often found on panoramic radiographs as radiopaque lines in the maxillary sinus region, mandibular ramus, or mandibular symphysis. [17] The percentage of foreign bodies found in this study is more significant than in the study by Winaya et al. (2024), who examined 228 radiographs

and found foreign bodies in the form of "susuk" only in five radiographs, that's 1,8% of the samples used.[18]

Figure 6. Foreign bodies in the form of "susuk" were found in one of the samples. Notice the radiopaque line marked with a yellow circle in the maxilla and mandible region.

CONCLUSION

This study confirms that incidental findings are commonly observed on panoramic radiographs, with specific findings requiring further observation and additional supporting examinations to ensure accurate identification. Future studies should involve larger sample sizes to enhance data quality. It includes more than two experienced observers to improve credibility and adopt study designs incorporating additional variables such as age and gender. Detailing each incidental finding more comprehensively is also recommended. With the advancement of artificial intelligence (AI) technology, this study could serve as a foundational database for developing AI algorithms to detect incidental findings on panoramic radiographs more efficiently and accurately.

CONFLICT OF INTEREST

No potential conflict of interest was reported during research and in writing this article.

ACKNOWLEDGEMENT

We want to thank the board of directors at Hospital X Kota Jambi, faculty leaders at the Faculty of Dentistry Universitas, Prof. Dr. Moestopo (Beragama) and everyone who contributed to this study and wrote this article.

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