REVIEW ARTICLE

Jurnal Radiologi Dentomaksilofasial Indonesia August 2021, Vol. 5, No. 2: 70-9
P-ISSN.2685-0249 | E-ISSN.2686-1321

http://jurnal.pdgi.or.id/index.php/jrdi/index

Imaging of odontogenic keratocyst of the jaw by panoramic radiography: a scoping review

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ABSTRACT

Objectives: This review article is aimed to determine the imaging of odontogenic keratocyst of the jaw by panoramic radiography.

Review: This research is a descriptive research using the scoping review method based on the Preferred Reporting Items for Systematic Review and Meta-analysis Scoping Review (PRISMA-Scr) which was conducted from February 2021 to April 2021. The search for literature related to the research topic was carried out through database of scientific articles on PMC NCBI, Pubmed NCBI, and Garuda as well as hand searching. The identified articles were screened by checking for duplicates, reading the titles and abstracts, and reading the entire articles. A total of 16 articles were included out of 161 articles in total.

Conclusion: Imaging of odontogenic keratocyst of the jaw by panoramic radiography is most commonly found in the 1st and 2nd decades of life and in males, the lesions are unilocular or multilocular radiolucent and have an envelopmental shape in which the outline of the cyst surrounds the entire unerupted tooth. OKCs have well-defined with sclerotic or scalloped margins, most often occur in the posterior mandible and often associated with impacted 3rd molars, root resorption was a rare occurrence.

Keywords: *Odontogenic keratocyst, odontogenic tumor, panoramic radiography*
Cite this article: Sulastri S, Firman RN, Epsilawati L *Imaging of odontogenic keratocyst of the jaw by panoramic radiography: a scoping review.* Jurnal Radiologi Dentomaksilofasial Indonesia 2021;5(2)70-9. https://doi.org/10.32793/jrdi.v5i2.699

INTRODUCTION

Jaw lesions can be benign or malignant, and can occur at any age, with or without symptoms.[1] WHO classified the jaw lesions in 2017 into three groups, namely cystic lesions, benign tumor lesions, and malignant tumor lesions.[2] Cystic lesions are the most common among the three groups.[3,4]

Odontogenic keratocyst (OKC) is a developmental odontogenic cyst and the most aggressive localized cystic jaw lesion in the oral cavity with high growth potential and a tendency to recur.[5,6] WHO reclassified OKC into the tumor group as Keratocystic Odontogenic Tumor (KCOT) in 2005.[7] However, both supporting and disproving evidence for OKC as a neoplastic cystic lesion is considered insufficient and WHO returned OKC into the cyst group in 2017.[5,8] Frequency of OKC is 11.7% of all odontogenic cysts.[9] A retrospective study reported that the prevalence of OKC in Greece from 1987 to 2017 was 8.2%. This make OKC as the 4th common cysts compared to radicular cysts, dentigerous cysts, and residual cysts which are more common to occur. The number of cases is slightly more dominated by men than women with a ratio of 1.3:1 and the mean age of the patients was in the second to third decade. In addition, it is most commonly found in the mandibular molar region.[10] Another study in Indonesia regarding the prevalence of oral odontogenic cysts in 2011 – 2015 at Ibnu Sina Hospital and RSUD Sayang Rakyat Makassar showed the percentage of OKC patients was 10.2%, dominated by female patients.[11]

Panoramic radiography is a commonly chosen technique in dentistry for examining OKC cases because it has a broad coverage, including the entire face, dental arch, and surrounding supporting structures. These radiographs can help in the initial assessment of the extent of the lesion and the characteristics of the lesion that are quite specific and accurate in determining early diagnosis.[12–14] OKC are often occur asymptomatic and reported as incidental findings on radiographic examination. In a retrospective study, the incidence of asymptomatic cases of OKC which are found incidentally on radiographic examination was 62.8%.[15] This shows the importance of radiographic examination to be carried out in supporting the diagnosis of OKC.[16] Several studies have found that the radiographic image of OKC shows the lesion has ill-defined border.[17,18] This is a rare case because according to MacDonald Jankowski[19], the radiographic appearance of OKC generally has well-defined border. Based on its location, OKC can be

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Received on: May 2021
Revised on: July 2021
Accepted on: August 2021

found in the maxillary or mandibular region and about 30% cases of OKC are associated with at least 1 unerupted tooth, the most common is the third molar.[13] The association of the lesion with the third molar can also indicate another odontogenic cyst, which is dentigerous cyst. A study by Lam et al in Hong Kong reported a 22% misdiagnosis of OKC cases, with dentigerous cyst being the most common misdiagnosis.[20]

Based on the phenomenon, the authors see that the odontogenic keratocyst is quite damaging because of its aggressive growth with a larger size than other cysts.[5,6,13] Given that the symptoms of OKC are often asymptomatic, radiographic examination has an important role in determining the presence of these lesions. Misdiagnosis in interpreting the radiographic picture of OKC cases has implications for treatment plan.[20–23] These errors can be minimized by knowing information about the patient's age and the characteristics of the panoramic radiograph of OKC. Both can narrow the determination of the differential diagnosis and assist in the interpretation of the lesion so that the cyst can be recognized as soon as possible before it gets bigger.[24] Therefore, the authors are interested in conducting research on imaging of odontogenic keratocyst of the jaw by panoramic radiography which reviewed the age, gender, location, shape, border, internal, and the effect on surrounding tissues using the scoping review method.

This review article is aimed to determine the imaging of odontogenic keratocyst of the jaw by panoramic radiography. This research is expected to provide information regarding the imaging of odontogenic keratocyst of the jaw by panoramic radiography based on published studies and assist in establishing the diagnosis of odontogenic keratocyst cases of the jaw by panoramic radiography.

REVIEW

This research is a descriptive research using the scoping review method based on the Preferred Reporting Items for Systematic Review and Meta-analysis Scoping Review (PRISMA-Scr) which was conducted from February 2021 to April 2021. The author used Microsoft Office, Google Sheet, internet, and scientific literature databases as the research instrument. Research topics were determined through research questions that were arranged according to the PICO format (Population: individual with odontogenic keratocyst, Intervention: panoramic radiographic examination, Comparison: not available, Objective: odontogenic keratocyst include the description of age, location, shape, border, internal structure, and the effect on surrounding tissues). The research population were articles on odontogenic keratocyst, with the research sample were the selected articles based on the specified inclusion criteria. The inclusion criteria in this research were articles that discuss the imaging of odontogenic keratocyst of the jaw by panoramic radiography, articles on odontogenic keratocysts in which histopathological examinations had been carried out, articles published in 2015 – 2020, and articles in English (indexed on Scopus) and Indonesian (indexed on SINTA). These criteria were determined due to the limited time of the research and the limitations of the author's language skills. The exclusion criteria in this research were articles that are not available in full-text form because data extraction cannot be carried out. Articles on odontogenic keratocyst associated with nevoid basal carcinoma syndrome (NBCCS) were also excluded. Articles about odontogenic keratocyst, but in which they were not related to age, location, shape, border, internal structure, and effect on surrounding tissues would be excluded since they were not related to the topic of this research.

The research was conducted by collecting article data on the international scientific literature databases such as PubMed NCBI and PMC NCBI and the national scientific literature database, namely Garuda. The process of searching for articles through PubMed NCBI and PMC NCBI was carried out using keywords and conjunctions in the form of Boolean Operators, which is an article search strategy by combining several terms in each concept using the words "OR", "AND", or "NOT".[25] In this research, the Boolean operator "NOT" was not used (Table 1). Hand searching was also carried out on the reference list of articles included as research samples for additional sources.

SEARCH AND SELECTION OF STUDIES

The search and selection of studies is shown in Figure 1. The search for literature related to the research topic was carried out through database of scientific articles on PMC NCBI, Pubmed NCBI, and

Table 1. The Search Strategy

Scientific Literature Databases	Search Strategy	Number of Articles
PubMed NCBI https://pubmed.ncbi.nlm.nih.gov/advanced/	(((odontogenic keratocyst[Title/Abstract]) OR (keratocystic odontogenic tumour[Title/Abstract])) OR (keratocystic odontogenic tumor[Title/Abstract])) AND ((panoramic radiography) OR (panoramic radiograph)) Filters: Full text, English, Indonesian, from 2015 - 2020	15
PMC NCBI https://www.ncbi.nlm.nih.gov/pmc	((((odontogenic keratocyst[Abstract]) OR keratocystic odontogenic tumour[Abstract]) OR keratocystic odontogenic tumor[Abstract])) AND ((panoramic radiography) OR panoramic radiograph) Filters: Publication date from 2015/01/01 to 2020/12/31	40
Garuda https://garuda.ristekbrin.go.id/	Odontogenic keratocyst	4

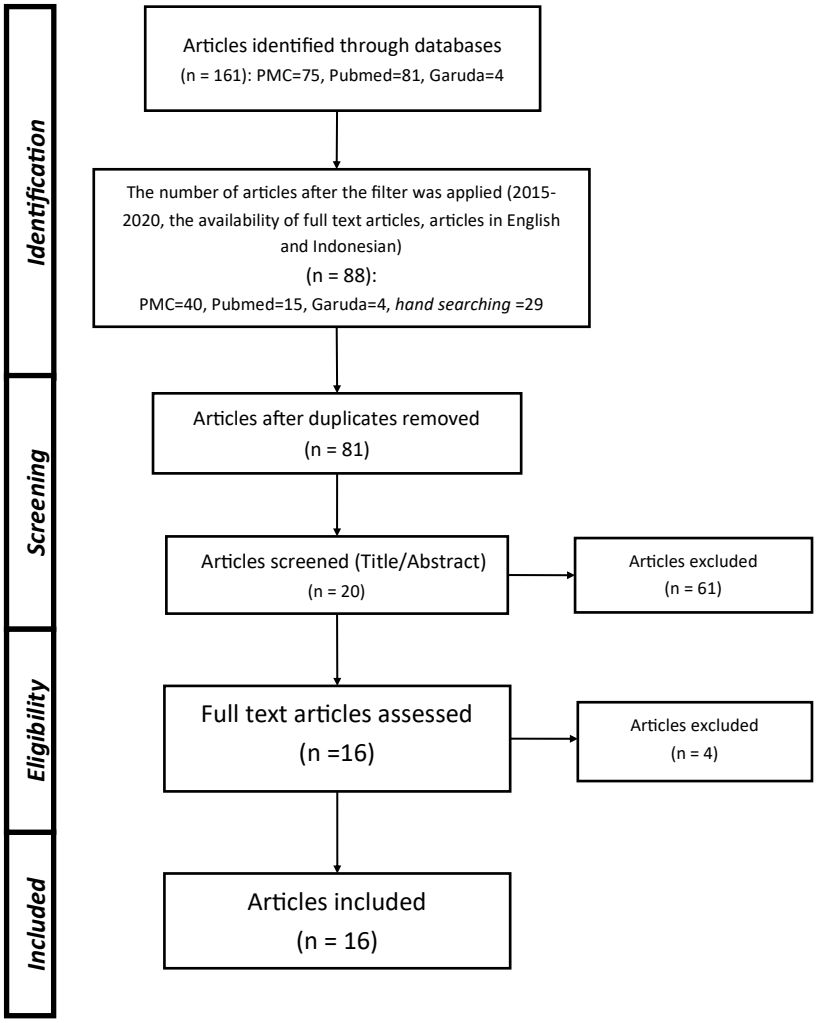

Figure 1. PRISMA-Scr Flow Chart

Garuda as well as hand searching. The identified articles were screened by checking for duplicates, reading the titles and abstracts, and reading the entire articles. From 3 databases, 161 articles were found: 81 articles from Pubmed, 75 articles from PMC, and 4 articles from Garuda. Then a filter was applied in the database search engine based on year (2015 – 2020), the availability of full text articles, and English and Indonesian articles, 59 articles were obtained, while 29 articles were obtained through hand searching. Then, a duplication check was carried out, the remaining 81 journals were obtained. The first screening was done by reading the title and abstract, 61 articles were excluded for some reasons so that 20 articles were included. The second screening was done by reading the articles as a whole, 4 articles were excluded for reasons (Table 2). The final result was obtained 16 articles which were reviewed as the research samples.

STUDY CHARACTERISTIC

The study characteristics of the articles included are shown in Table 3. Based on the type of study design, there were 1 comparative study article, 1 prospective cohort study article, 2 retrospective cohort study articles, and 12 case report articles. Based on the Scopus index, the journals included in the research sample consist of one Q1 journal article, two Q2 journal articles, twelve Q3 journal articles, and one Q4 journal article.

DATA SYNTHESIS OF THE INCLUDED STUDIES

Table 4 contains the results of the interpretation characteristics of odontogenic keratocyst: age, gender, location, shape, border, internal, and the effect on surrounding tissues. Figure 2 shows the number of participants by age and gender. The age of the participants was in the range of 8 – 82 years with 30 female participants and 32 male participants. Figure 3 shows the number of OKCs by location, shape, border, and internal structure. A total of 55 OKCs were reported to be located in the mandible (1 lesion in the anterior region, 11 lesions in the posterior region, and 3 lesions in the anteroposterior region) and 12 lesions in the maxilla (3 lesions in the posterior region). OKCs are either unilocular or multilocular, with a total of 45 unilocular lesions and 19 multilocular lesions. A total of 54 OKCs showed well -defined borders with 4 of them were well-defined with sclerotic margins, 2 lesions were well-defined with scalloped margins, and 1 lesion was well-defined with irregular border. Only 2 lesions showed ill-defined borders. A total of 16 articles presented that OKCs were radiolucent. Figure 4 shows the distribution of the effects of OKCs on the surrounding tissue.

Table 2. Reasons for Study Exclusion

Exclusion Criteria	Number of Articles
Articles were not relevant to the topic	60
Review articles	3
Articles were not indexed on Scopus	2
Total	65

Table 3. Included Study Characteristics

Author (year)	Title	Study Design	Journal	Country	Scopus Index
Daniel Berretta AM et al (2018)[26]	Evaluation of mandibular odontogenic keratocyst and ameloblastoma by panoramic radiograph and computed tomography	Comparative	Dentomaxillofacial Radiology	Brazil	Q1
Shastry SP et al (2020)[27]	Imaging Characteristic of 11 Lesions of Odontogenic Keratocyst in the Indian Subpopulation: A Cone-Beam Computed Tomography Experience	Retrospective cohort	Contemporary Clinical Dentistry	India	Q3
Lee H et al (2015)[28]	Enucleation of large keratocystic odontogenic tumor at mandible via unilateral sagittal split osteotomy: a report of three cases	Case report	Journal of The Korean Association Oral Maxillofacial Surgeons	South Korea	Q3
Hameed O et al (2020)[29]	Odontogenic keratocyst: An incidental finding during an orthodontic examination	Case report	Journal of Orthodontics	United Kingdom	Q2
Kshirsagar RA et al (2019)[30]	Odontogenic Keratocyst: Developing a Protocol for Surgical Intervention	Prospective cohort	Annals of Maxillofacial Surgery	India	Q3
Alchalabi NJ et al (2017)[31]	Using Carnoy's Solution in Treatment of Keratocystic Odontogenic Tumor	Retrospective cohort	Annals of Maxillofacial Surgery	Iraq	Q3
Goto M et al (2020)[32]	A rare case of odontogenic keratocyst extending into the sphenoid bone from the maxilla	Case report	International Journal of Surgery Case Reports	Japan	Q3
Vallejo-Rosero KA et al (2020)[33]	Conservative management of odontogenic keratocyst with long-term 5-year follow-up: Case report and literature review	Case report	International Journal of Surgery Case Reports	Brazil	Q3
Rodrigues-Fernandes C-I et al (2018)[34]	Pigmented odontogenic keratocyst: Report of a rare case and review of the literature	Case report	Journal of Clinical and Experimental Dentistry	Brazil	Q2
Morankar R et al (2018)[35]	Conservative management of keratocystic odontogenic tumour in a young child with decompression and an intraoral appliance: 5-year follow-up	Case report	BMJ Case Report	India	Q4
GS, Kamath AT *et al* (2018)[36]	A Linguoverted Impacted Tooth With Orocutaneous Fistula – A Rare Case Report	Case report	Clujul Medical	India	Q3
Gopalkrishna AA et al (2018)[37]	Trigeminal neuralgia induced by odontogenic keratocyst associated with impacted supernumerary teeth: A rare case report	Case report	Journal of Oral and Maxillofacial Pathology	India	Q3
Jendi SK (2019)[38]	Ectopic Third Molar: A Hidden Cause For Maxillary Sinusitis—A Rare Case Report	Case report	Indian Journal of Otolaryngology and Head & Neck Surgery	India	Q3
Gotmare SS et al (2016)[39]	Keratocystic odontogenic tumor with ossification and calcification: A case report with unusual histological findings	Case report	Indian Journal of Dental Research	India	Q3
de Molon, RS et al (2015)[40]	Five years follow-up of a keratocyst odontogenic tumor treated by marsupialization and enucleation: a case report and literature review	Case report	Contemporary Cinical Dentistry	Brazil	Q3
Sheethal, HS et al (2019)[41]	Odontogenic keratocyst arising in the maxillary sinus: a rare case report	Case report	Journal of Oral and Maxillofacial Pathology	India	Q3

Table 4. Characteristic of Odontogenic Keratocyst

Author (year)	Age, Gender	Location	Shape	Border	Internal Structure	Effect on Surrounding Structures
Daniel Berretta AM et al (2018)[26]	9 patients, 1) 80 y.o, M 2) 52 y.o, F 3) 52 y.o, F 4) 36 y.o, F 5) 30 y.o, F 6) 27 y.o, M 7) 13 y.o, M 8) 12 y.o, F 9) 8 y.o, M	9 OKCs in mandible	7 OKCs were unilocular 2 OKCs were multilocular	9 OKCs were well-defined	9 OKCs were radiolucent	• 4 OKCs associated with unerupted teeth (2 OKCs with M3, 1 OKC with C, 1 OKC with I2 and C) • 1 case showed root resorption
Shastry SP et al (2020)[27]	7 patients, 1) 38 y.o, M 2) 30 y.o, F 3) 25 y.o, F 4) 24 y.o, M 5) 18 y.o, F 6) 14 y.o, M (4 solitary OKCs) 7) 8 y.o, M (2 solitary OKCs)	Patient: 1) Mandible 2) Maxilla 3) Mandible 4) Mandible 5) Maxilla 6) 2 OKCs maxilla, 2 OKCs in mandible 7) 1 OKC in maxilla, 1 OKC in mandible	7 OKCs were unilocular, 1 OKC was uniocular envelopmental, 2 OKCs were multilocular, 1 OKC was undefined	11 OKCs were well-defined (2 OKCs were well defined with scalloped border)	11 OKCs were radiolucent	• 8 OKCs were associated with impacted teeth (5 OKCs with M3, 1 OKC with P2, 1 OKC with M2, 1 OKC with I2 and C) • 1 OKC showed root resorption • OKC compressed the inferior alveolar canal (1 OKC compressed the IAC to inferior, 3 OKCs compressed the IAC to the inferior and posterior) • 1 OKC caused perforation of the lower mandible • OKC caused thinning of the mandible border (1 OKC caused thinning to the inferior border and 2 OKCs caused thinning to the anterior posterior ramus and inferior border)
Lee H et al (2015)[28]	3 cases, 1) 52 y.o, M (2 solitary OKCs) 2) 21 y.o, M 3) 19 y.o, F	Case 1) 2 OKCs (right & left posterior mandible to ramus) 2) 1 OKC in left posterior mandible to ramus 3) 1 OKC in right posterior mandible to ramus	Case 1) Unilocular 2) Multilocular 3) Multilocular	4 OKCs were well-defined	4 OKCs were radiolucent	• All cases associated with impacted teeth (M3) • Case 1 caused deviation of inferior alveolar nerve (IAN) to the inferior
Hameed O et al (2020)[29]	12 y.o, M	Right posterior mandible	unilocular	Well-defined	Radiolucent	N/A
Kshirsagar RA et al (2019)[30]	3 cases, 1) 25 y.o, F 2) 74 y.o, F 3) 19 y.o, M	Case 1) Right posterior mandible to the middle of ramus 2) Antero posterior mandible (right premolar – left 3rd molar 3 region) 3) Right posterior mandible to ramus	Case 1) Unilocular 2) Multilocular 3) Unilocular	3 OKCs were well-defined	3 OKCs were radiolucent	All cases associated with impacted teeth (M3)
Alchalabi NJ et al (2017)[31]	29 patients (14 females, 15 males, age range: 12 – 62 y.o)	4 OKCs in maxilla, 25 OKCs in mandible	18 OKCs were unilocular, 11 OKCs were multilocular	18 cases were well-defined	Radiolucent	N/A
Goto M et al (2020)[32]	21 y.o, M	Right posterior maxilla to the maxillary sinus	N/A	Ill-defined	radiolucent	associated with impacted teeth (18) and the 18 displaced to the roof of sinus

(Cont.) Table 4. Characteristic of Odontogenic Keratocyst

Author (year)	Age, Gender	Location	Shape	Border	Internal Structure	Effect on Surrounding Structures
Vallejo-Rosero KA et al (2020)[33]	67 y.o, F	Anteroposterior mandible (33-46 region)	unilocular	Well-defined	radiolucent	N/A
Rodrigues-Fernandes C -I et al (2018)[34]	14 y.o, M	Left anterior mandible	unilocular	Well-defined, sclerotic	radiolucent	displacement of the root position (divergence of the roots of the mandibular left lateral incisors and the unerupted canines)
Morankar R et al (2018)[35]	11 y.o, M	Right anteroposterior mandible	unilocular	Well-defined with irregular border	radiolucent	associated with impacted teeth (permanent right 2nd premolar and canine) displacement of primary right lower 2nd molar to the inferior displacement of impacted canine to the mesial thinning of the lower border mandible
GS, Kamath AT et al (2018)[36]	23 y.o, M	Left posterior mandible	unilocular	Well-defined, sclerotic border	radiolucent	associated with impacted teeth (38 in linguoverted position)
Gopalkrishna AA et al (2018)[37]	82 y.o, F	Right posterior mandible	unilocular	Well-defined, sclerotic border	radiolucent	associated with impacted supernumerary teeth impinging the mandibular canal
Jendi SK (2019)[38]	24 y.o, F	Left posterior maxilla to the maxillary sinus	unilocular	Well-defined	radiolucent	associated with impacted teeth (28) with the OKC surrounded the tooth crown and the tooth displaced to the maxillary sinus pressed the lateral nasal wall
Gotmare SS et al (2016)[39]	33 y.o, F	Left posterior mandible to the condyle	multilocular	Well-defined, sclerotic margin	radiolucent	N/A
de Molon, RS et al (2015)[40]	15 y.o, M	Left posterior mandible	unilocular	Well-defined (radiopaque halo)	radiolucent	associated with impacted teeth (38)
Sheethal, HS et al (2019)[41]	15 y.o, P	Left posterior maxilla, in the maxillary sinus	unilocular	Ill-defined	radiolucent	associated with impacted teeth (28) and displaced to the left maxillary sinus

N/A : Unprovided data

DISCUSSION

The process sequence of interpreting a lesion on a radiograph is vary. In general, there are several things that need to be identified, they are location, shape, border, internal structure, and effect on surrounding tissues.[14,42] The age and gender of the patient are also important to consider so that can narrow the differential diagnosis of a lesion. Identifying these characteristics can facilitate the interpretation process and determine the nature and behavior of the lesion.[24]

The age of patients who were diagnosed with OKC based on Table 4 and Figure 2 has an age range of 8 – 82 years and most are in the age group of the 1st decade and then the 2nd decade. This shows a slight difference with research by Alva, PG et al[43] and Reduwan, NH et al[44] who reported the highest

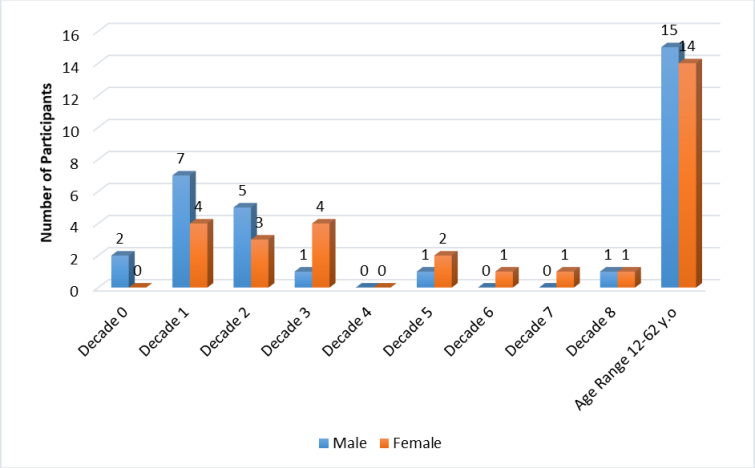

Figure 2. Age and gender of the participants

frequency of OKC in the 3rd decade followed by the 2nd decade. However, based on gender, there are similarities, which was dominated by males.[43] The patient's age is one of the important factors in the diagnosis of jaw lesions. OKC consists of non-syndromic (sporadic) and syndromic cases. Syndromic OKC only about 5% of all OKC cases.[45] Multiple OKCs in children need to be considered for association with nevoid basal carcinoma syndrome (NBCCS). This syndrome is genetically inherited with various expressions, such as multiple nevoid basal cell carcinomas, odontogenic keratocysts, congenital skeletal defects, ectopic calcifications, plantar and palmar pits, central nervous system and ocular lesions, and hypertelorism.[5,46] Patients with NBCSS are usually younger, under 20 years with a median age of 15 years when diagnosed with OKC.[45,47]

The most common location of OKC was in the mandibular posterior region as shown in Figure 3. This is in accordance with the findings by Bhat, A et al.[48] The location of the lesion is an important consideration in the interpretation process because each lesion has a predilection for a particular area.[49] This location is closely related to the original tissue forming the lesion.[50] Odontogenic keratocyst is a developmental odontogenic cyst, which is a cyst whose lumen is lined with epithelium that plays a role in tooth development and grows due to the activation of odontogenic cell remnants so that OKC can only occur in the tooth bearing area.[3,48,51] Another important thing that needs to be reviewed from the location is the finding of unilateral or bilateral lesions.[42] Two of the 16 included articles indicated bilateral cases as well as multiple OKC cases (Figure 5). These findings need to be examined for other systemic abnormalities because they may be associated with NBCCS.[27]

Based on shape, OKC can be unilocular or multilocular. Unilocular lesions consist of a single compartment of bone (Figure 6), whereas multilocular lesions form due to the fusion and overlap of pathological compartments in the bone (Figure 7). Unilocular lesions are benign and grow more slowly, whereas multilocular lesions are benign but have an aggressive process and have the potential to recur.[53] The results of this research show that the most common finding was the unilocular. This finding strengthens the research by Sanchez-Burgos, et al[54] and MacDonald-Jankowski.[55] One article reported OKC with unilocular envelopmental shaped. This is one of the

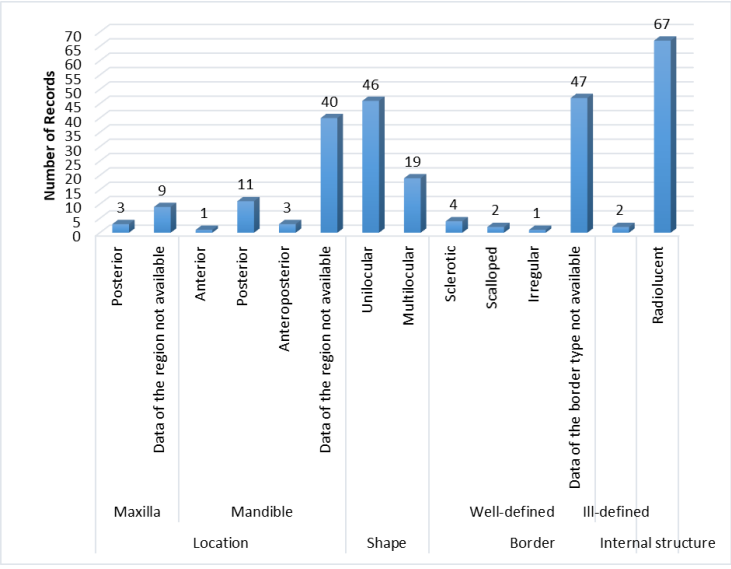

Figure 3. Number of OKCs classified by location, shape, border, and internal structure

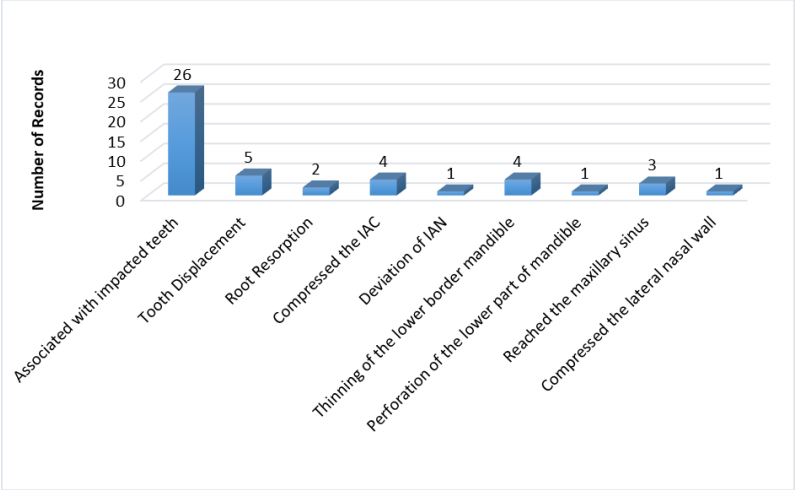

Figure 4. Distribution of effect of OKCs on surrounding tissues

characteristics that can distinguish OKC from dentigerous cysts. OKC has an epithelium that adheres more apically, whereas dentigerous cysts usually cover the crown of the tooth with epithelium attached to the cementoenamel junction.[14] Only 1 article did not report the shape data on panoramic radiography due to the limitations of these modalities so that the case had an additional examination, which was CBCT.

Well-defined lesions are usually benign, whereas ill-defined lesions tend to be aggressive and suggest an inflammatory or neoplastic process.[53] Based on the studies reviewed, OKC lesions had well-defined borders with sclerotic margins or might had edges that have a series of contiguous arches or scalloped. Irregular edges might be present. Histologically OKC has a capsule and it is surrounded by epithelium. The slow growth of OKC causes the pressure to the surrounding area of the lesion is sufficient to trigger a reaction in the surrounding bone such as matrix and mineral deposition so that OKC can have a well-defined appearance with sclerotic margin.[56] OKC can also had ill-defined border (Figure 8) as stated in 2 articles in Table 4. The location of the lesions in that 2 articles was in the maxilla. This ill-defined appearance may occur because it is related to trabecular architecture and bone thickness. Lesions with the same well-defined margins generally appear less defined in the maxilla than in the mandible, especially on 2-dimensional radiographs, additional radiography examinations such as CBCT are required.[42] Overall, this study supports the statement by White dan Pharoah[14] that OKC has well-defined border. In the findings of the included article, the OKC showed a radiolucent internal structure. Total radiolucency is usually found in cysts.[14] This indicates bone destruction and results in the formation of compartments filled with fluids, gases, or semisolid substances.[50,51,53]

The growth of a lesion can affect the surrounding tissue. This needs to be known by the

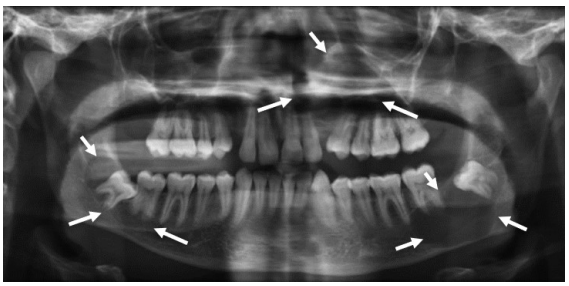

Figure 5. Multiple odontogenic keratocyst[52]

Figure 6. Unilocular OKC which associated with third molar[30]

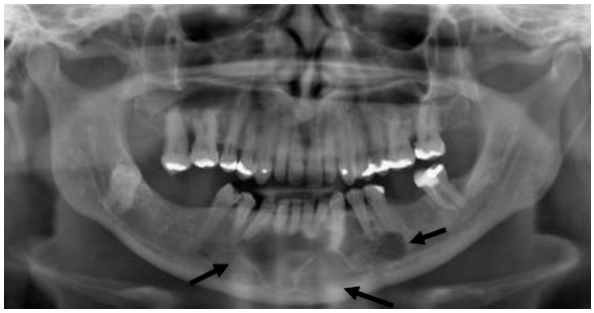

Figure 7. Multilocular OKC[26]

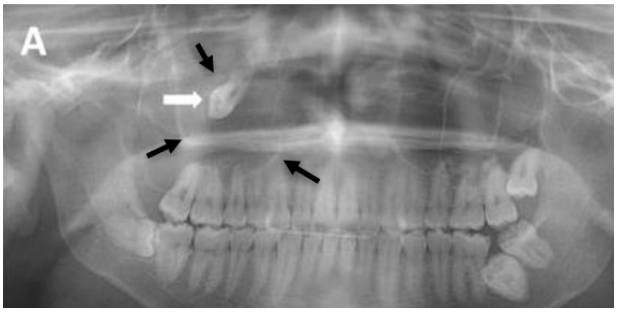

Figure 8. Ill-defined OKC which associated with 3rd molar that moved into the sinus[32]

observer to infer the behavior of the lesion so that it can help in identifying the disease.[14] The effect on surrounding tissue caused by the growth of the lesion is quite diverse. Figure 4 shows the most common finding was the association between OKC and impacted teeth (Figure 6). The impacted teeth involved were M3, M2, P2, C, I2, and supernumerary teeth. The association of OKC with third molar was the most frequently occurred. This is in accordance with the research of Mello, FW et al[57] on the prevalence of odontogenic cysts and tumors associated with impacted third molars. The results showed the prevalence of OKC associated with impacted third molars was 0.5%, the second highest after dentigerous cysts.

Based on the included articles, the other effect of the lesion on the surrounding tissue was displacement of the teeth which was shown in some of the findings. This characteristic usually occurs in lesions that grow more slowly and occupy space.[14] Tooth root resorption was only found in 2 articles. This is in line with the research of Chirapathomsakul, D et al[58] who reported that this characteristic was not very common in OKC, with an incidence of 1.3%. OKC undergoes very fine epithelial growth. Keratin that fills the lumen of OKC is formed very slowly with little pressure on the surrounding tissue so that it does not hit the cementoblasts and the root surface is not exposed. Besides, OKC is unrelated with inflammation and there are no mediators that cause resorption so that the findings of root resorption in OKC are rare.[59] Other effect on the surrounding tissues in this study were lesions pressing on the inferior alveolar canal, deviation of the inferior alveolar nerve, thinning of the lower border of the mandible, and perforation of the lower mandible.

OKC which was located in the maxilla could penetrate into the maxillary sinus and caused the involved tooth to move into the sinus. In addition, OKC lesions might compressed the lateral nasal wall. This is very likely occur because the presence of the maxillary sinus and nasal cavity in the maxilla causes involvement of this area to occur earlier. Perforation in this area also occurs earlier because the cortical bone of the maxilla is thinner than that of the mandible.[60]

This research uses a scoping review method with a structured and reproducible review process. This research can be used as a precursor for future research with a similar topic using a systematic review method. This research has limitations because it is only carried out on a number of databases and hand searching with a limited time span. This research also only provides the imaging of OKC by panoramic radiography. Suggestions for further research are to be able to conduct a study of the imaging of odontogenic keratocyst by panoramic radiography and other modalities, such as CBCT which is also needed to support the diagnosis in some cases because the resulting image is more detailed, but the role of panoramic radiography in the initial assessment of the lesion still needs to be considered. In addition, further researchers can add databases and do not limit the search time range so that more articles can be reviewed.

CONCLUSION

Imaging of odontogenic keratocyst of the jaw by panoramic radiography is most commonly found in the 1st and 2nd decades of life and in males, the lesions are unilocular or multilocular radiolucent and have an envelopmental shape in which the outline of the cyst surrounds the entire unerupted tooth. OKCs have well-defined with sclerotic or scalloped margins, most often occur in the posterior mandible and often associated with impacted 3rd molars, root resorption was a rare occurrence.

ACKNOWLEDGMENTS

None.

FOOTNOTES

All authors have no potential conflict of interest to declare for this article.

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