AMELOBLASTOMA INCIDENCE IN CHILDREN : A SCOPING REVIEW

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ABSTRACT
Ameloblastoma is a benign tumor originating from odontogenic epithelial, slow growth and locally invasive. Ameloblastoma rarely occurred in children. Ameloblastoma in Western countries was estimated around 8.7 – 15%, meanwhile in Asia African countries the incidence was around 14.6 – 25%. This study aims to discover the incidence of ameloblastoma in children. This is a literature review study using scoping review approach and applying PRISMA ScR (Preferred Reporting Items for Systematic Reviews and Meta Analyses-Scoping Review) approach on searches utilizing Boolean Operators on databases PubMed, Science Direct, Sage Journals, and EBSCOhost with pre-arranged keywords using PCC framework, with keywords "((Ameloblastoma) AND (Pediatric) OR (Ameloblastoma) AND (Children))". Total 11 articles eligible in this study. Ameloblastoma incidence in children was about 10 – 15%, where 11 – 18% occurred in children aged 14.7-year-old. The highest mean age was reported in Jordan with mean 16.0-year-old, while the lowest mean age was in Argentine with mean 10.8-year-old. The Incidence of ameloblastoma in children was about 10-15% based on eleven articles that have been identified using different sample collection techniques.

Keywords ***:*** *ameloblastoma, children, incidence*

INTRODUCTION

Ameloblastoma is a benign tumor originating from odontogenic epithelial, slow grow, and locally invasive(Malathi et al., 2018). Etiology of ameloblastoma was unknown. Brown and Betz claimed the previous etiology was related to trauma, inflammation, malnutrition, non-specific from extraction, and caries (Brown et al., 2014). In general, clinical manifestation of ameloblastoma was extensive deformity, hard or tender mass, same color as the surrounding tissue, and rarely accompanied by pain (Malathi et al., 2018). Based on 2005 WHO histological classification, ameloblastoma was distinguished into 4 types, which are solid conventional or multicystic, unicystic, peripheral (extraosseous), and desmoplastic (Sheela et al., 2019). These classifications were changed later on in 2017 WHO into conventional ameloblastoma, unicystic type ameloblastoma, extraosseous or peripheral type ameloblastoma, and metastatic ameloblastoma (Sheela et al., 2019).

Ameloblastoma management was still controversial. Several surgery modalities, including conservative and radical approach, were done with varied results (Meshram et al., 2017),(Isolan et al., 2018),(Andrade et al., 2013). Certain management modalities, such as enucleation, marsupialization, segmental or marginal resection, were often used (Meshram et al., 2017),(Isolan et al., 2018),(Andrade et al., 2013).

Ameloblastoma incidence was diagnosed in the third to fifth decades of life; however, the lesion may be found in any age group (Sheela et al., 2019). Ameloblastoma rarely occurred in children, estimated in 10 – 15% ameloblastoma cases(Johnson et al., 2017). Ameloblastoma in Western countries was estimated in 8.7 – 15%, while in Asian African countries was detected in 14.6 – 25% (Almajid & Alfadhel, 2019). Mean age of ameloblastoma incident in

developed countries was 10 – 15 years older compared to developing countries (Bianco et al., 2020).

Incidence rate may benefit in determining or informing specific population experiencing specific disease. Incidence was defined as a description of frequency of new disease in a definite timeframe in a particular population (Schoonhoven, 2006). The evaluation of ameloblastoma incidence in children may provide a depiction in dentistry clinician on specified disease' frequency as a consideration in identifying ameloblastoma in children. Numerous studies were done in the last ten years on ameloblastoma in children; however, there was no publication on scoping review analyzing and presenting ameloblastoma incidence in children. The goal of this scoping review is to map data on ameloblastoma incidence in children from recent literatures to discover available scientific evidence. This study aims to learn the incidence of ameloblastoma in children.

METHOD

This study is a literature review with scoping review approach using PRISMA ScR (Preferred Reporting Items for Systematic Reviews and Meta Analyses-Scoping Review) protocol. The search was done through Boolean Operators on databases PubMed, Science Direct, Sage Journals, and EBSCohost with keywords prepared by PCC framework, using keywords "((Ameloblastoma) AND (Pediatric) OR (Ameloblastoma) AND (Children))". Instruments applied in this study were laptop, Microsoft Software, search engines (PubMed, Science Direct, Sage Journals, and EBCCohost), Mendeley application, and scientific journal articles.

The study was conducted from January to May 2022, started by data collection to screened articles based on inclusion criteria. Samples used in this research were articles with inclusion criteria: literature reported on ameloblastoma in children, full text is available, and had open access. Year of article publication was between 2011 – 2021. Other inclusion criteria include observational study articles (cohort, cross-sectional, and case-control studies), clinical study, systematic review, case report, review article, and original article. Study procedure started from data screening based on exclusion criteria which was incomplete and inaccessible articles or literatures, and literatures that was not discussing about ameloblastoma in children. Screened articles were then rechecked based on title relevance and abstract through Rayyan QCRI web application, continued with checking the relevance of the articles as a whole. All articles eligible underwent data processing, including data recording and presenting in tables through Microsoft Excel application. Operational definition in this study, based on articles discussing on ameloblastoma in children aged 0 – 18-year-old.

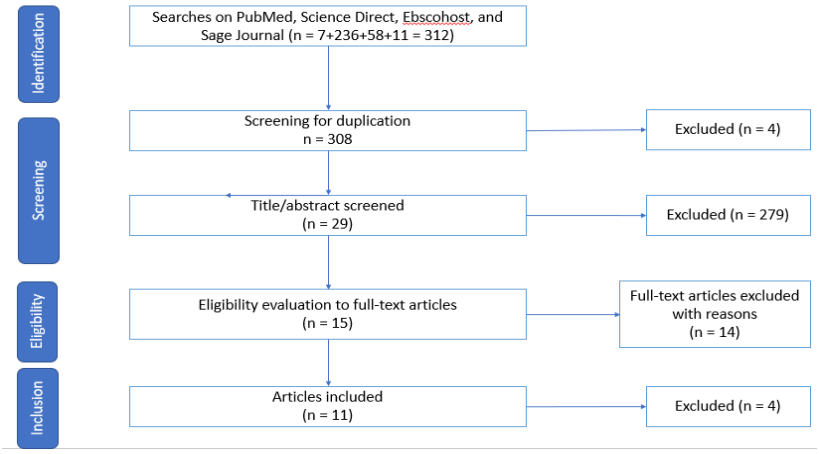

Figure 1. Pathways of Searching and Identifying Articles

RESULT

Total 11 articles were identified as eligible in the study came from PubMed, Science Direct, Sage Journals, and EBSCohost databases. Selected articles were analyzed after going through article searching and choosing using PRISMA-ScR (Figure 1). Articles were then identified based on author's name, year of publication, article's title, samples, and study design applied.

Table 1. Results of Article Identification

NO	Author (Year of Publication)	Title	Country Of Origin	Gender	Age	Therapy	Conclusion (Ameloblastoma Incidence)	Study Design
1	M. El Sayed et al (2020)(El Sayed et al., 2020)	A Rare Case Report of Huge Maxillary Ameloblastoma in a 3.5 years old girl	Amerika Serikat	Female	3,5	Maxillectomy	Ameloblastoma in children is more frequent with unicystic type than multi-cystic type, the article described in the population aged 10,6-23,8.	Case Report
2	Z. Chaudhary, S. Krishnan, P. Sharma et al (2012)(Chaudhary et al., 2012)	A Review of Literature on Ameloblastoma in Children and Adolescents and a Rare Case Report of Ameloblastoma in a 3-Year-Old Child	India	Female	3	Fine needle aspiration (FNA)	The youngest cases of ameloblastoma occurred in a 2-year-old patient, with the highest mean ages being 16.0 (Jordan) and 10.8 (Argentina). The incidence rate for ameloblastoma among children is 16.9%	Case Report
3	Giraddi, Girish B Arora, Kirti Saifi et al (2017)(Girad	Ameloblastoma: A retrospective analysis	India	Male	9	Resection	Data from pediatric patients are rather scarce, where the	Review Article
				Female	12	Enucleation		

	di et al., 2017)	of 31 cases		Male	13	Enucleation	average age of the 31 cases looked at was only 5 children. Of the five pediatric patients who were diagnosed with mandibular ameloblastoma.	
				Male	16	Resection		
				Female	18	Resection and reconstruction with iliacgraft		
4	R. Kalaskar et al (2011)(Kalaskar et al., 2011)	Conservative management of unicystic ameloblastoma in a young child: Report of two cases	India	Male	9	Enucleation	Ameloblastoma in children represents 10 to 15% of all ameloblastoma, and provides information that unicystic ameloblastoma is a tumor of the early age group.	Case Report
				Female	12	Enucleation		
5	F. Awadalkreem, O.Abdoun (2020)(Awadalkreem & Abdoun, 2020)	Enucleation and surgical stent as a treatment strategy for a large unicystic ameloblastoma: Case report and review of literature	Afrika	Male	14	Enucleation	The average age of paediatric patients suffering from améloblastoma is 14.7 years. Améloblastoma showed an increased incidence (44.2%) of symphysis.	Case Report
6	E. Almajid, A. Alfadhel (2019)(Almajid & Alfadhel, 2019)	Management of large pediatric ameloblastoma: Conservative approach with 4-	Saudi Arabia	Female	13	Hemimandi-bulaerectomy	Ameloblastoma in children accounts for 8.7% to 15% of the total ameloblastoma in western countries	Case Report

		years follow up				and 14.6-25% in Asia and Africa.	
7	S. Sheela, S. Singer, H. Braidy et al (2019)(Sheela et al., 2019)	Maxillary ameloblastoma in an 8-year-old child: A case report with a review of the literature.	Amerika Serikat	Male	8	Resection	The article describes ameloblastoma (90.1%; 192 of 213) in this age group occurring in patients between the ages of 11 and 20 years; only 9.9% (21 of 213) cases were found in patients aged 10 years or younger.	Case Report
8	B. Senguven et al (2013)(Sengüven et al., 2013)	Recurrent unicystic mural type ameloblastoma in a 9-year-old boy, 8 years follow-up	Turki	Male	9	Fine needle aspiration (FNA)	It is not always easy to estimate the true incidence of ameloblastoma in children due to differences in the age limit that define the pediatric population and also the inconsistency of histological classification in previous publications.	Case Report
9	J. Johnson, J. Jundt, I. Hanna et al (2017)(Johnson et al., 2017)	Resection of an ameloblastoma in a pediatric patient and immediat	Amerika Serikat	Male	11	Resection - costochondral rib graft	Approximately 10-15% of ameloblastomas occur in patients younger	Case Report

		e reconstruction using a combination of tissue engineering and costochondral rib graft.					than 18 years.	
10	W. Lim, L. The, L. Yong et al (2014)(Lim et al., 2014)	Retrospective Analysis of Vascularised Free Fibula Grafts in Oromandibular Reconstruction and Dental Rehabilitation following Resection of Ameloblastoma	Singapore	N/A	N/A	N/A	Among the forty-three patients reviewed (n = 43), there were 21 males and 22 females. Of these, there were 29 Chinese (67.4%), seven Malays (16.3%), one Indian (2.3%) and six patients in the Other category (14.0%). The age of the patients ranged from 11 years to 57 years and the mean age of the patients was 29 years.	Original Article
11	S. Bansal, R. Desai, P. Shirsat et al (2015)(Bansal et al., 2015)	The occurrence and pattern of ameloblastoma in children and adolescents: an Indian institutional study of 41 years and review of	India	N/A	N/A	N/A	Of the 256 patients with ameloblastoma, 39 (15.2%) were included in the study. There are 26 males and 13 females, giving a male-to-	Review Article

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the literature

female ratio 2:1.

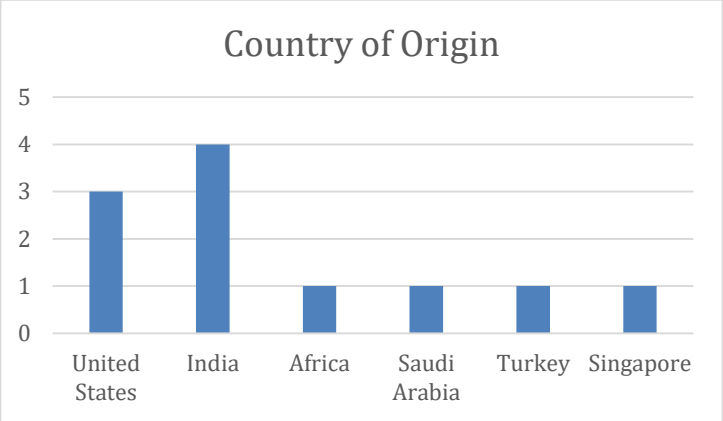

Diagram 1. The Number of Articles Based on Study Population

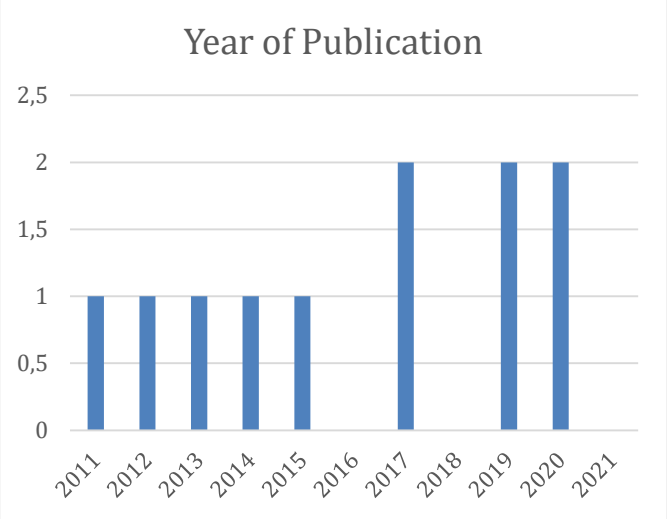

Diagram 2. Articles Based on Year of Publication

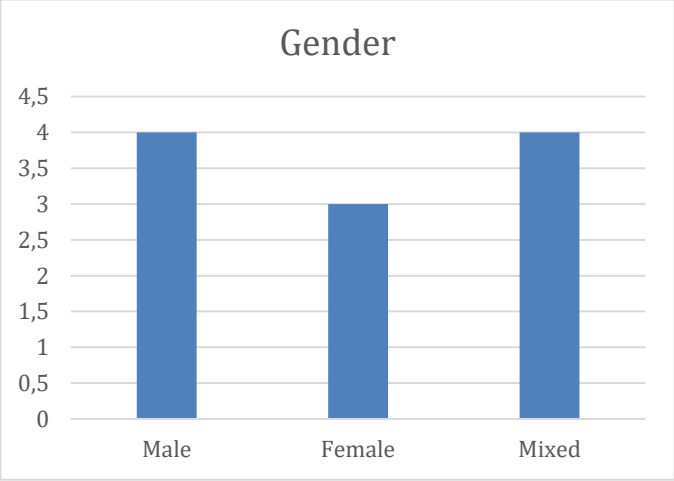

Diagram 3. Articles Based on Gender

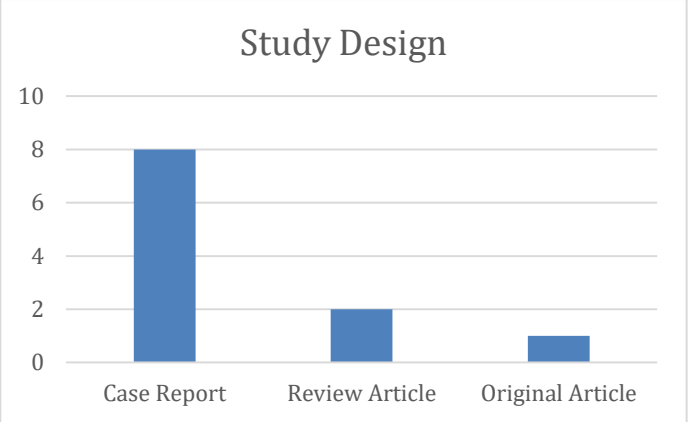

Diagram 4. Articles Based on Study Design

Diagrams showed that from 11 reviewed articles, 3 were from United States, 4 from India, and others from Africa, Saudia Arabia, Turkey, and Singapore (Diagram 1). Based on reviewed article timeframe which were in the last 10 years (2011 – 2021), out of 11 identified articles, 1 was from 2011; 2012; 2013; 2014; and 2015, 2 articles from 2017; 2019; and 2020 (Diagram 2). From 11 articles identified, 4 observed ameloblastoma in male children, 3 in female, while 4 in all genders. There was an article on 2 patients, male and female. There was also an article observing more than 2 patients (Diagram 3). Based on study design, case report, review article, and original article were identified in 8, 2, and 1 article, respectively (Diagram 4).

From 11 articles analyzed, 8 were case reports on ameloblastoma in children in which 7 discuss on unicystic ameloblastoma and 1 on plexiform ameloblastoma. In 8 case reports, the age of children with ameloblastoma was between 3 – 14-year-old, the youngest was a 3-year-old female patient with unicystic ameloblastoma in maxillary area (Chaudhary et al., 2012). The oldest was a 14-year-old patient with unicystic ameloblastoma (Awadalkreem & Abdoun, 2020). These 8 case reports gave a total 5 articles discussing ameloblastoma in male children and 4 in female children, while 1 article talk about unicystic ameloblastoma in 2 pediatric patients, female and male.(Kalaskar et al., 2011) Management in these eight case reports varies. Article on unicystic in a 3.5-year-old American female cured through maxillectomy and direct reconstruction (El Sayed et al., 2020). Article on unicystic ameloblastoma in a 3-year-old female from India was managed with Fine Needle Aspiration (Chaudhary et al., 2012). Other case report article about 2 children from India diagnosed as unicystic and managed with enucleation.(Kalaskar et al., 2011) The only case report in Africa reported unicystic ameloblastoma in a 14-year-old male that was given enucleation and surgery stent therapy.[15] Another case report on ameloblastoma in 13-year-old Saudia Arabian female was conservatively treated with hemimandibularectomy (Almajid & Alfadhel, 2019). Plexiform ameloblastoma and therapy of choice was resection.(Sheela et al., 2019) Ameloblastoma in Turkish children was presented in a case report of a 9-year-old male child discussing the evidence of Fine Needle Aspiration.[17] Next case report was on an American 11-year-old with resection for his unicystic ameloblastoma with costochondral rib graft reconstruction (Johnson et al., 2017).

Two out of 11 articles reviewed were review articles, depicting ameloblastoma in children where 1 article described 31 ameloblastoma cases with several types (Giraddi et al., 2017). Between these 31 cases, 5 were ameloblastoma in children with varying therapy (Giraddi et al., 2017). The other review article evaluated ameloblastoma through observation and analysis of ameloblastoma cases to determine the incidence and clinical manifestation of ameloblastoma in children (Bansal et al., 2015). One article was an original article deliberate patients' demography and surgery result (Lim et al., 2014).

DISCUSSION

Ameloblastoma was a neoplasm classified as benign odontogenic epithelial tumor on the jaw (Malathi et al., 2018). Ameloblastoma grew slowly and locally invasive, no pain was reported, therefore, it was usually discovered during later stage with swelling and bone destruction (Malathi et al., 2018). Generally, clinical manifestation of ameloblastoma was extensive deformity, hard or tender mass, with the same color as surrounding tissues, and rarely presented with pain (Malathi et al., 2018). Most ameloblastoma was unilateral (95%) and occurred on posterior jaw (85%), most on mandibula (80 – 93%) (Ruslin et al., 2018). Ameloblastoma was characterized as an odontogenic tumor with radiographic imaging as radiolucent, unilocular or multilocular (soap bubble), tended to infiltrate surrounding tissue (Sheela et al., 2019),(Isolan et al., 2018),(Ruslin et al., 2018). Ameloblastoma rarely occurred in children, where a search on Medline by Z. Chaudhary et al did not identify many specific result on children or adolescent patients (Chaudhary et al., 2012). These result was based on ameloblastoma routine review mentioned above or categorized based on patient's age with lesion. About 10 – 15% ameloblastoma was detected in patients younger than 18-year-old (Johnson et al., 2017),(Awadalkreem & Abdoun, 2020).

According 2005 WHO, ameloblastoma was classified as 4 types using the terms solid/multicystic, unicystic, extraosseous / peripheral, and desmoplastic(Kleihues & Eds, 2014). Ameloblastoma classification based on 2017 WHO was changed into conventional ameloblastoma, unicystic ameloblastoma, extraosseous or peripheral ameloblastoma, and metastatic ameloblastoma (Kleihues & Eds, 2014). Conventional ameloblastoma was a intraosseous ameloblastoma or ameloblastoma growing inside the bone, slow growth, no pain, and widely expanded into surrounding tissue (Kleihues & Eds, 2014), (Masthan et al., 2015). Extraosseous or peripheral ameloblastoma was often detected in soft tissue. 2017 WHO classification of metastatic ameloblastoma was moved to subtype benign ameloblastoma of malignant odontogenic tumor (Kleihues & Eds, 2014) (Masthan et al., 2015).

Ameloblastoma in children in several reviews reported unicystic ameloblastoma cases which was often found in children compared to other types. Unicystic ameloblastoma was locally invasive odontogenic neoplasm. This type presented clinical feature, coarse radiography, however, histologically showed typical ameloblastomatous epithelial characterized by covering part of cyst's cavity, with or without luminal tumor growth and/or mural in young age (Siar et al., 2012),(Arora et al., 2013). Unicystic ameloblastoma had a wide cystic cavity with luminal, intraluminal, or mural ameloblastic cells proliferations, therefore, it may be called ameloblastomas luminal, ameloblastomas mural, and ameloblastoma originating from dentigerous cyst (Bianco et al., 2020). This type is less aggressive and its recurrency rate is low (Mahmoud et al., 2018).

From reviewed article, the cause of ameloblastoma in children was caries and teeth eruption or teeth that did not grow (Brown et al., 2014). Ameloblastoma from the residual of epithelial cells, dental lamina, odontogen cyst epithelial wall, mouth mucosa basal epithelial cells, and the residual of mallases epithelial remainder of Hertwig sheath in periodontal ligament in growing teeth or from its enamel organ (Mahmoud et al., 2018). This tumor generally occurred as central lesion in jaw bone slowly destroying and tends to expand from spongiosa into bone cortex(Phattarataratip & Sappayatosok, 2020).

The incidence of ameloblastoma in children was estimated about 10 – 15%, where 11 – 19% was detected in 14.7-year-old (Awadalkreem & Abdoun, 2020). Ameloblastoma in developing countries was often discovered in mandibula; however, a study by F. Awadalkreem et al described that 10 – 15% case had a high incidence in relation to symphysis bone (44.2%) (Awadalkreem & Abdoun, 2020). The area of ameloblastoma cases was discussed in other reports, ameloblastoma on molar-ramus of the mandibula was common,

followed by symphysis(Sheela et al., 2019). Ameloblastoma tended to be observed in symphysis in African population(Sheela et al., 2019). Nigerian reported that 58% lesion was in mandibula and anterior symphysis (Sheela et al., 2019).

The youngest ameloblastoma case was reported in a 2-year-old, according to reviewed articles (Table 1). The highest mean age was in Jordan with mean age 16.0-year-old and the lowest mean age Argentine with mean age 10.8-year-old (Chaudhary et al., 2012). In their report, Z. Chaudhary et al showed that the rate of ameloblastoma cases in children was in mixed ethnic area consist of African, Caucasian, and others effecting from Africa around 45.5% and America around 42.4%, along with Caucasian in 54.5 – 57.6% (Chaudhary et al., 2012). The relation between ameloblastoma incidence with histopathology was rarely found in several case report, however, as mentioned above, ameloblastoma in children was mostly unicystic (Chaudhary et al., 2012). Other report clarify that adult population was related to histopathology of lesion in specific age group, such as follicle and plexiform type occurred mostly in the 3rd decade of life (Chaudhary et al., 2012).

Incidence in radiological finding in ameloblastoma cases stated that unilocular ameloblastoma was commonly found, especially in younger population (Sheela et al., 2019). In their report, Sheela et al stated that the incidence was around 56.76 – 66.667% (Sheela et al., 2019). Sheela et al reported other incidence where multilocular radiolucent lesion was detected in 54.5%, higher compared to unilocular which were 44% (Sheela et al., 2019). Typical soap bubble appearance (multilocular radiology) was seen in 85.2% ameloblastoma case (Sheela et al., 2019).

From 1036 reviewed cases, F. Awadalkreem et al explained that ameloblastoma occurred in a lot of cases, where around 2% was in a size big enough to cause severe deformed face, and functional implication in patients aged less than 10-year-old and 75 (9%) on those aged 10 – 19-year-old (Awadalkreem & Abdoun, 2020). Although ameloblastoma is a benign tumor, it may have a destructive impact in children, physically or emotionally (Johnson et al., 2017). Modern biotechnology and surgery techniques may remove tumor and reconstruct the deformed mandibula (Awadalkreem & Abdoun, 2020). Several reports stated a high recurrency rate of ameloblastoma in children (Awadalkreem & Abdoun, 2020).

Therapy in ameloblastoma aimed to remove the disease with minimum impact to patient's oral health, function, and life quality (Kalaskar et al., 2011). The decision of ameloblastoma management made based patient's situation and surgeon's best consideration (Phattarataratip & Sappayatosok, 2020). Treatment plan was decided according to ameloblastoma area, either mandibula or maxilla (Faras et al., 2017). The higher percentage of chancellus bone in maxilla facilitates ameloblastoma spread, while cortical plate's density in mandibula tended to limit neoplasm dissemination(Faras et al., 2017). Ameloblastoma treatment in children was affected by 3 factors, include continuation of face growth, different bone physiology (chancellus bone higher percentage, increased bone turnover, and reactive periosteum), and the presence of non-erupting teeth, difficulty in early diagnosis, and domination of unicystic ameloblastoma (Faras et al., 2017). In treatment in children, several reports recommended only enucleation treatment (Phattarataratip & Sappayatosok, 2020) (Faras et al., 2017).

Reviewed articles reported that majority of surgery management in children was conservative enucleation in 60 – 71% from all reviewed articles. Enucleation modality only presented the highest recurrency rate as high as 30.5% and the lowest recurrency rate was achieved through resection as low as 3.6% (Awadalkreem & Abdoun, 2020). Enucleation was defined as removal of tumor as a whole up to health bone. This therapy is an intraosseus surgery, mainly on esthetics purposes. This technique was usually recommended in cystic ameloblastoma on young population due to its minimal effect on face deformity (Awadalkreem & Abdoun, 2020). This scoping review had several limitations, one of which was only few articles were included in this review. Moreover, this is a scoping review article

which did not use statistical measures in determining the relations between each variable to promote descriptive analysis. Scoping review also did not study in detail because its purpose was to identified published articles to perform future research. The result of scoping review did not result in specific medical recommendation, but only concluded the result of researches from secondary data which are previous studies. However, scoping review is a study with an ideal approach to determine the scope of literatures in specific topic and gave clear indication on literature volume and published study and general description (extensive or detailed) from the researcher. Other limitation was that only few articles exhaustively discuss ameloblastoma incidence in the last ten year or previous years in order to compare the increase of yearly incidence. Recommendation for future studies was to do similar researches with similar sample collection methods.

CONCLUSION

The Incidence of ameloblastoma in children was about 10-15% based on eleven articles that have been identified using different sample collection techniques.

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