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Risk detection of osteoporosis with panoramic radiograph using mental index in 30-60 years old patients (an overview in Ulin Hospital Banjarmasin)

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ABSTRACT

Objectives: This research is aimed to determine the detection of osteoporosis risk with a panoramic radiograph using mental index in 30-60 years old patients in Ulin Hospital Banjarmasin.

Materials and Methods: This research was a descriptive study with a cross-sectional study design. The population in this research was digital panoramic radiograph from Radiology Installation of Ulin Hospital Banjarmasin from January 2018 – December 2021 database. The technique used is purposive sampling and obtained 36 digital panoramic radiographs from patients aged 30-60.

Results: The results showed based on age that the lowest madibular cortex width was the left jaw 3.33 ± 0.32 in age 56-60 and the highest mandibular cortical width was the right jaw 3.67 ± 0.50 in age 30-35. Based on gender, The lowest mandibular cortex width was in men right jaw 3.44 ± 0.52 and the highest madibular cortical width was in women right jaw 3.77 ± 0.47. The mean value of the mandibular cortex width in the group at risk for osteoporosis was 2.91 ± 0.21.

Conclusion: The age group at risk of osteoporosis is the age of 56-60 years old and the gender at risk of osteoporosis is men.

Keywords: *Osteoporosis, bone density, panoramic radiograph, mental index*
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INTRODUCTION

Osteoporosis is a disease characterized by decreased bone strength, causing bones to become brittle and easily broken. Osteoporosis sufferers around the world in 2009 reached 200 million sufferers. The International Osteoporosis Foundation (2020) states that it is estimated that by 2050, there will be 6.3 million patients per year experiencing fractures, and more than half of them are found in Asia. Indonesia will experience an increase in osteoporosis cases from the previous four decades, in 2013 as many as 251 million, and in 2050 to 300 million cases. Men and women who are at risk of osteoporosis at the age of 50 will make up 1/3 of the total population of Indonesia.[1–3]

Bone density is a degree of grayness that can be seen in the results of panoramic radiographs as radiolucent, radiointermediate to radiopaque images. Low bone density can provide radiolucent images to radiointermediate and high bone density can provide radiopaque images.[4] Cortical bone is a bone found in the area of the mandibular cortex where radiologically it is seen as a radiopaque picture along the inferior cortex of the mandible. The height of the mandibular cortical bone is the distance of the outermost boundary of the mandibular cortex visible in the radiograph to the radiopaque boundary towards the inner bone. The decrease in bone density will then continue to become osteoporosis.[3,5,6]

Osteoporosis can occur in any part of the bone including the jawbone. Early detection of cases of osteoporosis is indispensable for effective prevention and treatment. Osteoporosis in the jawbone can be seen radiographically to see the density of the bone. Dentists have an important role in the early detect cases of osteoporosis because indirectly dentists can see the effects of osteoporosis on the oral cavity. The detectable effects of osteoporosis on the oral cavity are tooth loss, resorption and reduced alveolar bone height, reduced mandibular inferior cranial cord width, and temporomandibular joint disorders. One way to establish a diagnosis of osteoporosis is to look at the results of a radiograph.[3,7]

Radiography is one of the supporting examinations used to establish a diagnosis in the field of dentistry, radiograph results can provide an overview of the depletion of the inferior cortex of the mandible and bone density. Osteoporosis can be detected by the dentist in patients who perform examinations with the results of panoramic radiographs. Osteoporosis can be measured on panoramic radiograph results using radiomorphometric indices. The radiomorphometry index consists of several indices, namely Mental Index (MI), Antegonial Index (AI), Gonion Index (GI),

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Mandibular Cortical Index (MCI), and Panoramic Mandibular Index (PMI).[3,8]

MATERIALS AND METHODS

This research was an analytical descriptive study. This research has received ethical clearance approval from the Research Ethics Commission of the Faculty of Dental Medicine, Lambung Mangkurat University Banjarmasin No. 024/KEPKG-FKGULM/EC/IV/2022. The population of this study was was digital panoramic radiograph from Radiology Installation of Ulin Hospital Banjarmasin from January 2018 – December 2021 database. The sample of this study used purposive sampling, which was a secondary data of panoramic radiograph photos of patients aged 30-60 who have been recapitulated at the Radiology Installation of Ulin Banjarmasin Hospital from January 2018 – December 202 which meets the inclusion and exclusion criteria. The inclusion criteria were: 1) Panoramic radiograph photo results of patients 30-60 years old from January 2018 – December 2021, 2) Panoramic radiograph photo results with a clear mandibular cortex. The exclusion criteria were: 1) The results of panoramic radiograph photos with diseases affecting the mandibular bones, 2) The results of panoramic radiograph photos with mandibular fractures, 3) The results of panoramic radiograph photos cannot be interpreted, 4) The results of panoramic radiograph photos have overlapping, 5) The contrast of the film is too low or too high, 6) The results of photos with low sharpness so that the outermost boundary line is not clear, 7) The details of the object are lacking, so the differences in the anatomical parts of each part are less clear, 8) The resulting photo is distorted so that the size and shape are not the same as the original object, 9) The brightness of the radiograph is too bright and too dark.

This research was carried out at the Radiology Installation, Ulin Banjarmasin Hospital in January – May 2022. The procedure of this study was: The examination was carried out on each photo result of a panoramic radiograph of patients 30-60 years old from January 2018 – December 2021 that met the inclusion and exclusion criteria, then the radiograph photo was analyzed with imageJ software version 1.53K used Mental Index (MI) (normal value of ≥ 3.2 mm).[9] Measurements were made by identifying the foramen mentale and then a line was made perpendicular to the tangent line

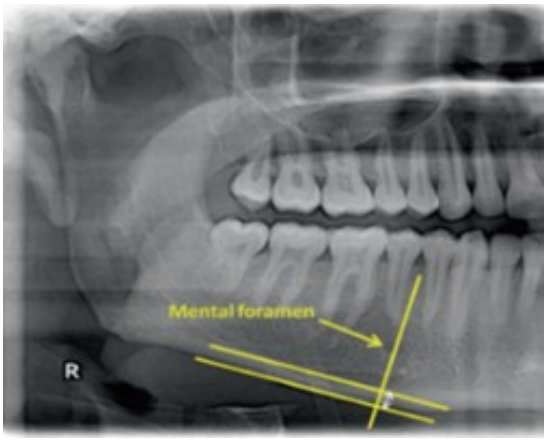

Figure 1. Mental Index (MI)[10]

Table 1. Sample Characteristics

VARIABLE	N	PERCENTAGE
AGE		
30-35 years old	17	47%
36-45 years old	12	33%
46-55 years old	5	14%
56-60 years old	2	6%
Total	**36**	**100%**
GENDER		
Women	18	50%
Men	18	50%
Total	**36**	**100%**

Table 2. Mean value of Mandibular Cortex Width by Age

AGE	n	MANDIBULAR CORTEX WIDTH	
		RIGHT JAW (MEAN ± SD)	LEFT JAW (MEAN ± SD)
30-35 years old	17	3.67 ± 0.50	3.61 ± 0.49
36-45 years old	12	3.52 ± 0.56	3.61 ± 0.63
46-55 years old	5	3.45 ± 0.70	3.42 ± 0.51
56-60 years old	2	3.44 ± 0.70	3.33 ± 0.32
Total	36	3.52 ± 0.62	3.50 ± 0.50

Table 3. Mean value of Mandibular Cortex Width by Gender

GENDER	n	MANDIBULAR CORTEX WIDTH	
		RIGHT JAW (MEAN ± SD)	LEFT JAW (MEAN ± SD)
Women	18	3.77 ± 0.47	3.76 ± 0.52
Men	18	3.44 ± 0.52	3.37 ± 0.44
Total	36	3.61 ± 0.50	3.57 ± 0.48

Table 4. The Results of the Osteoporosis Assessment with Mental Index

VARIABLE	n	Risk of Osteoporosis	No-Risk of Osteoporosis
AGE			
30-35 years old	17	3	14
36-45 years old	12	4	8
46-55 years old	5	2	3
56-60 years old	2	1	1
Total	36	10	26
GENDER			
Women	18	2	16
Men	18	8	10
Total	36	10	26

Table 5. Average values of Mandibular Cortex Width by Category of Osteoporosis and Non-Osteoporosis

CATEGORY	MANDIBULAR CORTEX WIDTH
	MEAN ± SD
Risk of Osteoporosis	2.91 ± 0.21
No-Risk of Osteoporosis	3.82 ± 0.38

of the lower limit and the upper limit of the mandibular cortex through the center of the foramen mentale and the average value was taken as the final measurement. The data from these measurements then analyzed used descriptive analysis and presented in the form of a table.

RESULTS

The results of this research obtained 36 panoramic radiographs of patients 30-60 years old at the Radiology Installation of Ulin Hospital Banjarmasin from January 2018 – December 2021 that qualify for inclusion and exclusion criteria. The sample characteristics was shown in Table 1 that women has a total of 18 photos (50%), men has a total of 18 photos (50%), and the most age range was 30-35 years old had a total of 17 photos (47%).

The mean value of mandibular cortex width based on age is shown in Table 2 the age group 30-35 years old for the right jaw was 3.67 ± 0.05 and for the left jaw was 3.62 ± 0.49. Group 36-45 years old for the right jaw was 3.52 ± 0.56 and the left jaw was 3.61 ± 0.63. Group 46-55 years old for the right jaw was 3.45 ± 0.70 and the left jaw was 3.42 ± 0.51. Group 56-60 years old for the right jaw was 3.44 ± 0.70 and the left jaw was 3.33 ± 0.32.

The mean value of mandibular cortex width based on gender is shown in Table 3. Women obtained the mean value of the mandibular cortex width of the right jaw was 3.77 ± 0.47 and the left jaw was 3.76 ± 0.52. Men obtained the mean value of the mandibular cortex width of the right jaw was 3.44 ± 0.52 and the left jaw was 3.37 ± 0.44.The results of osteoporosis risk assessment with mental index based on age are shown in Table 4, 10 out of a total of 36 panoramic radiographs detected at risk of osteoporosis and 26 out of a total of 36

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panoramic radiographs detected at no risk of osteoporosis. The results of osteoporosis risk assessment with mental index based on gender, women with a total of 2 panoramic radiographs with osteoporosis risk and 16 panoramic radiographs not at risk of osteoporosis. Men with a total of 8 panoramic radiographs has osteoporosis risk and 10 panoramic radiographs were not at risk of osteoporosis. These results were obtained based on the results of calculations using the mental index, where the mandibular cortex value <3.2mm was included in the osteoporosis risk category and the mandibular cortex value >3.2mm is included in the category of no risk of osteoporosis.

The mean value of mandibular cortex width based on categories of osteoporosis risk and no osteoporosis risk is shown in Table 5. The osteoporosis risk group obtained a mean value of mandibular cortex width of 2.91 ± 0.21. The group not at risk for osteoporosis obtained a mean mandibular cortex width of 3.82 ± 0.38.

DISCUSSION

The results of the study Table 2 showed that the average value of the mandibular cortex width decreased significantly with age, where the age group of 30-35 years had a greater average value of the mandibular cortex, namely the right jaw 3.67 ± 0.50 and the left jaw 3.61 ± 0.49, while the age group 56-60 years had the lowest average value of the mandibular cortex, namely the right jaw 3.44 ± 0.70 and the left jaw 3.33 ± 0.32. Ledgerton in 1997 stated that as we age, the width value of the mandibular cortex gradually decreases.[11] Sghaireen in 2020 states that the width value of the mandibular cortex is higher at a younger age.[9,12,13] Azhari in 2017 in her study stated that the difference in the width of the mandibular cortex of the right and left jaws can be caused by a pattern of one-sided mastication.[14] The low width of the mandibular cortex is also accompanied by tooth loss, although tooth loss has many causes, however, some studies state that people who experience bone resorption or with osteoporosis experience tooth loss.[15]

Bones will periodically undergo a process of continuous renewal referred to as bone remodeling. The process of bone remodeling is the process of bone resorption by osteoclasts and bone formation by osteoblasts that go hand in hand to maintain bone mass and strength. Increasing age causes this bone remodeling balance process to be disturbed whereas, bone resorption by osteoclasts will take place faster than the formation of new bones by osteoblasts.[2,16,17] The process of bone formation occurs rapidly at the age of puberty. This process reaches its peak around the age of 20-35 years old and will slowly decrease along with the aging process. The decrease in bone mass begins around the age of 30, then it will decrease further after the age of 40, and continues to decline along with the aging process. Bone density in the elderly is lower compared to the bone density of young age.[14,18] According to the International Osteoporosis Foundation in 2020, several things affect a person's bone density condition, namely gender, age, race, long-term glucocorticoid therapy, lifestyle, and calcium intake.[2]

The results of the study Table 3 showed that the average value of the width of the men mandibular cortex was lower with a right jaw value of 3.44 ± 0.52 and the left jaw was 3.37 ± 0.44, while the women was taller with a right jaw value of 3.77 ± 0.47 and the left jaw was 3.76 ± 0.52. The results of this study are inversely proportional to researchers by Sairam in 2018 who stated that the width of the women mandibular cortex is lower than that of men.[19] no difference in the thickness of the women and men mandibular cortex.[20] The difference can be caused by the presence of growth spurts. For every growth spurt, the women will start two years first before the men begins the growth spurt. This causes the growth period of women to be completed faster than men so that the total period of growth of men is longer than that of women. Mens have two additional years of growth due to differences in maturation so that mens have greater bone mass than women.[21,22]

Factors that also affect the growth of bone mass are hormonal. An increase in sex hormones can cause physiological changes, including an acceleration of the body's growth in general and the expansion of lymphoid tissue. Sex hormones in mens and women are very different. The hormone affects bone growth. Testosterone has an important role in men, while women are affected by the hormone estrogen which supports growth.[24] Hormonal changes in men and women will cause bone resorption which can cause osteoporosis. Osteoporosis is divided into two, namely primary osteoporosis which occurs in postmenopausal women and elderly women or men, and secondary Schneider in 2020 in his study denied that there was osteoporosis caused by certain diseases or disorders, due to surgical procedures, or the administration of drugs whose effects accelerate bone resorption.[2] Secondary osteoporosis occurs 60% in men and 40% in women. Several factors cause secondary osteoporosis in men, namely alcohol consumption as a daily intake, low body mass index (BMI), excess glucocorticoids, hypogonadism (hormonal suppression therapy for prostate cancer), gastrointestinal disorders (malabsorption syndrome, inflammatory bowel disease, gluten enteropathy, primary biliary cirrhosis, gastrectomy, hypercalciuria), chronic obstructive pulmonary disease, post-transplant syndrome, neuromuscular disorders, a history of cerebrovascular accidents. Systemic diseases that can cause secondary osteoporosis, namely rheumatoid arthritis, multiple myeloma, and other malignancies, while the result of drugs, namely glucocorticoids, anticonvulsants, thyroid hormones, and chemotherapy.[23-25] Unidentified secondary osteoporosis can contribute to the severity of osteoporosis or inadequate treatment response since it is very important to identify the underlying cause so that it can be treated to improve bone

health.[26] Although osteoporosis is four times more common in women than men, some evidence suggests that men tend to have more complications with a risk of death after having a hip fracture. The silent disease nature of osteoporosis causes a delay in early diagnosis so as not to get the right treatment.[27]

The results of the Table 4 study showed that the group at risk of osteoporosis was 10 out of 36 radiograph photos, 2 people were at risk of osteoporosis and 8 men were at risk of osteoporosis. This can be influenced by a decrease in estrogen secretion, lifestyle, race, and genetics which plays an important role in the relationship of age with osteoporosis.[2]

The lifestyle in question is a bad lifestyle, such as less vitamin D intake, consumption of high-caffeine drinks, lack of physical activity, low calcium intake, and smoking habits. Drinks high in caffeine can cause brittle bones and are damaged because they are toxic which will remove bone-forming calcium along with urine and inhibit the process of bone mass formation (osteoblasts). Smoking can also be a cause of osteoporosis because the nicotine content which is the main active ingredient in tobacco can stimulate bone turnover. The process of bone remodeling is mediated by the balance of osteoclasts and osteoblasts. The effect of nicotine on bone cellular is to disrupt the balance between bone formation and resorption.[28,29] Nicotine inhibits the formation of osteoblasts and stimulates the formation of osteoclasts that can cause osteoporosis.[2,23]

The results of the study Table 5 showed the average value of the mandibular cortex width of the group at risk of osteoporosis 2.91 ± 0.21 and the group not at risk of osteoporosis 3.82 ± 0.38. Nagi in 2014 in his study stated that the group with a risk of osteoporosis had an average value of lower mandibular cortex width than the group not at risk of osteoporosis. The results explained that measurements of the mandibular cortex in the mental foramen area using a mental index are efficacious in distinguishing groups at risk of osteoporosis and not at risk of osteoporosis.[30]

Osteoporosis is a condition where there is a decrease in bone mass which causes a decrease in bone density. Osteoporosis can occur in the jawbone which can be seen in radiography to see the density of tulang.[34] Osteoporosis was initially detected using the Dual-Energy X-Ray Absorptiometry (DEXA) tool, but this method is less affordable so one way to establish a more affordable and easier diagnosis of osteoporosis is to measure the width of the mandibular cortex in radiograph results using a mental index (MI).[6,7,9]

CONCLUSION

According to the results, the age group at risk of osteoporosis is the age of 56-60 years old and the gender at risk of osteoporosis is men.

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FOOTNOTES

All authors have no potential conflict of interest to declare for this article. This research was registered and approved by the Research Ethics Committee. All procedures conducted were in accordance with the ethical standards.

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