

EVALUATION OF CALCIFIED CAROTID ARTERY ATHEROMAS DETECTED BY PANORAMIC RADIOGRAPH ABOVE 50-YEARS-OLD IN ISFAHAN

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ABSTRACT

The purpose of our study was to evaluate the incidence of CCAAs detected on panoramic radiographs of above 50-years-old patient population. Further, we evaluated the relationship between CCAAs and general and oral health examinations.

Calcified carotid artery atheromas or CCAAs are projected on panoramic radiographs as a radiopaque nodular mass or masses adjacent to the cervical vertebrae at or below the intervertebral space between C₃ and C₄

We concluded that, panoramic radiography should be evaluated not only for pathosis of teeth and jaws, but also for other incidental findings, especially in the soft tissue region of the neck. The incidental findings could provide potentially life saving informations especially for those elderly people who are at risk for stroke .

Key words: Panoramic radiograph , Calcified carotid artery atheroma, Dental

INTRODUCTION

As the number of the aged persons is increasing worldwide, the number of oral and other diseases will increase exponentially.

Our study makes extensive use of panoramic radiographs obtained during our project, for detection of calcified carotid artery plaque, (calcified carotid artery atheroma), or CCAA by means of panoramic radiography. CCAAs are projected on panoramic radiographs as a radiopaque nodular mass or masses adjacent to the cervical vertebrae at or below the intervertebral space between C₃ and C₄.

From many studies it appears that panoramic radiography is a useful imaging modality for the identification of some asymptomatic patients at the high end of risk for stroke.

Calcified Carotid Artery Atheroma Atherosclerotic Lesions

Atherosclerotic vascular disease may manifest as coronary heart disease (e.g, angina, myocardial infarction, sudden death), cerebrovascular disease (e.g, stroke and transient ischaemic attack) or peripheral

vascular disease (e.g, claudication and critical limb ischaemia).

PANORAMIC RADIOGRAPH

“A tomogram of the jaws taken with a specialized machine designed to present a panoramic view of the full circumferential length of the jaws on a single film – also known by the several trade names of machines, most of which incorporate (PAN) into the name”². or A technique for producing a single tomographic image of the facial structures that includes both the maxillary and the mandibular dental arches and their supporting structures ².

ADVANTAGES

These are as follows:

- Broad coverage of the facial bones and teeth
- Low patient radiation dose
- Convenience for the examination of the patient
- Ability to be used in patients unable to open their mouths
- Short time required to make a panoramic image, usually in the range of 3-4 minutes, (includes the

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time necessary for positioning the patient and the actual exposure cycle).

Patient's understandability of panoramic films making them a useful visual aid in patient education and case presentation².

Differential diagnosis of carotid artery calcification includes the following anatomic and pathologic radiopacities⁶:

Anatomical

- 1 Hyoid bone: the greater horn arising from the posterior end of the hyoid bone at 135° angle and crosses the pharyngeal airway. It has a defined cortex and trabecular pattern⁶.
- 2 Styloid process: bilateral structure originating from the temporal bone. On a panoramic film it appears projecting downward and forward between the ramus and the mastoid process⁶.
- 3 Stylohyoid ligament: arises from the inferior aspect of the styloid process and connects to the lesser horn of the hyoid bone. When calcified it can be posterior to the mandible, either continuously or in segmented fashion⁶.
- 4 Stylomandibular ligament: connects inferior aspects of styloid process with the angle of the mandible. When calcified, it may be seen on panoramic radiography⁶.
- 5 Thyroid cartilage: the chief cartilage of the larynx. When calcified, the superior horn may be seen on a panoramic radiograph⁶.
- 6 Triticeous cartilage: a small nodule of cartilage within the lateral thyrohyoid ligament. When calcified, it appears as a radiopacity the size of a grain of wheat, just below the tip of the greater cornu of the hyoid bone⁶.
- 7 Epiglottis: a vertically oriented crescent – shaped soft tissue opacity above the greater horn of the hyoid⁶.
- 8 Soft palate⁶.
- 9 Tongue: posterior aspect of the tongue⁶.
- 10 Auricle: ear lobe⁶.
- 11 Atlas: anterior tubercle of the atlas⁶.
- 12 Vertebrae⁶.

Pathological

- 1 Calcified lymph nodes: cauliflower – like in shape and varied in radiodensity. They are almost always unilateral, single, multiple, or in a chain⁶.
- 2 Phleboliths: dystrophic calcifications found in veins, usually smaller than hilar stones, usually multiple,

and frequently have concentric radiopaque and radiolucent rings (bulls – eye pattern)⁶.

- 3 Submandibular salivary gland sialoliths: stones located in the hilum, almost always unilateral and appear below the inferior border of the mandible in the third molar ramus area. They are usually smooth in outline and diffusely calcified⁶.
- 4 Loose body: a small pathologic bony outgrowth (osteophyte) that fractured off the body of a cervical vertebra⁶.
- 5 Tonsilloliths: multiple small radiopacities clustered together over the oropharyngeal airspace⁶.
- 6 Calcified acne⁶.

METHODOLOGY

After determining the volume of our samples (400) according to the counsellor of statistic and getting the letter of introduction from the Department of Investigations, Dental Centres and Dental Radiology Department of Isfahan city, like Dental College of Isfahan and other Prosthodontic and Periodontic Departments of Dental College of Isfahan, the files of the patients were collected and essential informations were obtained and check list was prepared. In addition to this, evaluation of the panoramic radiograph was done and important informations were collected. Whatever was obtained from the investigation and research was used for statistical analysis and Chi-square tests and T-test were done and at last but not the least patients with this appearance on panoramic radiography were considered for the presence of blood pressure, diabetes mellitus, cardiovascular diseases, etc. If any above mentioned pathologies were found patient was referred to the respective physician and lastly the results of our statistical analysis were prepared.

RESULTS

The results obtained from statistical analysis showed:

According to Chi-square test there was a significant relationship between the carotid calcification in both males and females (pvalue=0.015) and relationship in the presence of carotid calcification between diabetic and non-diabetic patients (pvalue=0.005) but no significant relationship was found between carotid calcification and periodontal disease (pvalue = 0.075). According to Chi-square test there was a significant relationship between presence of carotid calcification in healthy individuals and those suffering from high blood pressure (pvalue=0.015). Similarly a significant relationship between carotid calcification and cardiovascular disease (pvalue =0.005) was established. Moreover, as per T-test Analysis there was a signifi-

cant relationship between mean age and mean number of teeth present and presence of calcification was found.

- a Mean age and presence of carotid calcification (pvalue=0.018).
- b Mean number of teeth present and presence of carotid calcification (pvalue=0.001).

DISCUSSION

Our study analysis showed significant relationship between the carotid calcification in both males and females, between diabetic and non-diabetic patients, in healthy individuals and those suffering from high blood pressure, and cardiovascular disease, but significant relationship was not found between calcification and periodontal disease. There was a significant difference between mean age and mean number of teeth present and presence of calcification. Takeshi et al, studied the incidence among 80- year-olds of calcified carotid artery atheromas (CCAAs) as detected on panoramic radiographs. The relationship between CCAAs and general and oral health was also evaluated. Six hundred and fifty –nine panoramic radiographs (262 males, 397 females), were obtained from 80-year-old residents of Fukuoka Prefecture, Japan³.

Of 659 panoramic radiographs, 33(5%) were noted to have CCAAs. These appeared as a radiopaque nodular mass or masses adjacent to or just below the intervertebral space between C₃ and C₄. CCAAs were found in 8 males and 25 females. There were marginally significant differences between males and females in CCAAs(pvalue=0.06)³. Seventy four percent of CCAAs were detected on the right side. There appeared to be very little relationship between CCAAs and general and oral health³. The results of this study gives further support to the idea of using panoramic radiographs to detect CCAAs. Therefore, we feel that panoramic radiographs should be evaluated not only for pathosis of the teeth and jaws, but also for other incidental findings, especially in the soft-tissue region of the neck. The findings from this study provide potentially life-saving information especially for those elderly people who are at risk for stroke³. There results were nearly the same as ours. There was a significant difference between males and females, in our study, as well as in Takeshi et al study.

But there was no difference in patients having calcification and there comparison with the presence of blood pressure in Takeshi et al study but in our study a significant difference was found between the two groups. Since Friedlander and Lande first reported the detection of CCAAs by means of panoramic radiography, a number of articles have also described the detection of CCAAs on panoramic radiographs^{9,10,11,12}. Friedlander and Lande reported on 1000 subjects hav-

ing panoramic radiographs with 2% showing CCAAs. Subjects were between the ages of 50 and 75 at the Dental Service of the North Veterans Administration Medical Center in New York City^{4,5,6,7,8}.

In another study, Friedlander et al used panoramic radiography to detect CCAAs of 19 white males, who had a recent cerebrovascular accident and were hospitalized. The results showed that 7 (37%) of those patients, with an average age of 65 years, had CCAAs^{4,5,6,7,8}. In yet another study, Friedlander and August reported on panoramic radiographs of patients, with an average age of 66.1 years, receiving radiation treatment to their necks. Of these, 21.2% (7 of 33 subjects) showed CCAAs, whereas control subject with an average age of 67.3 years, showed only 4.7% (5 of 107 subjects) with CCAAs^{4,5,6,7,8}.

Overall, Friedlander et al's study detected 2% to 4.7% of CCAAs in asymptomatic patients by means of panoramic radiography. In Takeshi's study of 80-year-olds CCAAs were detected by panoramic radiographs in 5% (33 of 659 subjects). However, we have data on medical histories of the subjects having CCAAs^{4,5,6,7,8}.

The percentage of the detection of CCAAs in Takeshi's study was slightly higher than with the asymptomatic subjects of Friedlander et al. It seems that the main reason for these differences was due to the different age ranges of subjects.

The CCAAs in Takeshi's study were detected in 8 males and 25 females. Of the 25 females, one had bilateral CCAAs. There was marginal difference between the males and females in the detection of CCAAs (pvalue=0.06). In the Takeshi's study, 34 CCAAs were detected in 33 individuals. Of the 34 CCAAs, 25 were located on the right side and 9 on the left side. It is said that CCAAs are detected in the region of the carotid bifurcation on panoramic radiographs³.

According to Adachi, the carotid bifurcation level to the cervical vertebrae in Japanese people differs on the left and right sides. Normally, bifurcation level of the right carotid artery is more often located between C3 and C4, whereas the bifurcation level of the left carotid artery is located between C4 and C5. In this study, a radiopaque nodular mass or masses adjacent to the cervical vertebrae at or below the intervertebral space between C3 and C4 was regarded as a CCAA. Also, the C5 is not completely projected on panoramic radiographs with a 5-in cassette. Therefore, it is speculated that CCAAs on the left side are less often detected than those on the right side on panoramic radiographs⁸.

Stroke is the third leading cause of death in Japan. Intracranial carotid lesion are more common than

extracranial carotid lesions among the Japanese. However, Nagao et al reported that the prevalence of severe atherosclerotic lesions of the extracranial internal carotid arteries increased significantly between 1965 and 1989, whereas lesions of the intracranial carotid system were observed at similar levels between the two time points. They also stated that severe atherosclerosis in the extracranial internal carotid artery was more frequent in patients with diabetes mellitus⁹. In Takeshi's study however, there was no difference between the subjects with CCAAs and those with none in the data obtained from the fasting sugar examination³.

Handa et al studied the relationship between the ischaemic stroke event rate and the severity and appearance of the carotid atherosclerosis using ultrasonography. Their results were that patients with ulcerated plaque had a seven-fold higher hazard ratio for stroke than those without such plaque (pvalue <0.01)¹⁰.

Blood pressure, electrocardiography, blood cholesterol, and blood sugar were compared between the subjects with CCAAs and those with none. However, there were no differences between the two subjects in individual examination items. In comparing our results with JS Huber, he recommended that all the panoramic radiographs were screened thoroughly for carotid artery calcification and many normal anatomical radiopaque structures may be visible on a panoramic radiograph near the angle of mandible including the stylohyoid and stylomandibular ligaments, hyoid bone and epiglottis. These structures may often be confused with pathosis¹¹.

According to the study of Maria M. Saurez there is a possibility of detecting signs of atherosclerosis in arteries of maxillofacial region by use of panoramic radiography and we do agree with this statement¹².

According to the study of Rosangela Saga et al calcification atheromas of carotid artery are not the only features that can produce radiopaque images lateral to the panoramic radiograph, and in our study we did consider this matter¹³.

If CCAAs are accidentally detected in patients by means of panoramic radiography, advanced diagnostic examinations, such as ultrasonography, MRI, and angiography should be recommended to confirm carotid stenosis for such persons.

And last but not the least, a dental surgeon should be able to diagnose CCAAs on panoramic radiographs and refer the patient to the physician as early as possible to save his life.

CONCLUSION

We concluded that, panoramic radiography should be evaluated not only for pathosis of the teeth and jaws, but also for other incidental findings, especially in the soft tissue region of the neck. The incidental findings could provide potentially life saving information for aged persons.

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