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Capabilities of Digital Radiographic Examinations in The Diagnosis of Coronary Calcification.

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ABSTRACT

According to the latest clinical researches the identification of coronary artery calcification is an important prognostic method for assessing the risk of developing cardiovascular diseases. Opportunity assessment of digital radiography in the diagnosis of coronary artery calcification. The study presents the results of examination of 180 patients with calcifications of various localization (coronary arteries, aortic arch, heart valves, pericardium). A survey was carried out by a digital X-ray of the universal digital X-ray diagnostic device with remote control SHİMADZU. For more refined interpretation of the survey results, the data were analyzed by the digitizer FUJİ FİLM CAPSULA. According to the results of our study, the most frequent localization of calcifications is the left descending artery. In addition, there is a correlation between the spread of coronary calcification and calcification of the aorta, as well as the age of patients.

Keywords: coronary calcification, digital radiography, coronary arteries, aortic arch, heart valves, pericardium

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INTRODUCTION

Coronary artery disease (CAD) and its complications are considered to be one of the main causes of disability and mortality in developed countries [1,2,3]. According to the data of the WHO as of 2009 CAD accounts for death of 15 million people [4]. It means that CAD should be treated as a serious social problem.

Early diagnosis of CAD is an issue most frequently discussed in the local and foreign literature. Experts regularly bring up this issue with regard to the emergence of the latest diagnostic technologies [5].

A number of clinical studies prove the existence of close correlation between the coronary calcifications (CC) and the risk of cardiovascular problems. Due to this fact, detection of CC is a crucial means for the evaluation of cardiovascular risks. Thus, determination of such clinical risks as detection of CC acquires particular significance for the patients-carriers of the given risk factors [6].

In modern science the study of capabilities of coronary atherosclerosis diagnosis (based on the amount of artery calcification) is a new, independent trend in medicine. However, despite a wide scope of research, many issues in this field remain the subject of serious discussions.

A constant study of new methods of diagnosis capable of identifying early calcification in the given category of patients is necessary for establishing a close correlation between coronary calcification and clinical symptoms of CAD.

The development of radiology in recent years has led to a gradual change of the role of X-ray radiography in modern diagnostics. In the past, X-ray radiography was considered to be the main method of radiology at the early stage of health care. However, X-ray radiography later was substituted by more advanced technology methods such as CT (computer tomography), MRI (magnetic-resonance imaging), PET (positron emission tomography) etc.

However, the above mentioned methods of visualization being widely used, common chest X-ray is a diagnostic base of visualization in patients suspected with coronary arteries disease. Clinical practice proves that commonly used chest X-ray allows to determine a certain extent of these diseases, i.e. this type of examination may be used for the differentiation of examination risks [7,8,9,10].

The results of clinical studies show that chest X-ray can only detect CC of a large volume, i.e. limitations due to the specific nature of the disease are quite evident. From this point of view, the use of X-ray radiography in the assessment of risk groups makes it possible for patients to avoid more complex invasive types of examination.

It should be noted that the results of the study directly depend on the technical capabilities of the medical apparatus, the entire equipment, the size of patient's body, calcification in annexa and physician's experience and professionalism.

According to the researchers, chest X-ray still remains the diagnostic base of visualization in patients suspected with coronary arteries disease.

TARGET. Regarding to above mentioned information, the main aim of the study is to identify capabilities of digital radiography in the diagnosis of CC.

MATERIALS AND METHODS

The study presents the results of examination of 180 patients with calcifications of various localization (coronary arteries, aortic arch, heart valves, pericardium), at the age of 43-70 years, in average 56,4±0,6 years.

In 77(42,8±3,7%) of the examined patients there was identified arterial hypertension, in 59 (32,8±3,5%) – diabetus mellitus of the 2nd type, in 62 (34,4±3,5%) –metabolic syndrome; 33(18,3±2,9%) patients had had myocardial infarction, in 89 (49,4±3,7%) patients there were observed degenerative changes in the lumbar column, in 20(11,1±2,3%) patients

- gastroesophageal reflux.

A survey was carried out by a digital X-ray of the universal digital X-ray diagnostic device with remote control SHİMADZU FLEXAVİSİON. Chest radiography was carried out in standard views (postero-anterior), during deep breath standing in 4 standard views: anterio-posterio, left lateral, right anterior oblique and left anterior oblique (45°). No contrasting agents were used in the survey.

For more refined interpretation of the survey results, the data were analyzed by the digitizer FUJİ FİLM CAPSULA.

The collected images were archived and stored in the electron memory, kept in the system of electronic processing and **PACS** transfer (picture archiving and communicating system).

STATICTICAL PROCESSING OF THE SURVEY

Statistical processing of the obtained data was carried out by means of χ2-Pearson criterion with the calculation of the polychoric connection.

RESULTS AND DISCUSSION

Having a thorough knowledge of coronary anatomy and its correlation with annexa, one can easily differentiate coronary calcifications, calcification of cardiac valves and lymph gland as well as pulmonary parenchyma.

As a whole, there were examined 720 coronary vessels: left descending artery (LDA), left circumflex artery (LcxA), root of the left coronary artery, right coronary artery (RCA). Besides, aortic arch was examined in all the patients.

CTR (cardio thoracic ratio) was calculated by dividing the transverse cardiac diameter by the inner diameter of the biggest point of the chest above the diaphragm. Normally, this indicator must not exceed 0.5. In 91(50,5±3,7%) patients the CTR proved to be above the norm.

Vascular calcification in X-ray images was detected in various localizations. As is seen from the diagram, 140 (77,8±3,1%) patients were found to have CC, 11 (6,1±1,8%) patients- pericardiac calcifications, 14 (7,8±2,0%) patients-calcification of mitral valve and in 68 (37,8±3,6%) patients there was identified calcification of aortal arch (fig. 1).

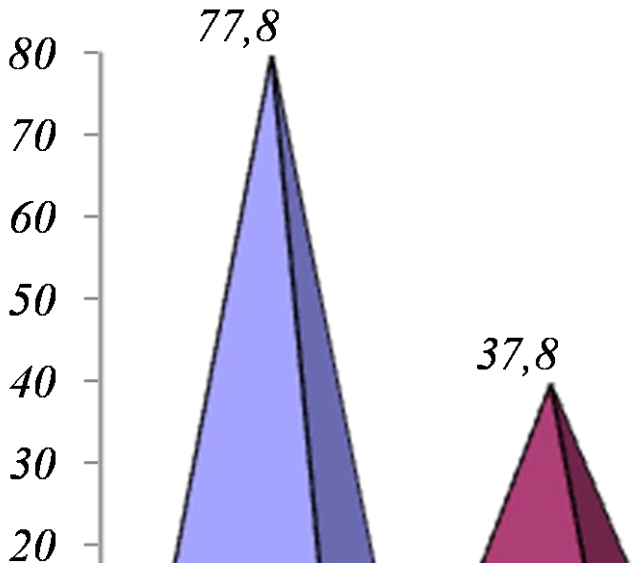

Figure 1. Frequency of identification of cardio vascular calcification in different locations.

CC in chest X-ray images in anterior and posterior views was detected in the localizations characteristic of such cases. In the front view, they were found mainly in the triangle of arterial calcifications. The left paravertebral line comprises the inner border of the mentioned triangle, hypotenuse of the upper half of the left cardiac alignment and the horizontal line between them forming the lower border.

CC in 87(48,3±3,7%) patients was visualized in the anterior interventricular branch of the left descending artery (LDA), in 84(46,7±3,7%) patients- in the left circumflex coronary artery (LcxA), in 49(27,2±3,3%) patients-in the right coronary artery (RCA), in 32(17,8±2,8%) patients- in the left main coronary artery (LMA). Calcification of the aorta was identified in 68(37,8±3,7%) patients.

In 99(55,0±3,7%) patients CC was detected in one coronary vessel, in 51 (28,3±3,4%) patients in two and in 17 (9,4±2,2%) patients in three and more coronary vessels.

The extent of aortal calcification was determined according to the previously established score.

0-no visible calcification;
1-calcification area< 50% of the aortal arch;
2- calcification area >50% of the aortal arch;
3- calcification of the entire aortal arch

In our survey, the zero degree of aortal calcification was identified in 112(62,2±3,6%) patients, calcification of the I degree- in 28(15,6±3,7%) patients, calcification of the II degree - in 30(16,7±3,4%) patients, calcification of the III degree - in 10(5,6±3,7%) patients.

The scientific work has dealt with the dependence of CC on patients' age. It was found that events and degree of calcification increased with the age (Table 1).

The table shows that patients under 50 years old mostly had single-vessel disease of coronary arteries (83,6±4,7%), whereas patients above 60 years were found to have two or more than 3 vessel disease (45,2±6,3% and 25,8±5,6% respectively).

Besides, the results of the survey suggested a direct correlation of aortic calcification with patients' age. It was established that with age the degree of aortic calcification significantly increased. The patients under 50 were found to have aortic calcification of the I degree, whereas aortic calcification of the III degree was mainly characteristic of the patients over 60 (55,2±6,3% and 52,8±4,6% respectively).

Table 1: Dependence of CC on patients' age

Age	No disease	1-vessel CAD	2-vessel CAD	3-vessel CAD	r; χ2; p
Under 50 лет (n=61)	2 3,3±2,3%	51 83,6±4,7%	7 11,5±4,1%	1 1,6±1,6%	r=0,334; χ2=63,7; p < 0,001
51-60 (n=57)	7 12,3±4,3%	34 59,6±6,5%	16 28,1±6,0%	–	
Over 60 (n=62)	4 6,5±3,1%	14 22,6±5,3%	28 45,2±6,3%	16 25,8±5,6%	

Similar results were also obtained in the studies of foreign specialists (11, 12.) The mentioned researchers conducted surveys to identify the risk factors and their long term correlation with cardio vascular diseases.The present survey shows that, with age the risk of coronary and aortic arch calcification increases.

The survey also determines a close correlation between the coronary calcification and aortic arch calcification. It was found that the increase of frequency of coronary calcification stood in proportion to the increase of aortic calcification (Table 2).

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Table 2: Correlation between the coronary calcification and calcification of the aorta

Aortic calcification	No disease	1-vessel disease	2-vessel disease	3-vessel disease	r; χ2; p
Absence (n=112)	7 6,3±2,3%	84 75,0±4,1%	21 18,8±3,7%	–	r=0,314; χ2=59,6; p < 0,001
Presence (n=68)	6 8,8±2,4%	15 22,1±5,0%	30 44,1±6,0%	17 25,0±5,3%	

Bannas et al. [13] in the studies with 128 patients also suggested a high level of correlation of coronary and aortic calcification. Researches came to the conclusion that identification of aortic calcification which is better visualized by digital radiography suggests the development of coronary calcification in the same patients within a short period of time.

It was also found that there is a close correlation between the localization areas of coronary and aortic calcifications. In particular, if coronary calcification is located in LDA, there is a higher likelihood for the calcification of the aorta. Thus, of 65 patients having both CC and AC it was calcification of exactly LDA that 34(52,3%) patients suffered from.

CONCLUSIONS

In conclusion, we would like to emphasize the following patterns identified in the present survey. Radiological method of research as a routine method of diagnosis is an early method of identification of initial signs of coronary and aortic calcification which, in turn allows to determine groups of patients with a high risk of CAD. It was established that the most common place of localization of coronary calcification is the left descending artery. The consistency between the prevalence of coronary and aortic calcifications is paid special attention to. Besides, there was established a direct correlation and dependence between patients' age and the spread of coronary calcification and calcification of the aorta.

REFERENCES

[1] Chang C.C., Chang M.L., Huang C.H. et al. Carotid intima-media thickness and plaque occurrence in predicting stable angiographic coronary artery disease // Clin. Interv. Aging. – 2013. – Vol. 8. – P. 1283 – 1288.

[2] Erdal M., Aparce M., Iglak Z. et al. Clinical features of aviators with coronary artery disease diagnosed by multislice CT angiography // Anadolu Kardiyol Derg. – 2014. – Vol. 14 (2). – P. 150 – 154.

[3] Judith A. Finegold, Perviz Asaria, and Darrel P. Francis Mortality from ischaemic heart disease by country, region, and age: Statistics from World Health Organization and United Nations // Int J Cardiol. 2013 Sep 30; 168(2): 934–945

[4] Melanie Nichols, Nick Townsend, Peter Scarborough et all. Cardiovascular disease in Europe 2014: epidemiological update European Heart Journal 2014

[5] Cassar A, Holmes DR Jr, Rihal CS, Gersh BJ.Chronic coronary artery disease: diagnosis and management. Mayo Clin Proc. 2009 Dec;84(12):1130-46.

[6] Mahesh V. Madhavan, BA*; Madhusudhan Tarigopula, MD, MPH†; Gary S. Mintz, MD†; Akiko Maehara, MD*; Gregg W. Stone, MD*; Philippe Généreux, MD* Coronary Artery Calcification Pathogenesis and Prognostic Implications Journal American College of cardilogy. volume 63, Issue 17, May 2014

[7] Hashimoto H, Iijim a K, Hashimoto M, et al. Validity and usefulness of aortic arch calcification in chest X-ray. J Atheroscler Thromb 2009; 16: 256–264.

[8] Iijima K, Hashimoto H, Hashimoto M et al. Aortic arch calcification detectable on chest X-ray is a strong independent predictor of cardiovascular events beyond traditional risk factors. Atherosclerosis, 2010; 210: 137–144

[9] Sultanova M.D., Azizov V.A., Sadigova T.A. Calcification diagnosis in patients with rheumatoid arthritis. Kazan Medical Journal, 2016,2, p.236-239

[10] Li J., Galvin H.K.et all. Aortic calcification on plain chest radiography increases risk for coronary artery diseases. Chest,2002,121(5), 1468-1471