

ORIGINAL RESEARCH

Concurrent validity of radiography and ultrasound examination for the diagnosis of aortic aneurisms in Albanian patients

Ilirian Laci¹, Alketa Spahiu²

¹ Radiology and Nuclear Medicine Service, University Hospital Center “Mother Teresa”, Tirana, Albania;

² Statistics Service, University Hospital Center “Mother Teresa”, Tirana, Albania.

Corresponding author: Dr. Ilirian Laci

Address: Rr. “Dibres”, No. 370, Tirana, Albania;

Telephone: +355672072668; E-mail: ilirianlaci@yahoo.com

Abstract

Aim: The aim of our study was to assess the concurrent validity of radiography and ultrasound examination among patients diagnosed with aortic aneurisms in Albania, a transitional country in South Eastern Europe.

Methods: This study included 75 consecutive patients diagnosed with aortic aneurisms (thoracic and/or abdominal) admitted at the University Hospital Centre “Mother Teresa” in Tirana during 2012-2014 (56 men and 19 women). For each patient, computerized tomography (CT) scan with contrast was used to confirm the diagnosis of aortic aneurisms. In addition to the CT scan (“gold standard” for the diagnosis of aneurisms), in 37 patients, radiography and ultrasound examination were simultaneously performed in order to assess the validity of these techniques. Furthermore, demographic data and other relevant clinical information were collected for each study participant.

Results: In 18 patients with thoracic aneurisms pertinent to ascendant aorta where radiography and ultrasound were simultaneously performed, ultrasound was able to diagnose 5 (27.8%) cases which were not detected through radiography ($P=0.038$). Conversely, in 16 patients with abdominal aneurisms where radiography and ultrasound were simultaneously performed, ultrasound was able to diagnose 4 (25.0%) cases which were not detected through radiography ($P=0.034$). The remaining three patients diagnosed with thoracic-abdominal aneurisms were not detected either by ultrasound examination or radiography.

Conclusions: In this sample of Albanian patients diagnosed with aortic aneurisms ($N=75$), overall, 9 (24.3%) subjects were detected through ultrasound examination but not radiography ($P<0.001$). Findings from this study provide valuable clues about the concurrent validity and predictive value of these two key examinations for the diagnosis of aortic aneurisms.

Keywords: Albania, aneurism, CT scan, predictive value, radiography, ultrasonography, ultrasound, validity.

Conflicts of interest: None.

Introduction

Aortic aneurysms are defined as enlargements (dilations) of the aorta which is caused by a chronic weakness (thinness) of the arterial wall. Under these conditions, there is a high risk for ruptures, as well as for other unfavourable cardiovascular events in subjects with aortic aneurisms (1-3).

In the United Kingdom, in patients with aortic aneurisms of a size about 40-55 mm, only 16% of deaths have been linked to surgical interventions or ruptures, whereas 50% of deaths have been linked to other cardiovascular events including myocardial infarction and stroke (4).

Aortic aneurisms affect about 8% of men aged 65 years and above, but the occurrence of this condition is increasing in women too (5,6). Data available from the Centre for Disease Control and Prevention (CDC) in USA indicate that aortic aneurisms constitute the fifteenth leading cause of death in American men and women aged 60-84 years old (7).

As aortic aneurisms remain one of the major causes of morbidity and mortality especially among older men, its prevalence is expected to increase gradually in parallel with population aging in most countries of the world. Aortic aneurisms are usually asymptomatic and are often detected upon radiological examinations performed for other reasons. Based on the radiological evidence, surgical or endovascular interventions are performed. Especially under emergency conditions, radiography and ultrasound examinations are very important in order to identify aortic aneurisms and aortic dissections (8). In principle, however, the diagnosis of aortic aneurisms is made through the following techniques: ultrasound, CT scan without contrast and/or with intravenous contrast (CTA), radiography, angiography (aortography) and magnetic resonance imaging (MRI) (8). The risk for rupture of aneurisms is related to the level of dilation. Several studies have convincingly argued that ultrasound may be a suitable method for the diagnosis of aortic aneurisms given the fact that it is a non-invasive technique, without radiation and relatively cheap (8). The sensitivity and specificity of ultrasound examination for detection of aortic aneurisms have been estimated at 87.4%-98.9% and 99.9%, respectively (9). Nevertheless, the accuracy of ultrasound examination may be far lower in obese individuals and in those with intestinal meteorism (9). As a matter of fact, it is possible to assess only the ascendant thoracic aorta through trans-thoracic ultrasound examination, whereas assessment of the descendent thoracic aorta is possible only through trans-oesophageal ultrasound (10).

In post-communist Albania, there has been an increase in cardiovascular diseases in the past two decades (11). In particular, the death rate from ischemic heart disease in Albania is the highest in South Eastern Europe (11), in line with the rapid changes in dietary patterns characterized by an increase in processed foods and an increase in the prevalence of smoking (12). In addition, Albania is the only country in South Eastern Europe which has experienced an increase in the mortality rate from ischemic heart disease and cerebrovascular diseases in the past two decades (11,12). However, specific information about the frequency and distribution of aortic aneurisms in the Albanian population is scant.

In this framework, the aim of this study was to assess the concurrent validity of radiography and ultrasound examination among patients diagnosed with aortic aneurisms in Albania, a transitional country in South Eastern Europe which, among other reforms, is also undergoing a deep reform in the health care sector.

Methods

This study included 75 consecutive patients diagnosed with aortic aneurisms (thoracic and/or abdominal) admitted at the University Hospital Centre "Mother Teresa" in Tirana (the only tertiary care facility in Albania) for the period from January 2012 to December 2014 (56 men and 19 women).

For each patient, computerized tomography (CT) scan with contrast was used to confirm the diagnosis of aortic aneurisms.

In addition to the CT scan (which is considered as the “gold standard” for the diagnosis of aneurisms), radiography was performed in 56 (74.7%) patients, whereas ultrasound examination was conducted in 45 (60.0%) patients (Table 1).

Table 1. Examinations performed in a sample of Albanian patients diagnosed with aortic aneurisms during 2012-2014 (N=75)

Radiography		Ultrasound		CT scan with contrast	
Number	Percent	Number	Percent	Number	Percent
56	74.7%	45	60.0%	75	100.0%

On the other hand, in 37 patients, radiography and ultrasound examination were simultaneously performed in order to assess the validity of these techniques. In principle, radiography and ultrasound examination were performed in patients admitted at the emergency unit who were residents in Tirana. Ultrasound in emergency conditions consisted of trans-thoracic or trans-abdominal examination, but not trans-oesophageal examination, because such a procedure involves a careful preparation and is not recommended under emergency conditions. On the other hand, patients from other districts of Albania for whom there was prior suspicion for aneurisms underwent directly CT scan examination.

Furthermore, other relevant clinical information and demographic data were collected for each study participant.

Mann-Whitney U-test was used to compare mean age and mean duration of hospitalization between male and female participants. On the other hand, Fisher’s exact test was used to compare the proportions of place of residence, smoking, hypertension and other chronic diseases between men and women. Conversely, Cramer’s V test (a measure of association between two nominal variables) was used to compare the concurrent validity of radiography and ultrasound examination. In all cases, a p-value of ≤ 0.05 was considered as statistically significant. Statistical Package for Social Sciences (SPSS, version 19.0) was used for the data analysis.

Results

This study involved 75 patients with a confirmed diagnosis of aortic aneurism according to CT scan with contrast (“gold standard”).

Demographic characteristics and clinical data of the patients included in this study are presented in Table 2.

Overall, 56 (74.7%) patients were men and 19 (25.3%) were women (male-to-female ratio about 3/1). Mean age in women was higher than in men, a difference which nevertheless was not statistically significant (62.5 ± 13.8 vs. 58.0 ± 15.7 years, respectively, $P=0.41$). On the whole, 31 patients were residents in Tirana compared with 44 patients who were residents in other districts of Albania. Mean duration of hospitalization was 7.4 ± 8.9 days, with no statistically significant sex-difference ($P=0.261$), notwithstanding a longer duration in men (10.3 ± 9.5) compared to women (6.4 ± 8.6). The overall prevalence of smoking was $32/75=43\%$; it was considerably higher in men than in women (52% vs. 16%, respectively, $P=0.007$). The overall prevalence of hypertension was $55/75=73\%$, with no significant difference between men and women ($P=0.249$). Overall, 60% (45 out 75) of the patients had other pre-existing chronic conditions, which were evenly distributed between men and women (Table 2).

Table 2. Demographic data and clinical characteristics of the patients diagnosed with aortic aneurisms

CHARACTERISTIC	WOMEN (N=19)	MEN (N=56)	TOTAL (N=75)
Age (years)	58.0±15.7*	62.5±13.8	59.1±15.3
Place of residence:			
Tirana	8 (25.8)†	23 (74.2)	31 (100.0)
Other districts	11 (25.0)	33 (75.0)	44 (100.0)
Total	19 (25.3)	56 (74.7)	75 (100.0)
Length of hospitalization (days)	6.4±8.6	10.3±9.5	7.4±8.9
Smoking:			
Yes	3 (9.4)	29 (90.6)	32 (100.0)
No	16 (37.2)	27 (62.8)	43 (100.0)
Hypertension:			
Yes	16 (29.1)	39 (70.9)	55 (100.0)
No	3 (15.0)	17 (85.0)	20 (100.0)
Other chronic diseases:			
Yes	11 (24.4)	34 (75.6)	45 (100.0)
No	8 (26.7)	22 (73.3)	30 (100.0)

* Mean ± standard deviation.

† Number and row percentages (in parenthesis)

Radiography was able to detect 20 patients with a confirmed diagnosis of aortic aneurism. Hence, 35.7% of suspected cases (20 out of 56 patients who underwent this procedure) were detected through radiography. It should be noted that radiography played a major role in thoracic aortic aneurisms, but less so for abdominal aortic aneurisms, except for old abdominal aneurisms with wall calcifications which enabled a prompt diagnosis upon radiography.

Conversely, trans-thoracic and trans-abdominal ultrasound examination was able to detect 36 patients with a confirmed diagnosis of aortic aneurism. Thus, 80.0% of suspected cases (36 out of 45 patients who underwent this procedure) were detected through ultrasound examination (data not shown in the tables).

It should be emphasized that complications such as ruptures, dissections, hematomas, or clots could not be detected either through radiography or by ultrasound examination.

Table 3 presents findings from radiography and ultrasound examination performed simultaneously in a sub-sample of 37 patients. In this sub-sample of patients diagnosed with aortic aneurisms (N=37), overall, 9 subjects (or, 24.3% of them) were detected through ultrasound examination but not radiography (Cramer's V=0.609, P<0.001).

Table 3. Findings from radiography and ultrasound examination performed simultaneously in a sub-sample of 37 patients

RADIOGRAPHY	ULTRASOUND		TOTAL
	Yes	No	
Yes	14 (100.0%)	0 (0%)	14 (100.0%)
No	9 (39.1%)	14 (60.9%)	23 (100.0%)
Total	23 (62.2%)	14 (37.8%)	37 (100.0%)

Overall, 23 (or, 62.2%) of the cases in this sub-sample (N=37) were detected by one of the two examination methods (radiography or ultrasound). Conversely, 14 (37.8%) of the cases in this-sample were not detected either by radiography or ultrasound examination (Table 2).

In 18 patients with thoracic aneurisms pertinent to ascendant aorta where radiography and ultrasound were simultaneously performed, ultrasound was able to diagnose 5 (27.8%) cases which were not detected through radiography (P=0.038) (not shown in the tables). Conversely, in 16 patients with abdominal aneurisms where radiography and ultrasound were simultaneously performed, ultrasound was able to diagnose 4 (25.0%) cases which were not detected through radiography (P=0.034). The remaining three patients diagnosed with thoracic-abdominal aneurisms were not detected either by ultrasound examination or radiography.

Discussion

This may be the first report from Albania informing about clinical characteristics of a consecutive sample of patients diagnosed with aortic aneurisms according to CT scan with contrast examination which is regarded as the gold standard for the confirmation of the diagnosis of this condition. Main findings of this study include a higher sensitivity of ultrasound examination compared to radiography. Hence, of the 37 patients who underwent both of these procedures, 9 (24.3%) subjects were detected through ultrasound examination but not radiography (P<0.001).

Radiography in emergency conditions is feasible and is considered as a straightforward procedure (8). In our study, radiography was able to detect about 36% (20/56) of the cases with aortic aneurisms. In particular, radiography played a major role for detection of thoracic aortic aneurisms, whereas in cases of abdominal aortic aneurisms it was less effective (valid). Similarly, trans-thoracic and trans-abdominal ultrasound examination is also feasible in emergency conditions (8,9). In our study, ultrasound examination was able to detect 80% (36/45) of the cases with aortic aneurisms. The remaining 9 (or, 20%) of the cases were not detected through ultrasound probably due to the inability of the examiners (lack of proper training) involved in this procedure.

Notwithstanding the higher detection rate of ultrasound examination compared to radiography, it was not possible in our study to assess the complications of aneurisms such as dissections, ruptures, fistulisation with other organs, involvement of blood vessels stemming from the respective aneurisms, or calcifications. On the other hand, in our study, hematomas were partly assessed through ultrasound examination.

Our findings related to radiography are generally in line with previous reports from the international literature (13). Hence, according to a previous study, aortic aneurisms were confirmed in about 50% of the cases (13). In any case, it is argued that chest radiography has a limited value for the diagnosis of aortic aneurisms (8,13). Radiography plays an important role only in cases of aortic aneurisms with wall calcifications. In all suspected cases of aortic aneurisms though, CT scan with intravenous contrast should be promptly conducted (8,13).

This study may have several limitations. Our study included all consecutive patients diagnosed with aortic aneurisms over a three-year period at the University Hospital Centre "Mother Teresa", which is the only tertiary care facility in Albania. Based on this recruitment approach, our study population involved an all-inclusive sample for the three-year period under investigation. Furthermore, the diagnosis of aortic aneurisms was based on the state-of-the-art clinical protocols and up-to-date examination techniques employed in similar studies conducted in other countries. In any case, the self-reported information which was collected through semi-structured interviews may have been prone to different types of information

bias. This may have been the case of self-reported smoking, hypertension and other pre-existing conditions.

In conclusion, this study provides useful evidence about the detection rate of radiography and ultrasound examination among patients diagnosed with aortic aneurisms in Albania, a transitional country in South Eastern Europe. Findings from this study provide valuable clues about the concurrent validity and predictive value of these two key examinations for the diagnosis of aortic aneurisms.

References

1. Lederle FA, Johnson GR, Wilson SE, Chute EP, Littooy FN, Bandyk D, et al. Prevalence and associations of abdominal aortic aneurysm detected through screening. Aneurysm Detection and Management (ADAM) Veterans Affairs Cooperative Study Group. *Ann Int Med* 1997;126:441-9.
2. Sakalihan N, Limet R, Defawe OD. Abdominal aortic aneurysm. *Lancet* 2005;365:1577-89.
3. Thompson MM. Controlling the expansion of abdominal aortic aneurysms. *Br J Surg* 2003;98:897-8.
4. The UK Small Aneurysm Trial Participants. Long-term outcomes of immediate repair compared with surveillance of small abdominal aortic aneurysms. *N Engl J Med* 2002;346:1445-52.
5. Chichester Aneurysm Screening Group, Viborg Aneurysm Screening Study, Western Australian Abdominal Aortic Aneurysm Program, Mulicentre Aneurysm Screening Study. A comparative study of the prevalence of abdominal aortic aneurysms in the United Kingdom, Denmark, and Australia. *J Med Screen* 2001;8:46-50.
6. Norman PE, Powell JT. Abdominal aortic aneurysm: the prognosis in women is worse than in men. *Circulation* 2007;115:2865-9.
7. U.S. Department of Health and Human Services Centers for Disease Control and Prevention National Center for Health Statistics. MD LCWK1. Deaths, percent of total deaths, and death rates for the 15 leading causes of death in 5-year age groups, by race and sex: United States, 2006; 2009 [10/11/09]. pp. 7-9.
8. Sprouse LRn, Meier GHr, Parent FN, DeMasi RJ, Glickman MH, Barber GA. Is ultrasound more accurate than axial computed tomography for determination of maximal abdominal aortic aneurysm diameter? *Eur J Vasc Endovasc Surg* 2004;28:28-35.
9. Lindholt JS, Vammen S, Juul S, Henneberg EW, Fasting H. The validity of ultrasonographic scanning as screening method for abdominal aortic aneurysm. *Eur J Vasc Endovasc Surg* 1999;17:472-5.
10. Jaakkola P, Hippelainen M, Farin P, Ryttonen H, Kainulainen S, Partanen K. Interobserver variability in measuring the dimensions of the abdominal aorta: comparison of ultrasound and computed tomography. *Eur J Vasc Endovasc Surg* 1996;12:230-7.
11. Institute for Health Metrics and Evaluation (IHME). Global Burden of Disease Database. Seattle, WA: IHME, University of Washington, 2014. <http://www.healthdata.org> (Accessed: March 3, 2016).
12. Albanian Institute of Public Health. National health report: Health status of the Albanian population. Tirana, Albania, 2014. <http://www.ishp.gov.al/wp-content/uploads/2015/01/Health-report-English-version.pdf> (Accessed: March 3, 2016).

Laci I, Spahiu A. Concurrent validity of radiography and ultrasound examination for the diagnosis of aortic aneurisms in Albanian patients (Original research). *SEEJPH* 2016, posted: 25 March 2016. DOI 10.4119/UNIBI/SEEJPH-2016-98

13. von Kodolitsch Y, Nienaber CA, Dieckmann C, Schwartz AG, Hofmann T, Brekenfeld C, Nicolas V, Berger J, Meinertz T. Chest radiography for the diagnosis of acute aortic syndrome. *Am J Med* 2004;116:73-7.

© 2016 Laci et al; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.