Should We Screen Coronary Artery Bypass Grafting Patients for Abdominal Aortic Aneurysm?

Koroner Baypas Cerrahisine Giden Hastaları Abdominal Aort Anevrizması İçin Taramalı mıyız?

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ABSTRACT Objective: Ruptured abdominal aortic aneurysm (AAA) is associated with 95% mortality rate. It is possible to decrease this rate by screening this disease. In this study, our aim is to evaluate effectiveness of screening AAA in atherosclerotic patients who were hospitalized for coronary artery bypass grafting (CABG) surgery. **Material and Methods:** Fifty male patients older than 60 years of age and who were planned to have CABG or were admitted for routine follow up after CABG were included in the study between January 2010 and January 2011. **Results:** The mean age was 68.2±5.7 (60-86) years. Four patients (8%) had increased diameters, 2 (4%) had aneurysms and 2 (4%) had dilatation. The patients with increased abdominal aortic diameter were older than 65 years of age and had hypertension. The aortic pathology was below the renal arteries in those patients. **Conclusion:** According to the results of first 50 patients of this ongoing study; screening for AAA is feasible in patients who undergo CABG, especially in men older than 65 years of age. High mortality rates of rupture AAA can indicate absence of screening programs. Our study reports early results for these patients.

Key Words: Abdominal aortic aneurysm; coronary artery bypass grafting; elderly

ÖZET Amaç: Rüptüre abdominal aort anevrizmasının (AAA) %95 mortalitesi vardır. Bu oranı tarama ile azaltmak mümkündür. Bu çalışmada amacımız koroner arter baypas greftleme cerrahisi (KABG) için hospitalize edilmiş aterosklerotik hastalarda AAA için taramanın etkinliğini değerlendirmektir. **Gereç ve Yöntemler:** Ocak 2010-Ocak 2011 tarihleri arasında kliniğimizde KABG cerrahisine gidecek ya da KABG sonrası rutin kontrollerinde görülen 60 yaş üstü 50 erkek hasta çalışmaya dahil edilmiştir. **Bulgular:** Ortalama yaş 68,2±5,7 (60-86) yıl idi. Dört hastada (%8) çapta genişleme mevcuttu, bunların 2'sinde (%4) anevrizma, 2'sinde (%4) ise dilatasyon vardı. Abdominal aort çapında genişleme olan hastalar 65 yaşından daha yaşlı ve hipertansiftiler. Aortik patoloji bu hastalarda renal arter seviyesinin altında bulunuyordu. **Sonuç:** Devam eden çalışmamızda ilk 50 hastalık sonuçlarımıza göre; AAA için tarama özellikle 65 yaş üstü KABG hastalarında uygulanabilirdir. Rüptüre AAA yüksek mortalite oranlarına sahip olması, tarama programlarının olmamasının bir işareti olabilir. Bizim çalışmamız bu hastaların erken sonuçlarını içermektedir.

Anahtar Kelimeler: Abdominal aort anevrizması; koroner arter baypas greftleme; yaşlı

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The diameter of abdominal aortic aneurysm (AAA) is the best predictor for rupture risk. There is a substantial increase in rupture risk as AAA diameter increases from 5 cm to 6 cm.[1,2] The diameter is not the only predictor for rupture, but also gender, hypertension, smoking and chronic obstructive pulmonary disease have been observed as predictors for rupture of the aneurysm.[1] Furthermore, the aortic diameter increases with age, and is larger in men compared to the women. Besides being rupture

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predictors, family history of AAA and coronary artery disease are also risk factors for development of AAA.[3] Female gender, African ethnic origin, and diabetes mellitus all have a protective effect, probably via a genetic mechanism.[3]

According to best available current evidence, 5.5 cm diameter appears to be an appropriate threshold for AAA repair. However, subsets of younger low-risk patients, with long projected life-expectancy, may prefer early repair.[1] Several international guidelines recommend screening of AAA by ultrasound in the high-risk population.[4] Ultrasonography (US) of the abdominal aorta is a safe and a technically simple method to identify AAAs. Ultrasonography is a valid diagnostic technique with a sensitivity and specificity of 98%.[5] High mortality rates from rupture AAA can indicate absence of screening programs.[3]

In this study, our aim is to evaluate effectiveness of screening AAA in atherosclerotic patients who were hospitalized for CABG, and to diagnose and treat aneurysm in an earlier period.

MATERIAL AND METHODS

PATIENTS

Fifty male patients older than 60 years aft age who had undergone coronary artery bypass grafting (CABG) surgery or were admitted for routine controls after CABG were randomized between January 2010 and Januray 2011. All patients were prospectively evaluated in this study. Abdominal aortic Doppler US was performed to all patients before CABG. Doppler US was performed with Logiq 7 (GE Healthcare Tokyo, Japan) 4 Mhz convex probe by the same radiologist. Abdominal aorta was measured in three levels; diaphragmatic, superior mesenteric artery (SMA), iliac bifurcation levels using coronary and sagittal planes.The evaluation was performed from the adventitia to adventitia of the aortic tissues.

MODEL AND FOLLOW UP

Patients were grouped according to abdominal aortic diameters. Patients who had less than 3 cm diameter of abdominal aorta were not followed up, 3-4.5 cm diameters followed up every year and 4.6-5.4 cm diameters followed up every 6 months. Patients who had larger than 5.5 cm abdominal aortic measurement underwent to surgical repair or endovascular grafting after CABG.

STATISTICAL ANALYSIS

Statistical analyses were performed with SPSS 17.0 software (SPSS Chicago, Illinois). Continuous variables were expressed as median (25-75%); categorical variables were defined as percentages. Mann Whitney U test was used to determine differences between continuous variables. The categorical variables were compared with Chi-Square test. All p values less than 0.05 were considered as statistically significant.

RESULTS

Fifty patients were evaluated and demographic data of these patients is given in Table 1. All patients were males and their median age was 67 (60-86) years. Four patients (%8) had increased diameters, 2 (%4 had aneurysms and 2 (%4) had dilatation. Twelve (24%) patients had the family history for atherosclerotic disease.

Due to the abnormal abdominal aortic diameters, we divided patients into subgroups; all of them were older than 65 years aft age and had arterial hypertension (HT). Abnormal aortic segment was in the infra-renal segment of the descending aorta in all patients. Demographic data of these 4 patients are summarized in Table 2.

There were no significant differences between the mean ages, ejection fraction (EF) of the subgroup (group 1) and the cohort (group 2). In addition, there were no significant differences in risk parameters between two groups such as diabetes mellitus (DM), HT, chronic renal failure and smoking. Only family history for atherosclerotic disease was significantly different between the two groups (p=0.038) (Table 3).

Three patients (75%) of the subgroup were smoking while 58.7% of the cohort were smoking (p=0.641). Only 1 patient (25%) had DM while 28.3% of the patients had DM in the cohort

TABLE 1: Demographic data of patients in abdominal aortic aneurysm screening program.

Variables	Median (%25-75)
Age	67
LDL (mg/dL)	104.5
Abdominal aortic diameters (mm)	
Diaphragmatic	21
SMA	18
Iliac bifurcation	15
	n (%)
DM	14 (28%)
HT	28 (56%)
CRF	2 (4%)
EF (%)	52.5±9.8
Smoking	30 (60%)
Family history for atherosclerotic disease	12 (24%)
Aortic dilatation	2 (4%)
Aortic aneurysm	2 (4%)

DM: Diabetes mellitus; HT: Hypertension; CRF: Chronic renal failure; LDL: Low density lipoprotein; EF: Ejection fraction; SMA: Superior mesenteric artery.

(p=1.000). All patients had HT in the subgroup however 52.2% had HT in the cohort (p=0.121). The mean age was 73.3±9.5 in Group 1 and 67.7±5.2 in Group 2 (p=0.213).

DISCUSSION

Abdominal aortic aneurysm (AAA) can be defined as the increase of diameter at least 50% greater than normal caused by the arterial wall pathologies.[6] More than 80% of all AAAs are clinically asymptomatic and are discovered incidentally or during an ultrasound examination. The incidence of AAA is 4-8% in men and 1.5% in women over 60 years of age.[7] Furthermore, AAA incidence is predicted to rise in parallel to an increase in globally aging population.[8] Vessel dilatation is often progressive and lack of effective non surgical therapy. Therefore, AAA expansion should be monitorized frequently.[9] The overall mortality rate of AAA rupture can be as high as 80-90%.[10] In the developing countries, 1-3% of the deaths of males between 65 and 80 years of age are due to ruptured AAAs.[11] Recently, mortality rates of elective open AAA surgery have decreased to less than 5% and surgical repair seems to be a complete curative therapy.[1]

In the absence of routine screening, diagnosis is often incidental during USG or other diagnostic examinations performed for other health complaints.[12,13] AAA is usually progressive, and is often accompanied by the formation of a laminated, non-occlusive, intraluminal thrombus. At the cellular level, histological examination demonstrates that pathophysiological processes in AAA involve all layers of the aortic wall including the aortic media, contrasting to those observed for occlusive atherosclerosis.[14] To describe the natural history of AAA; there are many published evidence or literature. AAA of 4.0-5.5 cm in diameter have a rupture rate of 0.7-1.0% per year and for AAA <4.0 cm, this rate is even lower. Women appear to have a higher rupture rate than men for small AAA. Median enlargement rate of AAA with 4.0-5.5 cm diameter is about 0.3 cm per year. Enlargement rate is related to AAA diameter. Enlargement rate of AAA has risen up to 3.0-4.0 cm. Rupture rates of AAA > 5.5 cm in fit individuals are unknown and unlikely to be known in the future. However, for unfit individuals with AAA >5.5 cm, the rupture rate is high, starting at about 10% per year and increasing by several fold in the largest AAA.[15]

TABLE 2: Demographic data of patients who were captured in abdominal aortic aneurysm screening program.

	Age (yrs)	DM	HT	CRF	Smoking	Diaphragmatic	SMA	İliac bifurcation
Patient 1	67	+	+	-	+	25	16	33
Patient 2	86	-	+	-	+	22	47	50
Patient 3	75	-	+	-	-	25	30	66
Patient 4	65	-	+	+	+	25	23	63

DM: Diabetes mellitus; HT: Hypertension; CRF: Chronic renal failure; SMA: Superior mesenteric artery.

TABLE 3: The comparison of patients who had increased aortic diameter and who did not.

Variables	Group-1 (n: 4)	Group-2 (n: 46)	p value
Age	73.3±9.5	67.7±5.2	0.213
EF	52±5.4	51.5±10.1	0.717
DM	1 (25%)	13 (28.3%)	1.000
HT	4 (100%)	24 (52.2%)	0.121
CRF	1 (25%)	1 (2.2%)	0.155
Smoking	3 (75%)	27 (58.7%)	0.641
Family history for atherosclerotic disease	3 (75%)	9 (19.6%)	**0.038**

EF: Ejection fraction; DM: Diabetes mellitus; HT: Hypertension; CRF: Chronic renal failure.

As mentioned before, most of the AAA are asymptomatic. "The UK Small Aneurysm Trial" in the UK and the similar ADAM study in the USA are randomized approximately 1000 cases with 4.0-5.5 cm AAAs to operation or watchful waiting. After five years, no differences were noticed with respect to AAA-specific mortality.[16,17] Eventually, 5.5 cm diameter and rapid progression were accepted as surgical indications for asymptomatic patients by most surgeons. Symptomatic AAAs without rupture were usually operated on as soon as possible because of the very high risk of early rupture. In elective operations, mortality rate is about 1-5% but in emergency operations mortality rate can rise to 40-60%.[18]

US screening of abdominal aorta is a technically easy and valuable diagnostic tool which is associated with a reduction of AAA-related mortality.[19] When we consider the high prevalence of AAA among the elderly men, AAA should be systematically screened. A national screening program should be established in our country in order to reduce mortality related to the AAA.[3] The longitudinal and transverse extent of the aorta and the aneurysm, the transverse extent of the remaining perfused lumen, and the thickness and distribution of the edge of the thrombus including the branching off of the celiac trunk, the superior mesenteric artery, and the renal arteries can all be individually documented. In addition, the common iliac and the external iliac arteries can also be visualized.[19]

An economic evaluation of an abdominal aortic aneurysm screening program in Italy showed that screening program can significantly reduce mortality rates associated with AAA, avoid AAA ruptures thanks to early diagnosis, and increase the life expectancy of those who had undergone screening.[1] Results from a similar analysis in Canada reported that a screening program produced a gain in life expectancy of 0.049 years.[7] Chichester trial[20] and the Multicentre Aneurysm Screening Study (MASS)[21] trial in the United Kingdom, the Viborg County study in Denmark and the Western Australia study[22] identified potential participants who were 65 years old or older via population registries or regional health directories; collectively, the studies included more than 125,000 participants. These trials showed that screening reduced the incidence of ruptured AAAs and AAA-related mortality.

In this study, as a result of screening men older than 60 years of age who had undergone CABG; we found that the percentage of patients who had aortic pathology was quite close to the upper limit reported in the literature. We attribute this to atherosclerotic disease and higher risk factors. In our continuing study, screening for AAA is feasible in patients who will undergo CABG, especially men older than 65 years of age.

Conflict of Interest

Authors declared no conflict of interest or financial support.

REFERENCES

1. Brewster DC, Cronenwett JL, Hallett JW Jr, Johnston KW, Krupski WC, Matsumura JS; Joint Council of the American Association for Vascular Surgery and Society for Vascular Surgery. Report of a subcommittee of the Joint Council of the American Association for Vascular Surgery and Society for Vascular Surgery. J Vasc Surg 2003;37(5):1106-17.
2. Guirguis EM, Barber GG. The natural history of abdominal aortic aneurysms. Am J Surg 1991;162(5):481-3.
3. Eckstein HH, Böckler D, Flessenkämper I, Schmitz-Rixen T, Debus S, Lang W. Ultrasonographic screening for the detection of abdominal aortic aneurysms. Dtsch Arztebl Int 2009;106(41):657-63.
4. Aboyans V, Kownator S, Lafitte M, Brochet E, Emmerich J, Tribouilloy C, et al; Working Group for Vascular Diseases/Thrombosis, French Society of Cardiology; Council of Echocardiography, French Society of Cardiology. Screening abdominal aorta aneurysm during echocardiography: literature review and proposal for a French nationwide study. Arch Cardiovasc Disease 2010;103(10):552-8.
5. 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(6):472-5.
6. Giardina S, Pane B, Spinella G, Cafueri G, Corbo M, Brasseur P, et al. An economic evaluation of an abdominal aortic aneurysm screening program in Italy. J Vasc Surg 2011;54(4):938-46.
7. Montreuil B, Brophy J. Screening for abdominal aortic aneurysms in men: a Canadian perspective using Monte Carlo-based estimates. Can J Surg 2008;51(1):23-34.
8. Sakalihasan N, Limet R, Defawe OD. Abdominal aortic aneurysm. Lancet 2005;365 (9470):1577-89.
9. Golledge J, Norman PE. Pathophysiology of abdominal aortic aneurysm relevant to improvements in patients' management. Curr Opin Cardiol 2009;24(6):532-8.
10. Longo C, Upchurch G. Abdominal aortic aneurysm screening: recommendations and controversies. Vasc Endovasc Surg 2005;39(3): 213-9.
11. Lindholt JS. Abdominal aortic aneurysms. Dan Med Bull 2010;57(12):B4219.
12. Golledge J, Tsao PS, Dalman RL, Norman P. Circulating markers of abdominal aortic aneurysm presence and progression. Circulation 2008;118(23):2382-92.
13. Fink HA, Lederle FA, Roth CS, Bowles CA, Nelson DB, Hass MA. The accuracy of physical examination to detect abdominal aortic aneurysm. Arch Intern Med 2000;160(6):833-6.
14. Michel JB. Contrasting outcomes of atheroma evolution: intimal accumulation versus medial destruction. Arterioscler Thromb Vasc Biol 2001;21(9):1389-92.
15. Lederle FA. The natural history of abdominal aortic aneurysm. Acta Chir Belg 2009;109(1): 7-12.
16. Lederle FA, Wilson SE, Johnson GR, Reinke DB, Littooy FN, Acher CW, et al; Aneurysm Detection and Management Veterans Affairs Cooperative Study Group. Immediate repair compared with surveillance of small abdominal aortic aneurysms. N Engl J Med 2002; 346(19):1437-44.
17. Mortality results for randomised controlled trial of early elective surgery or ultrasonographic surveillance for small abdominal aortic aneurysms. The UK Small Aneurysm Trial Participants. Lancet 1998;352(9141):1649-55.
18. Fedakar A, Mataracı I, Şaşmazel A, Büyükbayrak F, Aksüt M, Eren E, et al. Elective and emergency surgical repair in abdominal aortic aneurysms Turk J Thorac Cardiovasc Surg 2010;18(2):100-5.
19. 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(6):472-5.
20. Scott RA, Wilson NM, Ashton HA, Kay DN. Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomized controlled study. Br J Surg 1995;82(8):1066-70.
21. Ashton HA, Buxton MJ, Day NE, Kim LG, Marteau TM, Scott RA, et al; Multicentre Aneurysm Screening Study Group. The Multicentre Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial. Lancet 2002;360(9345):1531-9.
22. Norman PE, Jamrozik K, Lawrence-Brown MM, Le MT, Spencer CA, Tuohy RJ, et al. Population based randomised controlled trial on impact of screening on mortality from abdominal aortic aneurysm. BMJ 2004;329(7477): 1259.