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Prevalence of abdominal aortic aneurysm in a hypertensive population

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Two studies were undertaken to estimate the prevalence of abdominal aortic aneurysm in a hypertensive population. The initial study screened hypertensive people from three local general practices. In this study 918 patients underwent ultrasound scanning of the abdominal aorta (498 men and 420 women). A total of 24 abdominal aortic aneurysms were identified; 20 in men (4%) and four in women (0.9%). Of these, 11 were > 4 cm in transverse diameter. Following this study, only hypertensive men over the age of 60 years and women over the age of 65 years were screened from a total of 29 general practices. Regular scanning sessions were held at each practice and 1328 patients attended (744 men and 584 women). A total of 43 abdominal aortic aneurysms were detected; 39 in men (5.2%) and four in women (0.7%).

Hypertensive men are at increased risk of developing abdominal aortic aneurysms and should be offered an initial ultrasound scan at 60 years of age. Female hypertensives yield a much lower detection rate and screening hypertensive females would probably be an inappropriate use of available resources.

The spontaneous rupture of an abdominal aortic aneurysm is associated with an overall mortality of at least 80% *(1–3)*. This accounts for 1.7% of all deaths in the 65–80 years age group and represents the third most common cause of death. Elective repair is associated with a mortality of under 5% at 6 months *(4,5)*. After surgery, patients can expect a long-term survival rate only slightly less than that of the normal population of the same age *(1,6)*.

The initial growth rate of abdominal aortic aneurysms is relatively slow, probably taking several years to reach a substantial size *(7,8)*. However, they are frequently asymptomatic until shortly before rupture *(9)*. The sensitivity of clinical examination, although excellent for large aneurysms, becomes increasingly poor for abdominal aortas of a lesser diameter and particularly in obese patients. Several authors have called for the institution of a national screening programme for the detection of abdominal aortic aneurysms at an earlier stage *(10–14)*.

The cost, efficiency and feasibility of such a programme would depend greatly on which at risk groups were selected for screening. Collin *et al.* showed no increase in abdominal aortic aneurysms in hypertensives, whereas Twomey *et al.* demonstrated a 9% prevalence in a hospital population of hypertensives compared with only 5% for a general practice population *(15,16)*. Allen *et al.* *(17)* found a 5.3% prevalence in hypertensives with only 2.8% in the non-select group. The evidence for screening hypertensives for abdominal aortic aneurysms remains largely unsettled and the aim of this study is to scrutinise a large population of hypertensives from the general practices in the local area, including a younger age group of people who potentially have the most to benefit from a screening programme.

Patients and methods

This study consisted of two parts. Initially, a pilot study was instituted whereby three general practitioner practices in the Mid Glamorgan area of South Wales

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were invited to allow access to their patients and to identify all hypertensive patients (whether treated or not). The lists provided by the individual practices used their own definitions of hypertension. Once provided, all patients were invited to attend for screening at East Glamorgan General Hospital in the radiology department by a letter signed by the general practitioner and one of the authors (MHL). All screening sessions were conducted on a weekday morning.

On attending at their allotted time, patients were interviewed and asked specifically about their age, smoking history and the number of years they had been diagnosed as hypertensive. Any history of cardiac disease, cerebrovascular disease, respiratory disease, diabetes mellitus or previous vascular surgery was noted.

Ultrasonography was performed using a 3.5 MHz curved array transducer (Aloka SSD-500, Japan) by a consultant radiologist (RW). The abdominal aorta was considered aneurysmal if its maximal diameter in either the transverse or anteroposterior plane was 3.0 cm or greater. All patients in whom an aneurysm was detected were reviewed in outpatients. Depending on the size of the aneurysm recorded, arrangements were made either for surgery or for further follow-up ultrasonography at 3–6 monthly intervals.

Following this initial pilot study which was commenced in 1991, a formal screening programme for abdominal aortic aneurysms in hypertensives was introduced into the Taff Ely Health Authority from January 1994. It was considered a greater attendance rate would be possible if screening was held at individual practices in the area rather than at weekly sessions at the radiology department. For this purpose a post was created whereby a person (ET) was trained in the technique of ultrasound scanning of the abdominal aorta over an 8 week period. Training consisted of 4 days at the radiology department of East Glamorgan Hospital until reproducibility of scanning abdominal aortas was consistent with a consultant radiologist (RW).

After scrutinising the results of the pilot study, changes were made to the protocol for the formal screening programme. Only male hypertensives over the age of 60 years and women over the age of 65 years were invited for screening. All 29 general practices in the area were contacted and formal ultrasonography sessions were held in each practice. The clinics were based on the premise 15 patients could be screened in a single 3-hour session.

Results

Pilot study

In the pilot study, 1708 patients (919 men and 789 women) were invited to attend for screening and a total of 918 patients attended (498 men and 420 women). The overall attendance rate was 54% in men and 53% in women. The attendance rate varied considerably with age, with the peak attendance occurring in men aged 65 to 70 years (74%). There was a rapid fall in attendance rate for patients over the age of 75 years (<40%).

Aneurysms detected

A total of 24 abdominal aortic aneurysms were detected (Table I and Table II). Two of these patients were found to have concomitant iliac artery aneurysms. Of these aneurysms, 20 were in men (4%) and four were in women (0.9%). Of the 24 abdominal aortic aneurysms detected, 11 were >4 cm in transverse diameter. These aneurysms were in 10 men and one woman, representing a prevalence of 2%, and 0.2% respectively. Four men and the single female had an aneurysm >6.0 cm in diameter.

The prevalence of detected aneurysms varied considerably with age. This was found to be at its greatest in men aged 71 to 75 years (10.2%).

Concomitant diseases

Patients with aneurysms were at greater risk of ischaemic heart disease (51% *vs* 31%, $P<0.01$). They were also more likely to have a current or past history of smoking (74% *vs* 31%, $P<0.05$). The presence of cerebrovascular disease and respiratory disease were both more common in patients with screen-detected aneurysms; this failed to achieve significance.

Follow-up

Of the 24 patients with an aneurysm, five were operated on within 28 days of screening (four men and one

Table I. Abdominal aortic aneurysms detected in hypertensive males by age and size

		All aneurysms		*>4.0 cm*		*>6.0 cm*	
Age in years	*Total screened*	*Number*	*Prevalance (%)*	*Number*	*Prevalence (%)*	*Number*	*Prevalence (%)*
<56	109	—	—	—	—	—	—
56–60	84	3	3.6	—	—	—	—
61–65	95	7	7.4	4	4.2	2	2.1
66–70	111	3	2.7	2	1.8	1	0.9
71–75	59	6	10.2	4	6.8	1	1.7
76–80	32	1	3.1	—	—	—	—
>80	8	—	—	—	—	—	—
Total	498	20	4.0	10	2.0	4	0.8

Table II. Abdominal aortic aneurysms detected in hypertensive females by age and size

		All aneurysms		*> 4.0 cm*		*> 6.0 cm*	
Age in years	*Total screened*	*Number*	*Prevalence (%)*	*Number*	*Prevalence (%)*	*Number*	*Prevalence (%)*
< 56	72	—	—	—	—	—	—
56–60	67	—	—	—	—	—	—
61–65	75	1	1.3	—	—	—	—
66–70	96	—	—	—	—	—	—
71–75	51	3	5.9	1	2.0	1	2.0
76–80	43	—	—	—	—	—	—
> 80	16	—	—	—	—	—	—
Total	420	4	0.9	1	0.2	1	0.2

woman). In the age range 61–65 years, four males had an abdominal aortic aneurysm > 4 cm, two of which were > 6 cm in diameter. The four patients with abdominal aortic aneurysms > 4 cm in this age group were 61, 62, 64 and 64 years old, respectively. Three of these underwent aortic surgery with their maximum diameters measuring 5.9, 6.4 and 7.0 cm. One patient died from a myocardial infarction 3 days after operation.

Four men have undergone operative repair after repeated ultrasonographic screening due either to a transverse aneurysm diameter of > 6.0 cm (one man) or an increase in size by > 1.0 cm over a 6 month period (three men). Two other patients with screen-detected abdominal aortic aneurysms have died. One died of a myocardial infarction and the other from gastric carcinoma. The remaining 13 patients have been followed up with repeat ultrasound scans every 6 months.

Formal screening programme

Of 1849 patients invited to attend, 1328 attended. This represented an attendance rate of 79% in men (744) and 65% in women (584).

Aneurysms detected

A total of 43 aneurysms were detected in this group of patients (Table III). There were 39 recorded in males (5.2%) and the remaining four in females (0.7%). Thirty were of a transverse diameter 3.0–3.9 cm while 13 were > 4 cm. The majority occurred in males (12:1) and seven of the abdominal aortic aneurysms were > 5 cm. Two patients were under the age of 65 years with aneurysms of maximum diameters 4.2 and 5.4 cm, respectively. As noted previously, the size of the aneurysms varied considerably with age, with the majority being in patients aged 70 years or over.

Table III. Abdominal aortic aneurysms detected in hypertensives by size

Size (cm)	*Total detected*	*Overall prevalence (%)*
3.0–3.9	30	2.2
> 4.0	13	1.0

Follow-up

Of the 43 patients discovered to have an aneurysm, three patients have undergone uneventful repair of abdominal aortic aneurysms. The transverse diameter of these being 8.0, 8.0 and 5.5 cm (two male and one female). Those with an abdominal aortic aneurysm of 3.0–3.9 cm have undergone repeat ultrasound scans at 6-monthly intervals, while those with an abdominal aortic aneurysm of 4.0 cm or greater underwent scans at 3-monthly intervals.

Discussion

Many have suggested that hypertension is a risk factor for the development of abdominal aortic aneurysms *(18–20)*. These studies have invariably been based either on autopsy evidence or the relatively old *(18,21)*. The purpose of these studies was to assess prospectively the prevalence of abdominal aortic aneurysm in a local random population of hypertensive men and women.

Although other studies confined themselves to patients over the age of 65 years for initial screening, the pilot study imposed no minimum age limit for ultrasonography. Of concern is the number of abdominal aortic aneurysms found in men aged under 65 years. Although no aneurysms over 4.0 cm in diameter were identified in 193 men under 60 years of age, four of 95 men (4.2%) aged between 61 and 65 years had aneurysms > 4.0 cm in diameter. Three of these subsequently underwent operative surgery. This suggests that screening hypertensive men can safely start at a minimum of 60 years of age and before this would not be beneficial.

Autopsy studies have suggested rupture of abdominal aortic aneurysms may occur at a younger age in hypertensives *(18)*. Screening hypertensive men from the age of 60 years may therefore detect this group before their aneurysms reach potentially critical diameters.

In the pilot study, 3.5% of hypertensive men between 66 and 75 years were found to have an abdominal aortic aneurysm of > 4.0 cm diameter. It is of concern that 1 in 30 hypertensive males in this age group may need elective aneurysm surgery. The formal study showed a slightly higher overall prevalence of abdominal aortic aneurysm in

men than in the pilot study. A prevalence of 0.6% was found in females compared with 0.9% in the pilot study.

Conversely, in the pilot study, 420 women were screened with only one potentially operable abdominal aortic aneurysm, when the detection rate for hypertensive men was ten times greater for aneurysms of this size or larger. In the formal study this trend was again seen with only one abdominal aortic aneurysm > 4.0 cm in diameter out of 584 women. The subgroup of hypertensive males aged 61–65 years in the pilot and formal studies combined revealed eight of 1242 (0.6%) had an aortic aneurysm > 4 cm in diameter. Estimating the number of this group proceeding to rupture and requiring emergency surgery is conjecture. Potentially, early detection of asymptomatic abdominal aortic aneurysms and regular scanning may improve long-term survival rates.

From these two studies, the prevalence of abdominal aortic aneurysms in the general elderly male population is sufficient to justify setting up a screening programme. However, in contrast to other studies, these results would suggest hypertensive men should be regarded as being at particular risk and offered their initial ultrasound scan at 60 years *(15)*. Female hypertensives will yield a much lower detection rate for aneurysms and screening female hypertensives would probably be an inappropriate use of available resources. Insufficient knowledge is available concerning the natural history of abdominal aortic aneurysms in the hypertensive population. In the absence of any local screening programme for the general population, regular ultrasound scans play an essential part in the management of all hypertensive men, ideally being offered at the age of 60 years.

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