ORIGINAL ARTICLE

A 5-year retrospective study of abdominal aortic aneurysm repair in a Malaysian hospital

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ABSTRACT

Introduction: Prevalence and mortality due to abdominal aortic aneurysms (AAAs) have reduced; however, trends in Malaysia are difficult to determine due to the low prevalence and volume of published data. Our aim was to study current trends in AAA treatment in a national referral unit and compare them to previous reports.

Materials and Methods: A retrospective study was conducted on all patients who had AAA repair between 2015 and 2019 in Kuala Lumpur Hospital (HKL). Operating logbooks from the study period were digitised, and details of aortoiliac aneurysm surgery were analysed. We compared these findings to a previous study on AAA treatment conducted in HKL between 1993 and 1995.

Results: Over the course of 5 years, 496 abdominal aortic surgery were performed. There were 451 patients (90.9%) with AAA, whereas 41 patients (8.3%) had mycotic aneurysms. Among patients with AAA, the median age was 70 (IQR 11) and was mostly male (89.3%), whereas inlay repair was the most common technique (n = 395, 87.5%) while EVAR was employed in 36 patients (8.0%). A two proportion z test comparing emergency surgery proportions between our study cohort (56.1%) and the 1993–1995 cohort (39.3%) was significant (p = .017).

Conclusion: There has been a significant increase in the proportion of emergency surgery in HKL. Open surgery remains the most frequent repair technique. The increase in volume likely reflects the accessibility of healthcare, though other factors may play a role. Improvements in outcomes will benefit from research on the standard of care based on prospective data.

KEYWORDS:
aortic aneurysm; abdominal; infected; Malaysia

INTRODUCTION

Abdominal aortic aneurysm (AAA) prevalence has reduced in Europe whereas mortality associated with AAA has also seen a drop which has been attributed to the introduction of screening programmes.[1] There is a dearth of information on AAA repair among Southeast Asians in the literature. This is likely due to the low prevalence of the disease in this region[2,3] and among Asians in general when compared to Western data.[4,5] Most of these data are from East Asia as data from the Indian subcontinent are scarce[6] and the prevalence of AAA is low even among people of South Asian origin in Western populations.[7] Malaysia has a uniquely diverse demography with Malays, 'Orang Asli' and Borneo natives (62.5%) along with people of Chinese (20.6%) and Indian descent (6.2%) constituting 99.3% of the Malaysian population and has historically been a melting pot of ethnic groups.

Kuala Lumpur Hospital (HKL) is the main vascular referral centre in Malaysia and has been providing vascular services since 1993. We are reporting the current profile of AAA patients and surgery and comparing it with the previous cohort studied by Zainal and Yusha between 1993 and 1995.[8] Our objective was to determine if there is a relative difference in abdominal aortic surgery incidence and emergency proportions between these two periods.

MATERIALS AND METHODS

This research received ethical approval from the National Medical Research and Ethical Committee. We conducted a retrospective study of all patients who underwent aortic aneurysm-related procedures from January 2015 to December 2019 in HKL. General and vascular surgery operating logbooks over the study period were retrieved, and all procedural details were digitised. Aortic surgery cases were extracted using the keywords 'aorta', 'aortic', 'AAA', 'EVAR', 'EVAS', 'TEVAR' and each expansion. Inclusion criteria were abdominal and thoracic aortic aneurysms, aortic dissection (AD), penetrating aortic ulcer (PAU) and mycotic aneurysms of the abdominal aorta. Exclusion criteria were thoracic aneurysm, PAU, dissection, and nonaneurysmal aortoiliac occlusive disease. Case notes were retrieved data were analysed using Microsoft® Office Excel® (12.0.4518.1014). The incidence rate ratio was calculated based on the Malaysian population in 1995 (20.1mil) and 2019 (32.8mil)[9] using log Poisson regression in IBM SPSS Statistics (29.0.0.0).

RESULTS

Over 5 years, our department conducted aortic surgery on 496 patients. Most were men (88.9%), and the median age was 70 years (Table I). There were 489 index surgeries performed, with more emergency surgeries (56.0%) compared to elective cases (Table I). We compared these findings to the previous study by Zainal, which reported 56 surgeries over 30 months, of which 39.3% were emergencies.[8] The incidence rate ratio between the aortic surgeries in 1993–1995 and 2015–2019 was 0.374 (95%CI, 0.278 to 0.494, p < .0001) whereas two-proportion z-test showed that the emergency

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Table I: Characteristics of patients treated for abdominal aortic aneurysm in Kuala Lumpur Hospital between 2015-2019 (n=496)

Characteristics (n=496)	No. (%)
Age* (yrs)	70 (11.5)
Male	441 (88.9)
Ethnicity	
Malay	319 (64.3)
Chinese	153 (30.9)
Indians	12 (2.4)
Borneo	8 (1.6)
Others	4 (0.8)
Presentation	
Emergency	278 (56.0)
Asymptomatic	112 (22.6)
Leak	161 (32.5)
Thrombosis	10 (2.0)
Revision of previous repair	8 (1.61)
Disease	
Abdominal aortic aneurysm	451 (90.9)
Mycotic	41 (8.3)
Aortic dissection with aneurysmal degeneration	3 (0.6)
Risk factors (n=296)	
Age* (yr)	70 (11)
Male gender	264 (89.2)
Smoker	214 (71.8)
Creatinine > 150 µmol/L	54 (18.1)

*Data are presented as median (interquartile range).

Table II: Characteristics of intervention and complications for abdominal aortic aneurysm in Kuala Lumpur Hospital between 2015-2019 (n = 496)

Characteristics	No. (%)
Repair technique of AAA (n = 446)	
In-situ	394 (88.3)
Axilo-bifemoral bypass ± aortic ligation	11(2.4)
EVAR	37 (8.1)
ChEVAR	1 (0.2)
Aortic stent	8 (9.0)
Repair technique of mycotic aneurysm (n=41)	
In-situ	17 (41.5)
Axilo-bifemoral bypass ± aortic ligation	19 (46.3)
EVAR	1 (2.4)
Aortic stent	4 (12.2)
Repair technique of abdominal aortic aneurysmal degeneration due to aortic dissection (n=3)	
In-situ	3 (100%)
Revision surgery (n=6)	
Endovascular extension	2
Graft explantation & in situ repair	2
Axilofemoral bypass	1
Ligation of feeding vessels causing endoleak type 2	1
Complications	
Sigmoid ischemia	8 (2.0%)
Acute lower limb ischemia	16 (3.4%)
Inferior vena cava repair ± ligation	3
Laparotomy for acute abdomen	18
Secondary EVAR intervention	4

AAA = abdominal aortic aneurysm; EVAR = endovascular aneurysm repair; ChEVAR = visceral vessel chimney with endovascular aneurysm repair.

surgery proportions of both these time periods were not equal (z = 2.39, p = .017).

Leaking aneurysms constituted 32.5% (n = 161) of the cohort, whereas ten patients (2%) presented with occlusion of aortic aneurysms. In comparison with the proportions of leaking/ruptured aneurysms reported by Zainal (39.3%), there was not a significant difference in proportions between the two studies (z = 1.03, p = 0.304). During this period, we performed 416 *in situ* aortic repairs and 31 axillobifemoral bypasses when *in situ* repair was found to be unsuitable. Endovascular repair or revision was performed in 45 patients, including 38 EVAR and 8 balloon-expandable aortic stent graft (BE). One patient had a renal artery chimney stent during EVAR (Table II).

Most AAA morphology in this study was fusiform (n = 439, 98.4%) and seven patients had PAU. Open inlay repair was

Table III: Abdominal aortic aneurysm repair case series in Malaysia

Study, yr	No.	Study period (months)	Male (%)	Median age (year)	Smoker	Cardiac disease	Chronic kidney disease	Elective surgery (%)	Leak	Elective mortality (%)	Emergency mortality
Pung et al, 1991[27]	58	31	88	68.7	86	18	4	70.7	29.3	2	47
Zainal et al, 1998[8]	56	30	84.7	69	NA	17.7	8.1	60.7	39.3	8.8	59.1
Lakhwani et al, 2003[28]	54	48	92.6	68.5	94.4	35.1	11.1	38.9	61.1	14.3	42.4
Yii KM, 2003[16]	69	36	78.3	67 † 70 ‡	NA	NA	NA	46.4	24.6	6.3	27.0
Current study	496	60	88.9	70	71.8	31.5	18.1	44.0	32.5	9.6§	16.7‖

†Male. ‡Female, § Open abdominal aortic aneurysm repair, ‖Pooled mortality of EVAR and open repair of abdominal aortic aneurysms. NA = not available.

the dominant treatment choice (n = 394, 88.3%) whereas an endovascular approach constituted 10.3% of AAA treatment. Renal artery reimplantation was performed in four patients whereas a ChEVAR was performed in one. All three patients with aneurysmal degeneration of a proximal AD had open repair. Mycotic aortic aneurysms made up 8.3% (n = 41) of the cohort, of which nearly equal number of patients underwent in situ repair (n=17, 41.5%) and extraanatomical bypass and aortic ligation (n = 19, 46.3%), whereas five patients had endovascular exclusion stent grafts (12.2%).

Eight patients required revision of previous aortic repair that was not from our index cohort. Four of these patients presented with leaks, three of whom had a previous endovascular repair. One patient had a type 2 endoleak and had feeding vessels ligated, whereas one patient had a type 1 leak requiring explantation and in situ repair.

We retrieved records from 65.5% (296) of the total number of AAA cases performed in the study period. We found that most of these patients were smokers (71.8%) and 31% had myocardial disease. Elective mortality among asymptomatic patients was 9.6% for open surgery, whereas there was no mortality among elective EVAR. Mortality for emergency aortic surgery was 16.7%.

Complications included sigmoid ischaemia, inferior vena cava injury, and bowel involvement due to aortoenteric fistula (Table II). Nineteen patients from our cohort required a return to theatre for complications, with 57.9% occurring during the same admission. The most common complication requiring additional intervention after open *in situ* repair was lower limb acute ischaemia due to embolus. Sixteen femoral embolectomies and two distal bypasses were performed for patients with open aortic repair (4.5%). Four patients who received EVAR or aortic stent required secondary reintervention, two of whom were from the EVAR cohort of the study period (5.9%). One patient required proximal extension due to a type 1 endoleak, whereas the other patient required iliac angioplasty. Two patients presented with rupture post-EVAR; one had an in situ repair, whereas the other patient had an explantation, aortic ligation, and axillofemoral bypass.

DISCUSSION

Surgery for AAA in Malaysia has increased significantly since 1995. There was not only an increase in the relative incidence of AAA surgery but also an increase in the proportion of emergency surgery. It is likely that the prevalence of AAA in the country has increased, or that AAA was under-diagnosed in the community during the first study period. There was bias in calculating the incidence rate of each study period as we did not take into account the other centres providing similar services and the evolving health care system over the last 2 decades. However, the incidence rate ratio and the proportion of emergency surgery does infer an increase in AAA in the population. The reasons for this are unclear, as smoking trends have decreased among people aged more than 65 years old,[10] and the population has only increased by 63% since 1995.[9] This phenomenon may be contributed by exposure to other risk factor like hypertension or more referrals driven by greater awareness of the disease, improved imaging accessibility at referring centres, and improved perioperative and postoperative care. Reports from China reveal an increase in AAA mortality associated with hypertension,[11] whereas Finnish data suggest that an increased use of statin and antihypertensives may have contributed to a drop in AAA prevalence.[12]

The demographics of patients with AAA in our cohort were similar to those in other Malaysian studies (Table III). The median age of patients was 68–70 years, which is similar to Western data where most screening is offered to men over 65 years.[1] Similarly, most patients had a history of smoking, which is a known risk factor in the pathogenesis of AAA. Our series had a higher rate of chronic kidney disease (CKD) than the other local studies. This correlates with an exponential increase in the prevalence of end-stage renal disease in Malaysia, increasing from less than 200 to more than 1300 per million population over the last 20 years.[13] Although there is no direct association between the incidence of AAA and CKD, the latter is a predictor of mortality in AAA surgery.

The ethnicity of patients in our series was similar to the three previous studies conducted in West Malaysia, whereby Malays were the majority followed by Chinese. This distribution is more likely to be attributed to ethnic density instead of one group being at a higher risk than the other. The Malaysian ethnic landscape is diverse, and there is much heterogeneity within and genetic similarities between ethnic groups, owing to shared ancestry.[14] As Asians generally have a low prevalence of AAA, future research into risk stratification based on ethnicity in this region will unlikely have significant clinical benefits. An efficient and ethical approach to screening patients should be individualised, considering age, smoking history and sex instead of ethnicity.[7]

The incidence of mycotic aortic aneurysms in Asia is reportedly high, reaching 13% in Taiwan.[15] Although our results are similar to the incidence reported by Yii (7.2%).[16] The rate in our series is high compared to the European literature where rates are 0.5-2%.[15] The wide range may be attributed to challenges in diagnosis, including negative cultures in 21–40% of cases. This highlights a challenge in the management of mycotic aneurysms in this region where organisms such as Salmonella sp and Burkholderia pseudomallei are more common than in the West.[17–19]

Open AAA surgery remains the dominant modality in our centre. Our preference for this approach lies with concerns about the long-term durability of EVAR[20,21] along with the cost of treatment due to the financial austerity of the Ministry of Health. We practice prudent patient selection for EVAR suitability with adherence to IFU. Similar reservations contributed to the draft of the NICE guidelines in 2018[22] and reflected in the reducing trends of EVAR in the UK. In 2016, EVAR was performed in 69% of elective surgery[23] and reduced to 59% in 2022.[24] However, EVAR remains the dominant modality for AAA repair in the US, where more than 80% of AAAs are treated with EVAR.[25] These large differences in treatment modality have repercussions on both patient care and surgeon training. A balance between good endovascular and open surgery training is a challenge in any single centre to improve proficiency and competence in these high-risk procedures.

Though mortality has improved compared to the previous Malaysian studies (Table III), mortality among elective open AAA surgery in our series (9.6%) was high compared to national standards elsewhere, such as in the UK, where it is 3.1%.[24] There may be selection bias as some patients operated on the elective list may have been booked without preoperative assessment and optimisation due to symptoms or large aneurysm size. Similar findings were noted by Filipovic et al. in the UK, where mortality rates were 6.8% in 1998-2002, higher than European and American rates in the literature at the time.[26] The NHS has since observed a marked reduction in elective AAA mortality, which is probably linked to improvements in the standard of care and screening introduced in 2009.

We did not have any mortalities among our EVAR patients which is likely due to our strict criteria for an endovascular approach. Though the EVAR numbers were low, this likely pivoted early mortality in the open surgery group, as patients with complex AAA anatomy were more likely to have open surgery.

Measures to improve elective AAA mortality and reduce emergency AAA repair are symbiotic. Apart from performing audit cycles to achieve better standards of care during the perioperative period, other measures may be adopted or studied for feasibility. Improvements in community health care in reducing smoking prevalence and improving blood pressure control have been recommended. Screening in target groups may also result in earlier detection of AAA at smaller sizes, scheduling surgery as an elective procedure and increasing the proportion of EVAR surgery.[11] Feasibility studies for screening and quality assurance will benefit from prospectively collected data.

The limitations of this study are its retrospective nature. We were unable to retrieve 34.2% of the records from the index cohort, resulting in information bias and inability to record granular data of those patients, including mortality. Secondly, we did not capture the long-term secondary interventions of the EVAR cohort because of the relatively short study period and only captured those that required a return to theatre. Thus, type 2 endoleaks, which are treated in the angiography suite of our centre by interventional radiologists, were not recorded.

CONCLUSION

In conclusion, there has been an increase in AAA surgery at our centre, which is likely due to improvements in referrals and healthcare accessibility, but other factors may play a role in driving prevalence. Mortality among elective open AAA is high and most AAA repairs are performed as an emergency. Improvements in outcome will likely be driven by data from registries and improvements in primary health care.

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