

Outcome of abdominal aortic aneurysm in resource limited setting: A single-center cohort study

Aram Baram, Allaa Subhi Abdel-Majeed, Goran Majeed

ABSTRACT

Aims: The aim of the study is to analyze the risk factor and outcome of patients underwent open repair of abdominal aortic aneurysm in Slemani thoracic center-Iraq. **Method:** This is prospective, single cohort study, included patients who underwent open abdominal aortic aneurysm repair. Diameter of 5-5.5 centimeter represents the cut point for intervention. Polyester (Dacron) vascular grafts used mostly with invagination technique. Data regarding socio-demographic and clinical characteristics were collected and analyzed. **Results:** Sixty-eight patients operated for infra-renal abdominal aortic aneurysm, followed up to determine early and long term morbidity and mortality. In mean time of 24 months of follow up, we recorded 32% early operative morbidity, acute renal failure was commonest complication which significantly related to suprarenal clamp and peri-operative hypotension. We reported operative mortality of 3% and overall mortality of 7.5%. Freedom from re-admission and technical success rate at first year was 84% and 97% respectively. Cox

Regression method revealed significant effect of ischemic heart disease, emergency surgery and intraoperative hypotension on postoperative complications and morbidity. **Conclusion:** Open repair for infra renal abdominal aortic aneurysm is safe procedure with acceptable long-term survival. Early Postoperative complications and long term outcome mainly related to patients comorbidities and intraoperative complications.

Keywords: Infra-renal abdominal aortic aneurysm, Intra-operative complications, Longterm survival

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INTRODUCTION

Infra-renal Abdominal Aortic Aneurysm (IAAA) represents 85–95% of all Abdominal Aortic Aneurysms (AAAs) and it is defined when transverse diameter of aorta reaches above 3 cm [1, 2]. Rupture aortic aneurysm is the 10th leading cause of death in men older than 55 years [3]. According to Crawford et al. [3], operative mortality of elective AAA repair decreased to 1% which achieved by advances in surgical techniques and anesthetic measures [3], in addition uprising ten-year survival from zero with medical treatment to 30% with graft replacement and low survival associated with spontaneous rupture makes intervention mandatory for AAA [1–3]. Cost effectiveness of abdominal ultrasound brought by its very high

sensitivity and specificity for AAAs early detection gives the patients opportunity to have much safer and fruitful elective intervention than emergency repair for rupture [4]. New era of wide range development of Endovascular Aneurysm Repair (EVAR) and its applications for infra-renal abdominal aortic aneurysm in last decades, provides advantages of short length of stay (LOS) and short term improvement in quality of live (QoL) [5], but its uses still have limitations related to long term efficacy of EVAR, high cost applied on patients and institutes beside the morphological barriers of large aneurysms exceeding 5.5 cm and need for secondary intervention [5]. Long 15-year survival plus low rate of re-intervention for any graft-related complications achieved by open repair makes it noticeably choice for infra-renal AAAs especially for those who are fit for surgery [2].

In this study, we follow up post-operative patients with surgical intervention for large IAAA that equal or exceed 5.5 cm. The primary aim is evaluation of the quality of life, morbidity and mortality rate in 5 years in those patients who underwent open repair for IAAA in a resource limited setting like Iraq.

PATIENTS AND METHODS

In this single center, single cohort study, we analyzed patients' data in cardiovascular and thoracic surgery department in "Sulaymaniyah Teaching Hospital-Al Sulaymaniyah-Iraq" whose open repair for IAAA done between 2010 till 2014. All cases who survived elective or emergency operation were included regardless of associated comorbidities except for those with end stage renal failure or heart disease cases with ASA (American Society of Anesthesiologists) for physical status. According to the above data we concentrated on outcomes of 68 patients regarding post-operative quality of life, morbidities and mortality associated with those cases in first 30 days and long term mortality, the source for follow up data obtained either by patients' hospital data records, their relatives or from surgeons in charge. CT angiography was used as the main diagnostic modality (Figure 1).

Surgical Considerations

All surgeries carried out under general anesthesia with midline laparotomy intraperitoneal approach. Polyethylene terephthalate vascular graft (Dacron) was main synthetic graft used with sizes ranged from 20-30 millimeters (Figure 2). Inclusion techniques of graft used in all cases, the aneurysmal sac incised, thrombotic debris removed, graft invaginated inside the sac where anastomosis done followed by aneurysmorrhaphy over the graft (Figure 2). Due to shortage of resources, none of our cases underwent endovascular intervention.



Figure 1: CT angiography of a large infra-renal AAA.

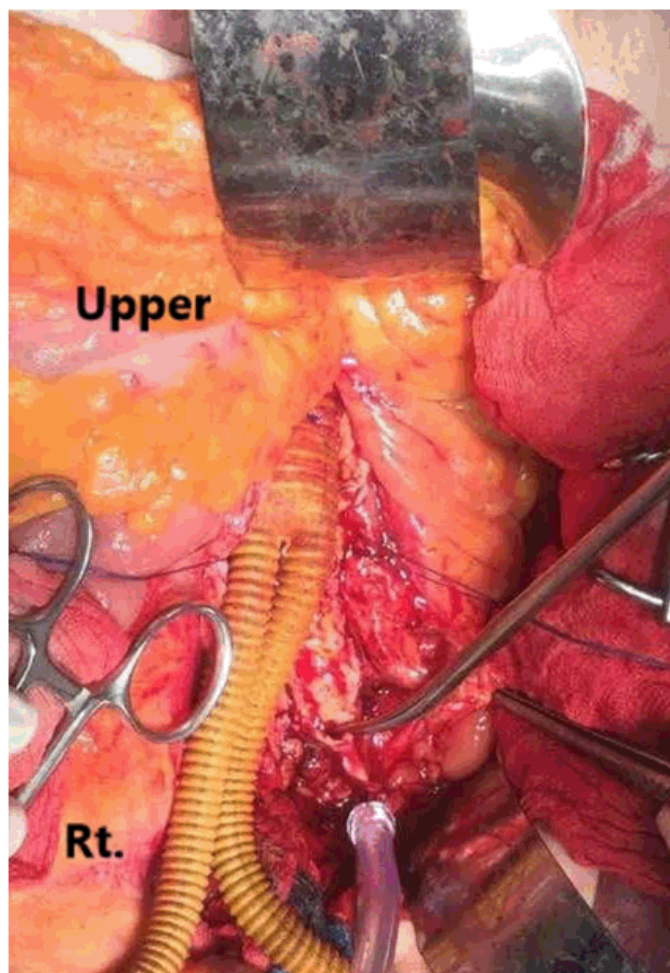


Figure 2: Sliver impregnated Dacron graft in place.

Data collection and statistical analysis

The data were collected from the patients, patients' relatives and medical reports. Statistical analysis done by SPSS® program version 24, to detect significances and relations between comorbidities and postoperative

complications with cross table method and chi-square test, in addition to that proportional Cox regression and Kaplan Meier survival analysis used to measure survival relation with time and hazards of each intraoperative factor to mortality and morbidity of patient.

RESULTS

This study included 68 patients. Patients' demographic and clinical characters were shown in Table 1. About 72 % of the patients (n= 49) had IAA with iliac arteries extension, only in 20 % of the patients (n=14) the aneurysm was exclusively infra-renal with no proximal or distal extensions, while in three cases the aneurysm was juxta-renal and in two cases with suprarenal extension (Figure 3). Aorto-biiliac bypass was main technique applied in 77% of the patients (52/68), in nine (13%) cases aorto-aortic anastomosis done, with remained seven patients either Aorto-femoral/ external iliac bypass had been carried out (Figure 4). Suprarenal clamp was main demanding intraoperative factor recorded in data which used in five cases for 30–45 minutes, Peri-operative hypotension also reported in other seven patients (10%). Mean surgery time was 170 min with mean blood loss of 740 milliliters.

Mean follow up time was 24 months (range 5-72 m). Early in-hospital morbidity was 32%, acute renal failure was main complication which present in seven patients (10%) (Table 2), which significantly relate to suprarenal clamp or hypotension intra-operatively (p < 0.05) (Table 3). All postoperative acute renal failure cases managed conservatively except for one case that needed hemodialysis.

First month operative mortality was 3% (two patients) both of them died for extensive myocardial infarction during hospital course at 7th and 15th post-operative day. Overall mortality in mean time of follow up was 7.4 %

(5/68) which all of them had advanced ages (Age ≥ 68 years). Freedom from hazards of death at first, third and fifth year was 94%, 88% and 62% respectively. Acute coronary syndrome was the main reason of re-admission and main mortality causative factor reported in 60% (3/5). Other two cases died for cerebrovascular accident and aorto-enteric fistulae respectively.

In 66 patients whose survived post-operative 30 day course, 97% of them had normal ultrasonic examination (U/S) at three months except for two cases had para-aortic hematoma that resolved in successive visits, in these two individuals, aneurysms type was in favor of saccular and dissecting morphology. At 6 month follow-up, 62 patients documented with normal U/S study with four missing records. In the first year follow up visit, our data referred to 85 % (n= 56) technical success and normal U/S, eight missing records and extra two mortalities due to myocardial infarction and aorto-entric fistulae complications respectively. Re-admission rates to hospital in 1st year and 3rd year were 16% and 24% respectively (Figure 5).

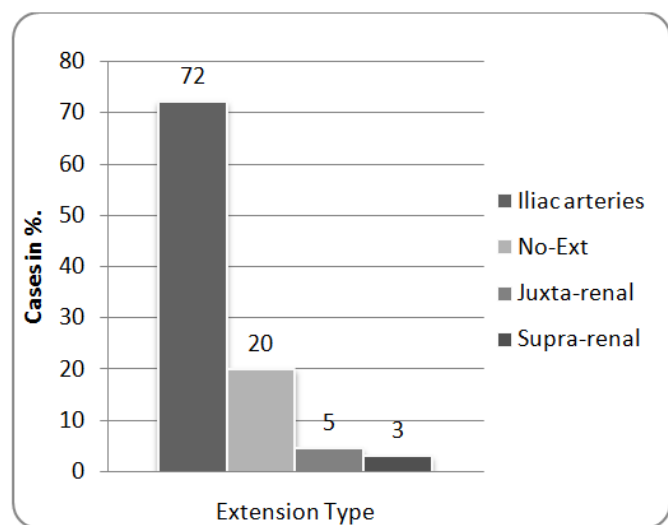


Figure 3: Extent of aneurysms.

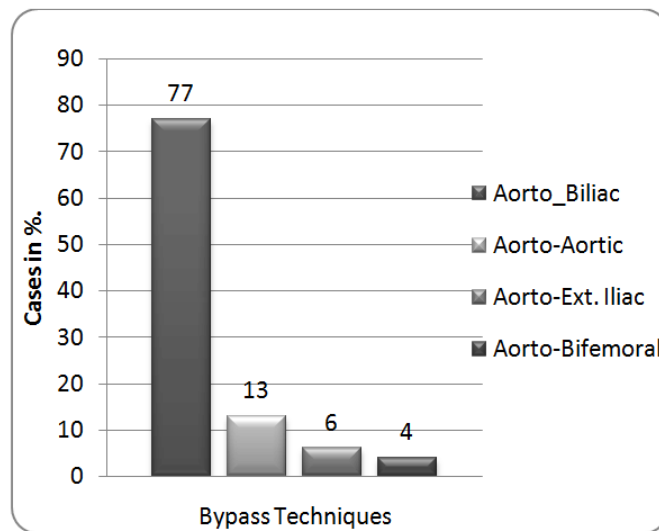


Figure 4: Surgical techniques.

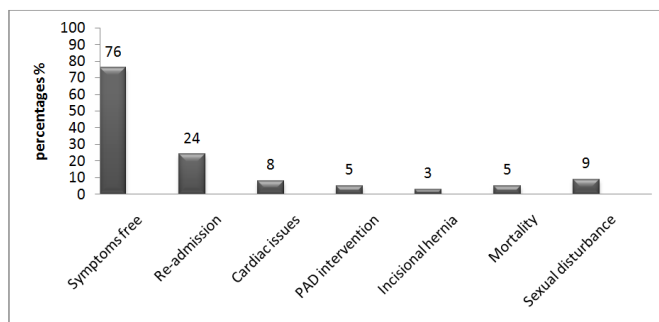


Figure 5: Post hospital discharge patients course.

Table 1: Patients and aneurysm characteristics

Patient's characteristics		
Factor	Categories	N (%)
Gender	Male	61 (90)
	Female	7 (10)
Smoking	Smokers	44 (65)
	Ex-smoker	11 (16)
	Non	13 (19)
Risk factors	Hypertension	44 (65)
	IHD	38 (56)
	Central obesity	24 (36)
	Diabetes mellitus	12 (17)
	COPD	12 (17)
Associated disorders	IRF	7 (10)
	PAD/CVI	4 (6)
	40-50% EF.	5 (7)
	Lymphoma	1 (2)
	Inguinal hernia	1 (2)
Presentation	Accidentally	43 (63)
	Abdominal pain	17 (25)
	Sign of rupture	6 (9)
	ALI	2 (3)
Morphology	Fusiform	66 (97)
	Saccular	1 (2)
	Dissecting	1 (2)
AAA size by imaging	U/S (mean size)	6.7
	CTA (mean size)	7

*IHD-Ischemic heart disease , IRF-impaired renal function, PAD-peripheral arterial disease, CVI-chronic venous insufficiency, ALI-acute limb ischemia U/S- ultrasonography, CTA computed tomographic angiography

Sexual activity disturbance was main concern in outpatients follow up visits which reported in 9% of total 66 patients (6 cases with 2 of them had increase in sexual desire) whose all underwent aorto-biiliac bypass. In addition prostatic carcinoma and pancreatic carcinoma diagnosed in 2 other cases throughout follow up sessions.

Table 2: Early morbidity

Early post-operative morbidity in relation to perioperative course							
Morbidity Course (No.)	Nil (%)	ARF (%)	Cardiovascular (%)	Pulmonary (%)	Ileus (%)	SSI (%)	Others (%)
Smooth course (50)	78	4	8	2	2	2	4
Hypotension (7)	14	29	29	29	-	14	-
Supra-renal clamp (5)	20	60	-	-	20	-	-

(Table 3). The cumulative early and late post-operative event were 44% (30 patients), which were significantly related to intraoperative hypotension and/or suprarenal clamp ($p < 0.01$) and with pre-operative acute or emergency presentation vs elective ($p < 0.05$). Ischemic heart disease was single significant patient factor which relate to presence of above events ($p < 0.05$), but none of other modifiable or non-modifiable comorbidities recorded as having magnitude with any early or late events ($p > 0.05$) (Table 3).

DISCUSSION

Abdominal aortic aneurysm is burdensome pathology needs early diagnosis and management before extension to a point in which patient may present with signs of ruptured aneurysm, which needs immediate surgery that carry higher mortality and poor prognosis in comparison to an elective repair [6–12]. In our results operative mortality rate in first 30 days was 2.9% which is almost in same class with other series as Alan D. et al [13] referred to 3.5% operative mortality in elective AAA repair with significant higher rates among older age groups and lowest patient volume hospitals. Zowlak et al [10] recorded 3.6 % operative death rate with no much significance between large and small size aneurysms. As been reported in our data (Table 3), and other trials and series, emergency presentation tagged as critical situation that can cause gross outcome, like been indicated in (predictors decreasing post-operative survival) by Derek P. et al [9], which regarded presence of aneurysm rupture signs as negative point in survival clock.

Nearly 85% and 76% of operated cases had freedom from any symptoms at first and third follow up year respectively, along returning to their own normal lifestyle, family life and jobs with better exercise tolerance. Besides that, we recorded 97% technical success rate at 1st year follow up visits, graft complications were only 3% (in 2 patients) which managed conservatively without secondary intervention, 12% of patients reported as missing data in 1st year, yet all of them had normal ultrasonic examination at long term follow up visits (Figure 6). However EVAR1 trial [14] described low graft

Table 3: Cross table for postoperative events and patient or surgical factors

Significance P-value Factor	Early Morbidity	Late morbidity	Overall mortality
Age (<60 Y vs.> 60 Y)	No (>0.05)	No (>0.05)	No (>0.05)
Smokers vs. non smokers	No (>0.05)	No (>0.05)	No (>0.05)
Hypertension	No (>0.05)	No (>0.05)	No (>0.05)
Ischemic heart disease	Yes (<0.05)	No (>0.05)	No (>0.05)
Central obesity	No (>0.05)	No (>0.05)	No (>0.05)
Diabetes & COPD	No (>0.05)	No (>0.05)	No (>0.05)
Emergency vs. elective surgery	Yes (<0.05)	No (>0.05)	No (>0.05)
Hypotension & Sup-R. clamp	Yes (<0.01)	No (>0.05)	No (>0.05)

related re-intervention rate (2%) in first 4 years after open repair, yet higher rate or re-intervention (10%) for endovascular repairs recorded in the same trail. Low mortality of surgery, long term survival plus good post-operative quality of life make us think about higher efficacy and applicability of open elective repair for AAA 9 (Figure 7 A and B) [1].

After the initial diagnostic workup (abdominal ultrasonography) computed tomographic angiography (CTA) was main imaging technique used for confirming diagnosis (Figure 2), evaluating morphological features of aneurysm and establishing ground plan for surgical repair. In spite of conventional angiography traditionally used for vascular diseases but recently spiral CT and 3 dimensional CT angiography became substitutional techniques that has high sensitivity and specificity for evaluating distinct aortic aneurysms pre and post-operatively as been reported in many series [10, 15], as been stated in ESC 2014 guideline [10] which introduce computed tomography as quick noninvasive available imaging modality, also L. la Roy et al [15] referred to postoperative follow up with double contrast CT as worthy method for detection of leaks, fibroses or abscess. P. Walker et al [16] pointed to computed tomography as replacement investigation to conventional angiography.

Proximal supra renal clamp beside it involves extra surgical dissection and intra-peritoneal organ manipulation, results in intraoperative time prolongation without much effect in short term operative mortality, but significantly affect rate of early acute renal failure and long term morbidity and mortality [17] (Figure 7 and Table 3) due to many factors as moreburden on heart or mobilization of atheromatous plagues that may

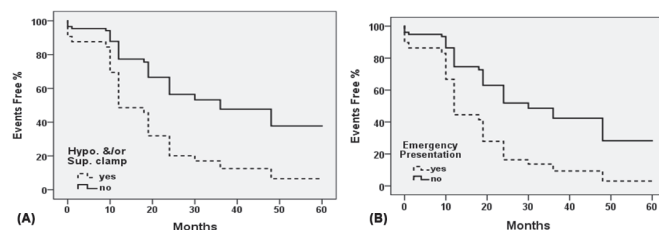


Figure 6(A and B): Cox-regression method for post-operative events freedom in relation to intraoperative hypotension and / or suprarenal clamp. (B) Cox-regression method for post-operative events freedom in relation to Emergency presentation vs. elective presentations.

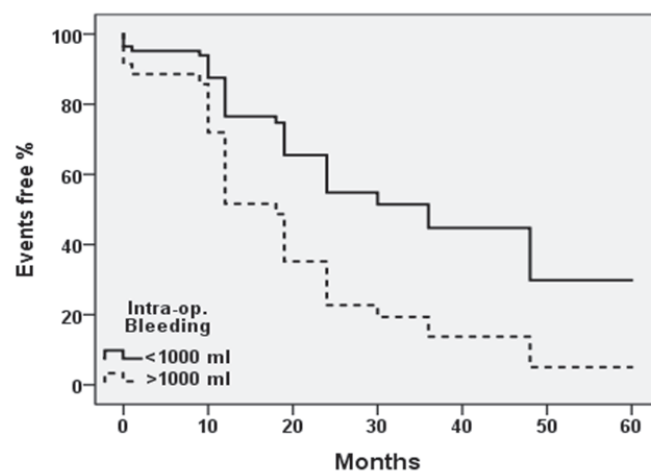


Figure 7: Cox-regression method for post-operative freedom from events in relation to mean of perioperative blood loss.

cause dissections and embolization of renal arteries, these effects of more proximal clamp mentioned by other authors. V. Patel et al [8] referred to complex aneurysm as a cause for major early complications and bad long term prognosis with no great effect on early operative mortality. Another trial by Derek P. et al [9] concluded that post-operative renal function impairment is associated with intra-operative supra-renal clamping and its significantly associated with poor long-term survival.

Intra-peritoneal approach was only approach used in all cases. Only 3% of the cases had early superficial wound infections with 0% reoperation rate. During late follow up 3% (in 2 case) had wound dehiscence managed surgically, compared to Clivind Clinic series by Norman R. et al [1], they reported with combined intra and retroperitoneal approaches early wound complications of 3%, 1.3% of early reoperation for wound dehiscence and additional 1.4% complications for intestinal obstruction and retroperitoneal hematoma.

Graft inclusion was main procedure used in our patients which decreased graft contact with adjacent organs by reduced the rate of aorto-enteric fistulae and adhesions [10] which is regarded as good prognostic factor in long term morbidity and mortality as been referred

by Crawford et al(3) as they registered double mortality rate with aneurysm excision and graft replacement in comparison with inclusion techniques.

Our patients mean blood loss was 740 milliliters (400-2400 ml), yet perioperative blood loss of more than 1000 ml associated with significant rate for early morbidity and development of any late post-operative events. Markivic et al [18] reported significant life threatening outcomes in patients with high blood loss (mean 3700 ml), another analysis by Lawrence Tim et al [19] referred to mean blood loss of 1748 ml and they recommend use of cell savior intra-operatively for blood loss more than 1000 ml.

There are several limitations to this study; as Abdominal aortic aneurysm is progressive pathology in old age classes and as Iraq is one of the countries with small rate of old age population, the number of operated patients are small which by its way may affect our study design and results. Furthermore, the limited strategies for renal protection and to shrink need for blood transfusion may cause inferior postoperative sequelae. Being single center based study is another short coming of the current study.

CONCLUSION

Open repair for IAAA is safe and has acceptable long-term survival. Early postoperative complications and long term outcomes mainly related to patients' comorbidities and intraoperative complications. Extra dissection for suprarenal aorta and applying more proximal clamp also had noticeable sequel on surgery course and postoperative renal failure.

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Author Contributions

Aram Baram – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Allaa Subhi Abdel-Majeed – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Goran Majeed – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Consent Statement

Written informed consent was obtained from the patient for publication of this study.

Conflict of Interest

Authors declare no conflict of interest.

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