Clinics in Surgery

Research Article
Published: 03 Aug, 2020

Early and Long-Term Outcome of 150 Consecutive Open Repairs for Ruptured Abdominal Aortic Aneurysms

Shota Yamanaka, Haruo Aramoto, Go Urabe, Yoshihisa Makino and Tomoki Shimokawa*

Department of Cardiovascular Surgery, Sakakibara Heart Institute, Japan

Abstract

Objectives: Early good outcomes of Endovascular Aneurysm Repair (EVAR) for Ruptured Abdominal Aortic Aneurysm (RAAA) have been reported. Even though EVAR for RAAA has the advantage of having low invasiveness, some disadvantages have been reported when it is compared to Open Repair (OR), which can be adapted to all cases. The aim of this study is to evaluate early and late outcomes of OR for RAAA in this endovascular era.

Methods: Between September 2004 and October 2015, 150 consecutive patients with RAAA underwent OR in our institute. We performed left intercostal thoracotomy and descending aorta clamping for hemodynamic instability. The primary endpoints were early outcome, long-term survival, and aortic related re-intervention-free rate. Risk factors of 30-day mortality were defined by univariate and multivariate analysis.

Results: The 30-day mortality was 15.3% (23/150). The cumulative five-year and ten-year survival rate were 66.2% and 50.7%, respectively. The cumulative five-year and ten-year freedom from aortic related re-intervention was 96.1% and 90.5%, respectively. Preoperative shock and Cardiopulmonary Resuscitation (CPR) were defined as risk factors of 30-day mortality.

Conclusions: Early and late outcomes were satisfactory compared to other reports n the outcomes of OR (or) EVAR for RAAA. Controlling the preoperative shock state may improve early outcomes. In the ruptured cases, there were fewer aortic related re-interventions in OR than EVAR. It is essential to choose the optimal treatment based on the condition of RAAA in OR and EVAR.

Keywords: Ruptured abdominal aortic aneurysm; Long-term survival; Open repair; Re-intervention

OPEN ACCESS

Correspondence:
Shota Yamanaka, Department of Cardiovascular Surgery, Sakakibara Heart Institute, 3-16-1 Asahi-cho, Fuchu, Tokyo 183-0003, Japan, Tel: (+81) 42-314-3111;
E-mail: syamanaka_shi@yahoo.co.jp

Received Date: *01 Jul 2020*
Accepted Date*: 25 Jul 2020*
Published Date*: 03 Aug 2020*

Citation:
Yamanaka S, Aramoto H, Urabe G, Makino Y, Shimokawa T. Early and Long-Term Outcome of 150 Consecutive Open Repairs for Ruptured Abdominal Aortic Aneurysms. Clin Surg. 2020; 5: 2896.

Introduction

Following the introduction of Endovascular Aneurysm Repair (EVAR) for Abdominal Aorta Aneurysm (AAA), the treatment has also been employed for Ruptured Abdominal Aorta Aneurysm (RAAA) [1]. Although good early results of EVAR for RAAA compared to Open Repair (OR) have been reported [2,3], but some Randomized Controlled Trials (RCTs) reported no difference in early outcomes [4,5]. The good results of EVAR for RAAA are considered to be attributable to the retrospective cohort, and do not indicate that EVAR is superior to OR. Although the early results of EVAR for RAAA are excellent, in the case of an anatomical condition or device time-lag, it is difficult to adapt to all cases [4]. Furthermore, EVAR can be converted to OR in the event of abdominal compartment syndrome or endoleak, and the rate of death increases after the conversion [6]. OR can adapt to all cases and is considered the gold standard for RAAA. The aim of this study was to evaluate early and late outcomes of OR for RAAA and to identify predictors of 30-day mortality.

Material and Methods

Between September 2004 and October 2015, 150 consecutive patients were diagnosed with infra-renal RAAA and underwent OR in our institute. Patients with preoperative shock were defined as those with systolic blood pressure of less than 90 mmHg or those who received catecholamine when they arrived at our hospital. Survival and re-intervention data were collected retrospectively from medical records. Median follow-up month was 16.5 months. This study shows early and late outcomes including survival rate and aortic related re-intervention-free rate and evaluates predictors of 30-day mortality. Preoperative patient demographics are listed in Table 1. All patients underwent OR in operation room. Eighty patients (53.3%) had preoperative shock status. Six cases received Cardiopulmonary Resuscitation (CPR). In the cases with severe hemodynamic instability

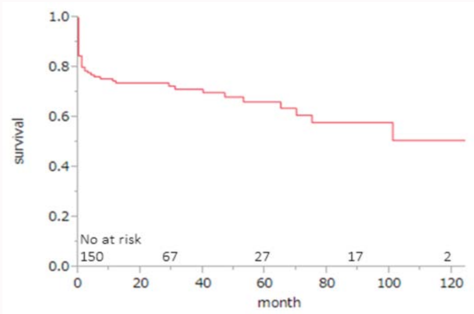

Figure 1: Freedom from all cause death.

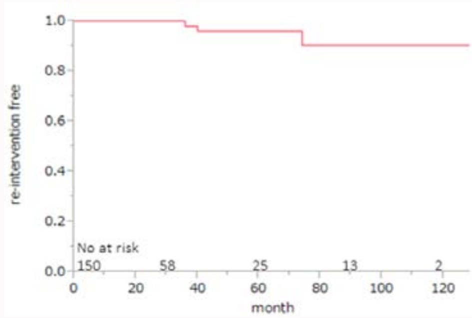

Figure 2: Freedom from aortic related re- intervention.

or in those receiving CPR, we performed a 5th or 6th left intercostal thoracotomy and clamped the descending aorta before abdominal incision.

Statistical analysis

All statistical analysis was performed using JMP 11 statistics for Windows (SAS Institute Japan). Normally distributed continuous variables were expressed as the mean ± standard deviation, and non-normally distributed continuous variables were expressed as the median with range. Categorical variables were expressed as percentage. Survival rate and re-intervention free rate was calculated using Kaplan-Meier methods. Multivariate logistic regression analysis was used to determine the predictors of 30-day mortality, A p value <0.05 was considered statistically significant.

Results

Intra-and postoperative data are listed in Table 2. Eight patients died in the operating room and did not receive graft replacement. The descending aorta was clamped with a left thoracotomy in twelve patients. Thirty-day mortality, including intraoperative death, was 15.3% (23/150), and the details are presented in Table 3. We analyzed 30-day mortality statistically to identify risk factors of early death in Table 4. Univariate analysis revealed that preoperative shock and preoperative CPR were statistically significant risk factors. Multivariate analysis revealed that only preoperative CPR was a statistically significant risk factor. Long-term results are presented in Figure1 and 2. During follow up, there were 47 deaths (31.3%), including in-hospital deaths. The cumulative five-year and ten-year survival rates were 66.2% and 50.7%, respectively. Three aortic related re-interventions for graft infection in two cases and residual aneurysm in one case were conducted. The cumulative five-year and ten-year freedom from aorta related re-intervention was 96.1% and 90.5%, respectively.

Table 1: Preoperative characteristics.

Variables	N=150
Age (years)	73 ± 9
Male gender	121 (80.7%)
Hypertension	98 (65.8%)
Diabetes mellitus	26 (17.3%)
Dyslipidemia	17 (11.3%)
Prior to abdominal operation	23 (15.3%)
Preoperative shock	80 (53.3%)
Preoperative CPR	6 (4.0%)
Fitzgerald III or IV	110 (77.3%)

CPR: Cardiopulmonary Resuscitation

Table 2: Intra- and postoperative data.

Variables	N=150
Operative time (min)	184 ± 73
Y graft	106 (70.7%)
I graft	36 (24.0%)
Reconstruction of renal artery	3 (2.0%)
Left thoracotomy	12 (8.0%)
ICU stay (day)	2
In- hospital stay	17
Complication	
Cerebral infarction	3 (2.0%)
Pneumonia	12 (8.0%)
Dialysis	22 (14.7%)
Bowel ischemia	9 (6.0%)

Table 3: Thirty day mortality.

Reason	N=23
Intraoperative death	10 (43.5%)
Bowel ischemia	8 (34.8%)
Pneumonia	3 (13.0%)
DIC	2 (8.7%)

DIC: Disseminated Intravascular Coagulation

Table 4: Statistical analysis of 30-day mortality.

Variables	Univariate analysis	Multivariate analysis
Age	0.59	
Male	0.16	0.22
Hypertention	0.06	0.14
COPD	0.19	0.14
Preoperative shock	0.01	0.08
Preoperative CPR	<0.001	0.004

CPR: Cardiopulmonary Resuscitation

Discussion

After the first report of OR for RAAA [7], although much research was reported and the surgical techniques and intensive care medicine advanced, the early mortality rate remained high [2-4]. EVAR was introduced in Japan in 2006 [8], and it has showed good early outcomes in elective patients and has spread to ruptured cases. Although many retrospective or prospective studies reported early the good efficiency of EVAR for RAAA [2,3,9-12], some RCTs reported no significant difference in early mortality between OR and EVAR [4-5,13]. Even though EVAR for RAAA has advantages, such as lower blood loss, reduce incidence of complications, and shorter length of ICU and in-hospital stay, it has disadvantages such as limited instructions for use, endoleak, device time-lag, and Abdominal Compartment Syndrome (ACS). Although a considerable number of cases that are ineligible for EVAR might have been included in the OR groups, both procedures cannot be compared simply. EVAR also has the problem of open conversion due to endoleak. Karkos et al. [6] reported that 6% of EVAR converted to OR in emergent cases and the mortality rate rose in the conversion cases. In addition, EVAR could not detect and immediately manage bowel ischemia in RAAA. Our study had nine cases of bowel ischemia. Rubenstein et al. [14] reported that 30% of RAAA patients developed ACS; more frequently in OR than in EVAR, and the mortality rate was higher in patients with ACS. Based on this evidence, we hesitate to apply EVAR to whole RAAA and we have consistently opted for OR.

Regardless of treatment (OR or EVAR) the early mortality of RAAA is still reported to be high at 15.7% to 37.4% [4-6]. The thirty day mortality in our study found was 15.3%, and we believe that this is an acceptable result when compared to other reports. Our study also revealed that preoperative shock and CPR were predictors of early mortality. Healey et al. [15] reported that the predictors of 30-day mortality were advanced age, elevated creatinine, and lowest systolic blood pressure. This study included 80 preoperative shock patients. In addition to our study, other reports [4,15] included 32.1% to 48% of preoperative shock cases. Controlling preoperative shock will lead to improved early mortality and morbidity of RAAA. We always use descending aorta clamping in cases with hemodynamic instability. Mattox et al. [16] first reported the efficiency of descending aorta clamping in cases with traumatic surgery. Cosellie reported supra-celiac clamping for elective AAA patients, and Burkit reported it for ruptured AAA cases [17,18]. The benefit of descending aorta clamping in that it does not require laparotomy. Hiatal clamping in the case of free wall rupture cannot control hemodynamic instability before laparotomy, and makes blood pressure fall at the time of laparotomy. Supra-celiac clamping involves a risk of mesenteric and renal ischemia, but Coselli et al. [17] reported that reducing operation time led to lower morbidity and mortality. Some reports recommended the use of intra-aortic balloon clamping for hemodynamic instability [19-21]. Although X-ray apparatus in needed, it can be applied using local anesthesia alone. Descending aorta clamping is not quite low-invasive, but it is a quick procedure even if it is performed in the emergency room. It is important to organize the algorithm to manage hemodynamic instability for RAAA with various methods [22]. In patients who underwent elective treatment for AAA, it is known that the long-term risk of aortic related re-intervention and aneurysm rupture increased after EVAR compared to OR [23-25]. There are, however, few articles regarding the long-term risk in rupture cases. van Beek et al. [26] reported that the rates of freedom from re-intervention in both procedures was similar, but in surviving patients, the rate of re-intervention was higher in EVAR than OR. EVAR for morphologically challenging or time - constraint RAAA may lead to more aortic related re-intervention in the long-term. In our study, we had merely three (2%) aortic related re-interventions. Two of these cases were graft infection, and only one case was re-intervention for residual aneurysm. Consequently, OR demonstrated few long-term aortic related re-interventions in ruptured cases. The development of a new device in EVAR will reduce long-term aortic related re-intervention.

Conclusion

Compared with other studies, the early outcome of OR for RAAA in this study was satisfactory. Preoperative shock was the strong predictor of 30-day mortality. To improve early outcome, it is important to control preoperative hemodynamic instability. OR had fewer long-term aortic related re-interventions than EVAR. RAAA has morphologic or hemodynamic variety, and it is thus necessary to choose the optimal treatment on a case-by-case basis.

References

1. Yusuf SW, Whitaker SC, Chuter TA, Wenham PW, Hopkinson BR. Emergency endovascular repair of leakingaortic aneurysm. Lancet. 1994;344(8937):1645.

2. Davenport DL, O'Keeffe SD, Minion DJ, Sorial EE, Endean ED, Xenos ES. Thirty-day NSQIP database outcomes of open versus endoluminal repair of ruptured abdominal aortic aneurysms. J Vasc Surg. 2010;51(2):305-9.

3. Mehta M, Byrne J, Darling RC 3rd, Paty PS, Roddy SP, Kreienberg PB, et al. Endovascularrepair of ruptured infrarenal abdominal aortic aneurysm is associated with lower 30-day mortality and better 5-year survival rates than open surgical repair. J Vasc Surg. 2013;57(2):368-75.

4. Reimerink JJ, Hoornweg LL, Vahl AC, Wisselink W, van den Broek TA, Legemate DA, et al. Endovascularrepair versus open repair of ruptured abdominal aortic aneurysms: a multicenter randomized controlled trial. Ann Surg. 2013;258(2):248-56.

5. IMPROVE Trial Investigators; Powell JT, Sweeting MJ, Thompson MM, Ashleigh R, Bell R, et al. Endovascular or open repair strategy for ruptured abdominal aortic aneurysm: 30 day outcomes from IMPROVE randomised trial. BMJ. 2014;348:f7661.

6. Karkos CD, Harkin DW, Giannakou A, Gerassimidis TS. Mortality after endovascular repair of ruptured abdominal aortic aneurysms: A systematic review and meta-analysis. Arch Surg. 2009;144(8):770-8.

7. Henry T. Bahnson. Considerations in the excision of aortic aneurysms. Ann Surg. 1953;138(3):377-86.

8. Parodi JC, Palmaz JC, Barone HD. Transfemoral intraluminal graft implantation for abdominal aortic aneurysms. Ann Vasc Surg.1991;5(6):491-9.

9. Kapma MR, Verhoeven EL, Tielliu IF, Zeebregts CJ, Prins TR, der Heij BV, et al. Endovascular treatment of acute abdominal aortic aneurysm with a bifurcated stentgraft. Eur J Vasc Endovasc Surg. 2005;29(5):510-5.

10. Chagpar RB, Harris JR, Lawlor DK, DeRose G, Forbes TL. Early mortality following endovascular versus open repair of ruptured abdominal aortic aneurysms. Vasc Endovascular Surg. 2010;44(8):645-9.

11. Mayer D, Aeschbacher S, Pfammatter T, Veith FJ, Norgren L, Magnuson A, et al. Complete replacement of open repair for ruptured abdominal aortic aneurysms by endovascular aneurysm repair: A two-center 14-year experience. Ann Surg. 2012;256(5):688-95.

12. Veith FJ, Lachat M, Mayer D, Malina M, Holst J. Collected world and single center experience with endovascular treatment of ruptured abdominal aortic aneurysms. Ann Surg. 2009;250(5):818-24.

13. Desgranges P, Kobeiter H, Katsahian S, Bouffi M, Gouny P. ECAR (Endovasculaireou Chirurgie dans les Anévrysmes aorto-iliaquesRompus): A French Randomized Controlled Trial of Endovascular Versus Open Surgical Repair of Ruptured Aorto-iliac Aneurysms. Eur J Vasc Endovasc Surg. 2015;50(3):303-10.

14. Rubenstein C, Bietz G, Davenport DL, Winkler M, Endean ED. Abdominal compartment syndrome associated with endovascular and open repair of ruptured abdominal aortic aneurysms. J Vasc Surg. 2015;61(3):648-54.

15. Healey CT, Neilson M, Clark D, Schanzer A, Robinson W; Vascular Study Group of New England None. Predicting mortality of ruptured

abdominal aortic aneurysms in the era of endovascular repair. Ann Vasc Surg.2017;38:59-63.

16. Mattox KL, McCollum WB, Jordan GL Jr, Beall AC Jr, DeBakey ME. Management of upper abdominal vascular trauma. Am J Surg. 1974;128(6):823-8.

17. Coselli JS, LeMaire SA, Büket S, Berzin E. Subsequent proximal aortic operations in 123 patients with previous infrarenal abdominal aortic aneurysm surgery. J Vasc Surg. 1995;22(1):59-67.

18. Büket S, Atay Y, Islamoğlu F, Yağdi T, Posacioğlu H, Alat I, et al. Proximal clamping levels in abdominal aortic aneurysm surgery. Tex Heart Inst J. 1999;26(4):264-8.

19. Malina M, Holst J. Ballooncontrol for ruptured AAAs: when and when not to use? J Cardiovasc Surg (Torino). 2014;55(2):161-7.

20. Mehta M, Paty PS, Byrne J, Roddy SP, Taggert JB. The impact of hemodynamic status on outcomes of endovascular abdominal aortic aneurysm repair for rupture. J Vasc Surg. 2013;57(5):1255-60.

21. Berland TL, Veith FJ, Cayne NS, Mehta M, Mayer D, Lachat M. Technique of supraceliac balloon control of the aorta during endovascular repair of ruptured abdominal aortic aneurysms. J Vasc Surg.2013;57(1):272-5.

22. Starnes BW, Quiroga E, Hutter C, Tran NT, Hatsukami T, Meissner M, et al. Management of ruptured abdominal aortic aneurysm in the endovascular era. J Vasc Surg. 2010;51(1):9-17.

23. Stather PW, Sidloff DA, Dattani N, Choke E, Bown MJ, Sayers RD, et al. Systematic review and meta-analysis of the early and late outcomes of open and endovascular repair of abdominal aortic aneurysm. Br J Surg. 2013;100(11):1541.

24. Schermerhorn ML, Buck DB, O'Malley AJ, Curran T, McCallum JC, Darling J, et al. Long-term outcomes of abdominal aortic aneurysm in the Medicare population. N Engl J Med. 2015;373(4):328-38.

25. Patel R, Sweeting MJ, Powell JT, Greenhalgh RM. Endovascular versus open repair of abdominal aortic aneurysm in 15-years' follow-up of the UK endovascular aneurysm repair trial1 (EVAR trial1): A randomised controlled trial. Lancet. 2016;388(10058):2366-74.

26. van Beek SC, Vahl A, Wisselink W, Reekers JA, Legemate DA, Balm R, et al. Midterm re-interventions and survival a endovascular versus open repair for ruptured abdominal aortic aneurysm. Eur J Vasc Endovasc Surg. 2015;49(6):661-8.