Outcomes of Open Repair In Patients with Non-Ruptured and Ruptured Abdominal Aortic Aneurysms: Siriraj Hospital Experience from 2002 to 2009

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Background: *Abdominal aortic aneurysms (AAAs) was very important in surgical practices. Open surgery has long been the standard for repair AAA. We conduct this study to determine outcome of open repair AAA in our center.*
Objective: *To study the outcomes of traditional surgical treatment for AAAs in a large series of patients who underwent open repair in both non-ruptured and ruptured groups.*
Material and Method: *From 2002 to 2009, all patients who underwent open repair and graft replacement of non-ruptured and ruptured AAAs were analyzed. Computerized perioperative data had been supplemented in the buddy scan program with a retrospective review of hospital charts/outpatient records. The primary outcome was 30-day mortality rate. The secondary outcomes were the length of hospital stay and the incidence rate of perioperative complications.*
Results: *During 2002 and 2009, 150 patients (119 men [79.3%], 31 women; mean age, 70±8 years) underwent the repair of AAAs. These patients were divided into two groups: 115 patients were in the non-ruptured group and 35 patients in the ruptured group. In non-ruptured group, the 30-day mortality was 4.34% (5 patients) and re-operative rate was 9.57% (11 patients). The complication rate was 37.4% and the post-operative hospital stay was 17 days. Regarding the ruptured group, the 30-day mortality was 10 from 35 patients (28.6%). The complication occurred in 30 patients (85.7%) and the most common organ complication was pulmonary (51.4%). The mean post-operative hospital stay was 24 days and the mean ICU stay was 11 days.*
Conclusion: *These results show that open repair of non-ruptured AAA maybe a safe procedure. Even in ruptured group, the outcome at our center was comparable with other studies.*

Keywords: *Abdominal aortic aneurysm*

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Abdominal aortic aneurysm (AAA) represent the thirteenth leading cause of death in the Western world[1] and previous study has suggested an increase in the incidence of AAAs in last three decades[2]. In Thailand AAA was very important in general surgical practices because of high incidence in elderly patients that were expected to increase number in the future, high propensity to rupture and high mortality rate when it ruptured. Even in western countries 30-day mortality after open repair ruptured abdominal aortic aneurysm (rAAA) was 48%[3]. In this era, we had two types of operation to repair AAA, conventional open repair and endovascular aortic repair (EVAR)[4].

Open surgery has long been the standard for repair AAA. Despite improvements in peri-operative care over the past two decades, early mortality in ruptured group remains common and estimates ranging from 45% to 50%[5-8]. Just like in non-ruptured group that 30-day mortality was 1.2% to 4.8%[9-11].

In Siriraj Hospital, we performed open repair as conventional method and EVAR was performed with selected cases in last 5 years. We still had few informations about outcomes of AAA treatment in Thailand. Then, we conduct this study to determine outcome of open repair AAA in ruptured and non-ruptured situation.

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Material and Method

In last 9 years, all inpatients data of Siriraj Hospital were recored in Buddy scan program. We used Buddy scan program to identify all the patients who underwent open repair of an AAA. In this study, we included all patients that were performed open repair for AAA in division of Vascular Surgery Department of Surgery Faculty of Medicine Siriraj Hospital Mahidol University between January 2002 and December 2009. We excluded patient who was performed EVAR or had thoracic aortic aneurysm. Methodology of this study was descriptive retrospective chart review then we recorded data in case record form and SPSS V.13 program.

We divided patients into 2 groups (1) Non-ruptured group, defined as patients who were found no ruptured or leakage of AAA. (2) Ruptured group, defined as patients who were found free rupture or concealed rupture of AAA. The documents of ruptured and non-ruptured AAA were confirmed by operative records and the interpretation of CT angiography.

The primary outcome of this study was operative mortality, defined as death during the initial hospitalization or death from any cause $\leq$30 days of the primary procedure. The secondary outcomes were (1) length of ICU stay, defined as length of total postoperative ICU admission (2) postoperative hospital stay, defined as length of postoperative hospital stay (3) Type and rate of complication, we separated into cardiac, non-cardiac and surgical complication. Although all complications were documented when we found any of the following events; cardiac complication (myocardial infarction, arrthymia or congestive heart failure), pulmonary complication (pneumonia, ARDS or pulmonary embolism), acute renal failure, sepsis, cerebrovascular events (CVA) or any surgical complications (abdominal compartment syndrome, bleeding, graft thrombosis, ischemic colitis, intraabdominal collection and wound infection).

We recorded all data in case record form and divided into 3 groups of data; demographic data, operative detail and outcome.

Statistical analysis

To determine outcome of open repair AAA, we compared operative data and outcome of non-ruptured and ruptured group. Tests of statistical significance were conducted with Chi-square or Fisher exact tests for categoric variables and analysis of variance for continuous variables with t-test. Descriptive statistics are listed as mean $\pm$ standard deviation for continuous variables and number (percentage) for categoric variables. Differences were considered significant if $p<0.05$. All statistical analyses were performed by SPSS program.

Results

From January 2002 through December 2009, 150 patients underwent open AAA repair in Division of Vascular Surgery Siriraj Hospital. 115 patients were operated in non-ruptured situation and 35 patients were operated in ruptured situation.

Demographic data and co-morbid factors were reported in Table 1, 2. In non-ruptured group, average age was 70 years and 90 patients (78%) were male. These results were same as in ruptured group. Mean aneurysmal diameter was higher in ruptured group but no statistical significance (7.2$\pm$1.5 cm vs. 6.1$\pm$1 cm, $p = 0.606$). Level of aneurysm was still no difference in both groups. Co-morbid factors were same in both groups except in ruptured group, we found more diabetes mellitus (8% vs. 34%, $p<0.001$) and less smoking (70% vs. 40%, $p = 0.003$) than non-ruptured group.

Table 1. Demographic data of all patients

Data	Non-ruptured (n = 115), n (%)	Ruptured (n = 35), n (%)	*p*-value
Age (years)	70$\pm$8.0	70$\pm$8.0	NS
Gender (male)	90 (78.0)	29 (83.0)	NS
Size of AAA (cm)	6.1$\pm$1.0	7.2$\pm$1.5	NS
Level			NS
Infrarenal	101 (93.0)	30 (86.0)	NS
Juxtarenal	13 (6.0)	5 (14.0)	NS
Suprarenal	1 (1.0)	0 (0.0)	NS
Iliac artery aneurysm	48 (42.0)	10 (29.0)	NS

About operative data that showed in Table 3, we used more operative times in non-ruptured group (335.8 vs. 277.4 min, $p = 0.005$). Blood loss (1,780 vs. 5,670 cc, $p<0.001$) and blood transfusion (4.1 vs. 13.5 units, $p<0.01$) were more in ruptured group as we expected. There was no statistical significant difference of aortic cross clamp time.

Primary and secondary outcomes were shown in Table 5 to 7, Operative mortality was about seven times higher in ruptured group (4.3% vs. 28.6%, $p<0.001$). In ruptured group, length of postoperative ICU stay was longer than non-ruptured group (4.6 vs. 11.5 days, $p = 0.002$), but postoperative hospital course had no statistical significant difference (17 vs. 24.4 days, $p = 0.072$). Overall complication was much more in ruptured group (37% vs. 86%, $p<0.001$) same as non-ischemic cardiac, pulmonary, sepsis and renal complication. Surgical complication rate was higher in ruptured group (18% vs. 49%, $p<0.001$), especially in bleeding and abdominal compartment syndrome. Re-intervention rate was 9.6% (11/115 patients) in non-ruptured group and 22.8% (8/35 patients) in ruptured group.

Discussion

Our study confirmed that open repair AAA in Siriraj Hospital had comparable outcome to western series in both non-ruptured and ruptured group. Recent UK EVAR trial compare outcome of open repair to EVAR that randomly assigned 1,252 patients with large

Table 2. Co-morbidity of patients

Underlying	Non-ruptured (n = 115), n (%)	Ruptured (n = 35), n (%)	*p*-value
Hypertension	89 (77.0)	27 (77.0)	NS
Diabetes mellitus	9 (8.0)	12 (34.0)	<0.001
Dyslipidemia	39 (34.0)	8 (23.0)	NS
Coronary arterial disease	30 (26.0)	10 (29.0)	NS
Smoking	80 (70.0)	14 (40.0)	0.003
Peripheral arterial disease	12 (10.0)	0 (0.0)	NS
Chronic kidney disease (Cr >2)	9 (8.0)	4 (11.0)	NS
COPD	22 (1.0)	5 (14.0)	NS

Table 3. Operative data

	Non-ruptured (n = 115)	Ruptured (n = 35)	*p*-value
Operative time (min)	335.8	277.4	0.005
Cross clamp time (min)	82.0	92.6	NS
Blood loss (cc)	1,780	5,670	<0.001
Blood transfusion (unit)	4.1	13.5	<0.001

Table 4. Outcome of open repair

	Non-ruptured (n = 115)	Ruptured (n = 35)	*p*-value
30-day mortality (%)	4.3	28.6	<0.001
Postoperative hospital course (day)	16.9±14	24.4±22	NS
Length of ICU stay (day)	4.6±5	11.5±11	0.002
Overall complication rate (%)	37.4	85.7	<0.001

Table 5. Postoperative complication

Complications	Non-ruptured (n = 115), n (%)	Ruptured (n = 35), n (%)	*p*-value
Overall	43 (37.4)	30 (85.7)	<0.001
Cardiac			
MI	6 (5.2)	4 (11.0)	NS
Non-MI	21 (18.0)	18 (51.0)	<0.001
Non-cardiac			
Pulmonary	21 (18.0)	18 (51.0)	<0.001
ARF	7 (6.0)	11 (31.0)	0.008
Sepsis	6 (5.0)	11 (31.0)	<0.001
Stroke	3 (3.0)	2 (6.0)	NS
Surgical complication	16 (14.0)	17 (49.0)	<0.001

Table 6. Surgical complication

Complications	Non-ruptured (n = 115), n (%)	Ruptured (n = 35), n (%)	*p*-value
Bleeding	2 (2.0)	9 (25.0)	<0.001
Abdominal compartment syndrome	1 (1.0)	5 (14.0)	0.003
Ischemic colitis	1 (1.0)	1 (3.0)	NS
Graft thrombosis	4 (3.0)	1 (3.0)	NS
Distal embolism	1 (1.0)	1 (3.0)	NS
Intraabdominal collection	3 (3.0)	2 (6.0)	NS
Wound infection	6 (5.0)	0 (0.0)	NS

abdominal aortic aneurysms (≥5.5 cm in diameter) to undergo either endovascular or open repair; 626 patients were assigned to open group. 30-day mortality in open group was 4.3%[12] that equal to our study (4.3%). Same result was found in Medicare population (4.8%)[9] Even in ruptured group, in 2010 Ryaz B. Chagpar et al found outcome of open repair for ruptured AAA had 30-day mortality 43.7%[13] that comparable to our study (28.1%).

In Asia, operative mortality was 2% for intact AAAs and 38% for ruptured AAAs from study of Cheng et al, 2003[14,15]. In Thailand, there was few study about outcome of AAA repair. In 2005, Sriussadaporn et al report outcome of open repair AAA that mortality of elective AAA repair was 4% and emergency aortic surgery was 41%[16]. The results of these studies was comparable to our study.

Then we look at our secondary outcome. In non-ruptured situation, Schermerhorn et al found that pulmonary complication was 17.4%, MI was 9.4%, acute renal failure 10.9% and mean length of stay was 9.3 days[9] that was comparable to our study. In ruptured group, Verhoeven et al report that re-intervention rate was 28.1%, mean length of ICU stay 3 days and mean length of hospital stay was 20 days[17]. These outcomes were comparable to our study.

In our study we found higher operative mortality and much more complication in ruptured group. The results were same as we expected due to ruptured patients may had unstable hemodynamic before surgery, more blood loss and need advanced surgical skill to repair AAA. Postoperative hospital stay and ICU stay was longer in ruptured patients due to more complication rate, especially in pulmonary complication (18% vs. 51%) and surgical complication (14% vs. 48.6%).

And in Table 3, operative time was longer in non-ruptured group (335 vs. 277 min, $p<0.01$) due to involvement of vascular surgery fellowship program in last 4 years and in ruptured situation we need to operate and cross clamp aorta rapidly. No difference in aortic cross clamp time in both group.

Then we preferred to repair AAA before it ruptured. We need to built better screening system to

include more AAA patients.

The limitation of this study was small number of ruptured patients due to lack of good database and chart record in our hospital in first 4 years of this study. We need other study that include more patients and better data record.

Conclusion

The results of open repair AAA in both ruptured and non-ruptured situation of our center were comparable to previous western and asian series. So that open repair AAA in non-ruptured situation was a safe procedure and lower morbidity and mortality than in ruptured situation. We need early screening program for AAA in elderly patients to include more patients for repair AAA before it ruptured.

What is already known on this topic?

Open repair AAA in non-ruptured situation was a safe procedure and lower morbidity and mortality than in ruptured situation. We found higher operative mortality and much more complication in ruptured group.

What this study adds?

This study show that open repair AAA in Siriraj Hospital had comparable outcome to western series in both non-ruptured and ruptured group. As well as other asian and thai series that had comparable outcome to our study.

Potential conflicts of interest

None.

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ผลการรักษาหลอดเลือดแดงใหญ่ในช่องท้องโป่งพองด้วยการผ่าตัดแบบเปิดในโรงพยาบาลศิริราช พ.ศ. 2545 ถึง 2552

ณัฐวุฒ พ่วงพันธุ์งาม, เฉนียน เรืองเศรษฐกิจ, คามิน ชินศักดิ์ชัย, ชุมพล ว่องวานิช, ณัฐวุฒิ เสริมสาธนสวัสดิ์, ประมุข มุทิรางกูร

ภูมิหลัง: โรคหลอดเลือดแดงใหญ่ในช่องท้องโป่งพองเป็นโรคที่มีความสำคัญในเวชปฏิบัติ ซึ่งการผ่าตัดเปิดเป็นการรักษามาตรฐาน การศึกษานี้ทำขึ้นเพื่อประเมินผลการรักษาด้วยการผ่าตัดในโรงพยาบาลศิริราช

วัตถุประสงค์: เพื่อศึกษาผลการรักษาหลอดเลือดแดงใหญ่ในช่องท้องโป่งพองโดยวิธีการผ่าตัดเปิด ทั้งในสถานการณ์ปกติและสถานการณ์ที่หลอดเลือดแดงโป่งพองแตก

วัสดุและวิธีการ: ศึกษาผู้ป่วยทุกรายที่เข้ารับการผ่าตัดรักษาหลอดเลือดแดงใหญ่ในช่องท้องโป่งพองทั้งในสถานการณ์ปกติและสถานการณ์ที่หลอดเลือดแดงโป่งพองแตกในช่วง พ.ศ. 2545-2552 ข้อมูลผู้ป่วย ได้จากการทบทวนประวัติผู้ป่วยย้อนหลังผู้ป่วยในและผู้ป่วยนอกผ่านระบบคอมพิวเตอร์ภายในโรงพยาบาลโดยศึกษาผลการรักษาหลักคือ อัตราการเสียชีวิตที่ 30 วันหลังผ่าตัด ผลการรักษารองคือ ระยะเวลาในการนอนโรงพยาบาลและอัตราการเกิดผลข้างเคียงหลังผ่าตัด

ผลการศึกษา: ระหว่างปี พ.ศ. 2545-2552 มีผู้ป่วยเข้ารับการรักษาหลอดเลือดแดงใหญ่ในช่องท้องโป่งพองด้วยวิธีผ่าตัดเปิด 150 ราย แบ่งผู้ป่วยออกเป็นสองกลุ่มเป็นกลุ่มหลอดเลือดแดงโป่งพองไม่แตก 115 ราย และ กลุ่มหลอดเลือดแดงโป่งพองแตก 35 ราย, ในกลุ่มที่ไม่แตกมีอัตราการเสียชีวิต 4.34% มีอัตราการเกิดผลข้างเคียงหลังผ่าตัด 37.4% และนอนโรงพยาบาลหลังผ่าตัดเฉลี่ย 17 วัน ในขณะที่กลุ่มที่หลอดเลือดแดงโป่งพองแตกอัตราการเสียชีวิต 28.6% อัตราการเกิดผลข้างเคียง 85.7% และนอนโรงพยาบาลหลังผ่าตัดเฉลี่ย 24 วัน

สรุป: ผลการศึกษานี้แสดงให้เห็นว่าการผ่าตัดรักษาหลอดเลือดแดงใหญ่ในช่องท้องโป่งพองด้วยวิธีการผ่าตัดเปิดในโรงพยาบาลศิริราชเป็นการรักษาที่ปลอดภัยได้มาตรฐาน แม้แต่ในกลุ่มที่หลอดเลือดแดงโป่งพองแตก ผลการรักษาในโรงพยาบาลศิริราชก็ยังเทียบเคียงได้กับการศึกษาในสถาบันมาตรฐานอื่น