
ORIGINAL RESEARCH

OUTCOME AFTER SURGICAL REPAIR OF SEALED RUPTURE ABDOMINAL AORTIC ANEURYSMS: A CASE-CONTROL STUDY

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OBJECTIVE: To establish, in a case-control study, the early mortality and long-term survival after surgical correction of sealed rupture abdominal aortic aneurysm, compared to controls who underwent standard, nonruptured abdominal aortic aneurysm repair.

PATIENTS AND METHODS: From January 1992 to December 2002, 465 patients underwent infrarenal abdominal aortic aneurysm repair. Of those, 13 had sealed rupture abdominal aortic aneurysm (2.8%). These cases were compared to 26 controls in which surgical repair was performed immediately preceding or succeeding each one of the sealed rupture abdominal aortic aneurysm surgeries.

RESULTS: Age, sex, risk factors for atherosclerosis, associated disease, and cardiac ischemia were similar between groups. Patients with sealed rupture abdominal aortic aneurysm presented a higher incidence of lumbar pain than controls (92.3% versus 3.9%; $P < .001$); fever and weight loss were detected in 5 (38.5%) patients with SAAA and in none of controls ($P = .0022$). Mean red blood cell transfusion was greater for sealed rupture abdominal aortic aneurysm than controls ($1,516 \pm 697$ vs. 773 ± 463 mL ($P = .0003$)). Postoperative complications were similar between groups. Early mortality was 7.7% for sealed rupture abdominal aortic aneurysm and 0% for controls. Five-year survival was significantly lower for sealed rupture abdominal aortic aneurysm (68.4%) than for controls (84.4%, $P = .04$).

CONCLUSION: We conclude that sealed rupture abdominal aortic aneurysm presents diagnostic and surgical challenges that can be adequately managed, achieving early postoperative mortality and complication rates that are similar to standard abdominal aortic aneurysm. However, patients with sealed rupture abdominal aortic aneurysm present higher mortality in the long term compared with patients having standard abdominal aortic aneurysm.

KEYWORDS: Abdominal Aortic Aneurysms. Sealed Rupture Aneurysms. Aortic Diseases.

INTRODUCTION

The main goal of the elective surgical treatment of an abdominal aortic aneurysm (AAA) is to prevent its rupture. Reported mortality rates from centers of excellence for elective surgical correction range from 0% to 5%.¹⁻³ For

ruptured AAAs, mortality rises to 90%, and it varies between 15% and 68% in those reaching the hospital alive and receiving emergency surgical treatment.^{4,5}

Szilagy et al⁵ described in 1961 a type of ruptured AAA, sealed rupture AAA, that presented special clinical features and thus differed markedly from the typical ruptured AAA (in terms of abdominal/lumbar pain, pulsatile mass, and hypovolemic shock). Since its diameter is frequently small, a pulsatile mass may not be detected. Limited retroperitoneal hematoma induces a clinical picture suggestive of retroperitoneal infection, with lumbar pain, fever, anorexia, and leucocytosis, without hemodynamic instability.

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Sealed rupture AAA is not common, comprising between 1.5% and 3.2% of all AAA,^{5,6} and these lesions are usually reported in small series or as case reports.⁶⁻⁸ Our goal was to present a case-control study reporting our experience with 13 cases of sealed rupture AAA (SRAAA) over 11 years. As controls we selected 26 patients with standard atherosclerotic AAA who underwent surgery immediately before and after each of the SRAAA surgeries.

PATIENTS AND METHODS

From January 1992 and December 2002, 465 consecutive patients with infrarenal AAA were operated on by a single surgeon (TPB). Amongst these, 13 (2.8%) were considered to have a SRAAA, defined as a ruptured aneurysm contained by an organized hematoma and fibrosis as determined by abdominal CT scan and/or during surgical procedure. Patients with recent retroperitoneal rupture, without fibrotic organization or vertebral body erosion were not considered to have a SRAAA. We performed a case-control study in which those 13 patients were compared to 26 nonselected patients with elective AAA who underwent surgery immediately before and after each of the SRAAA repair surgeries.

Risk factors, clinical features, surgical aspects, complications, and mortality were obtained from patients' charts, follow-up visits, and/or telephone conferences. We recorded age, sex, tobacco abuse, hypertension, pulmonary disease, diabetes, renal disease, coronary artery disease, cerebrovascular, and/or peripheral vascular disease. Clinical features recorded included abdominal and lumbar pain, weight loss, fever, routine laboratory exams, and abdominal CT scan. Arteriography was performed whenever peripheral vascular disease was detected or renal vascular disease was suspected.

Surgical procedures were performed using a standard technique. Aneurysm diameter, clamping time, type of repair, renal vein ligature, and use of fluid and blood were recorded. Postoperative complications, mortality and long-term survival were obtained for up to 10 years of follow-up.

Statistical analysis

For the statistical analysis, normality was verified by Lillieford's test. The Fisher exact test was used to establish differences between groups; for comparison between mean values of continuous normally distributed variables, the *t* test for independent samples was used. For variables not showing normal distribution, we employed the nonparametric Mann Whitney U test for comparison between groups for continuous variables. For survival com-

parison we used Kaplan-Meier curves. Statistical differences were declared for a *P* value less than .05.

RESULTS

There were no significant differences between the SRAAA and CAAA groups regarding age, sex, cardiovascular diseases, or other risk factors (Table 1). Patients with SRAAA presented more symptoms; 38.4% of them presented fever and weight loss (Table 2). Lumbar pain was the most common complaint, reported by 12 (92.3%) patients with SRAAA, while only 1 patient (3.8%) from AAA group reported pain (*P* <.001). White blood cells count showed no significant differences between groups (Table 2).

Table 1 - Demographics and risk factors for 13 patients with sealed rupture AAA (SRAAA) and 26 controls (CAAA)

| Demographics and risk factors | SRAAA n (%) | CAAA n (%) | <i>P</i> value |
|-------------------------------|-------------------------------------|------------------------|--------------------|
| Mean age (years) | 68.8 | 69.0 | .92 ^a |
| Sex (%) | Male 11 (84.6%) Female 2 (15.4%) | 25 (96.2%) 1 (3.8%) | .25 ^b |
| Tobacco use | 11 (84.6%) | 23 (88.5%) | >.99 ^b |
| Hypertension | 9 (69.2%) | 20 (76.9%) | .70 ^b |
| COPD | 6 (46.1%) | 10 (38.5%) | .74 ^b |
| Myocardial infarction | 4 (30.8%) | 9 (34.6%) | >.999 ^b |
| Angina | 3 (23.1%) | 3 (11.5%) | .38 ^b |
| Coronary artery bypass | 2 (15.4%) | 8 (30.8%) | .45 ^b |
| Diabetes mellitus | 0 | 7 (26.9%) | .07 ^b |
| Stroke | 0 | 1 (3.8%) | >.999 ^b |
| Chronic renal failure | 0 | 1 (3.8%) | >.999 ^b |

^a *t* test for independent samples. ^bFischer exact test

Table 2 - Clinical presentation and preoperative exams in 13 patients with sealed rupture AAA (SRAAA) and in 26 controls (CAAA)

| Clinical presentation | SRAAA n (%) | CAAA n (%) | <i>P</i> value |
|---|-------------|------------|----------------|
| Asymptomatic | 0 | 18 (69.2%) | <.001 |
| Lumbar pain | 12 (92.3%) | 1 (3.8%) | <.001 |
| Epigastric pain | 2 (15.4%) | 5 (19.2%) | >.999 |
| Diffuse abdominal pain | 7 (53.8%) | 4 (15.4%) | .02 |
| Fever | 5 (38.5%) | 0 | .002 |
| Weight loss | 5 (38.5%) | 0 | .002 |
| White blood cells count >10.000 / mm ³) | 9 (69.2%) | 9 (34.6%) | .09 |

Fisher exact test

An abdominal CT scans were obtained for 12 (92.3%) patients with SRAAA and for 8 (30.8%) patients with CAAA (*P* = .0004). Ultrasonography was performed in 9 (69.2%) patients with SRAAA and in 20 (76.9%) with CAAA. Only 4 patients (15.4%) with CAAA underwent arteriography. The mean aortic aneurysm diameter was 7.3

± 3.7 (mean \pm SD) in SRAAA and 5.8 ± 1.3 cm in CAAA ($P = .07$).

All patients with SRAAA presented a contained aortic rupture, which was posterior in 11 (84.6%) and anterior-posterior in 2 (15.4%) cases. Representative CT scans and intraoperative findings show a posterior rupture with hematoma (Figure 1, top), posterior rupture with hematoma (Figure 1, middle), and vertebral body exposure (Figure 1, bottom).

Aortic reconstruction techniques were similar in patients with SRAAA and AAA (Table 3). The left renal vein was

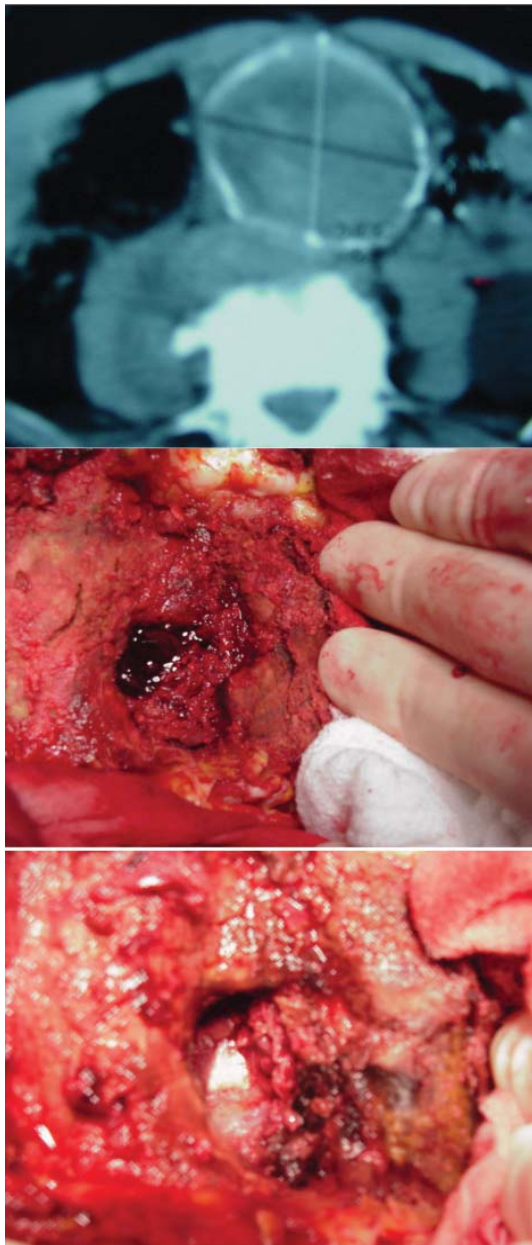


Figure 1 - Representative CT scan and intraoperative findings show a posterior rupture with hematoma (top), posterior rupture with hematoma (middle), and vertebral body exposure (bottom)

ligated in 3 (23.1%) SRAAA patients and in none of the CAAA patients. The mean red blood cell transfusion volume was greater in SRAAA patients ($1,516 \pm 697$ mL) than in AAA patients (773 ± 463 mL; $P = .0003$). A local inflammatory reaction was observed in 4 patients with SRAAA (30.7%) and in none with AAA.

Table 3 - Aortic reconstruction technique in 13 patients with SRAAA and 26 controls (CAAA). Fischer's exact test

| Aortic reconstruction | SRAAA n (%) | CAAA n (%) | P value |
|---|----------------|---------------|---------|
| Aorto-aortic | 1 (7.7%) | 2 (7.7%) | >.999 |
| Aortic-iliac | 6 (46.1%) | 16 (61.5%) | .496 |
| Aortic-bifemoral | 3 (23.1%) | 6 (23.1%) | >.999 |
| Left aortic-iliac and right aortic femoral | 2 (15.4%) | 2 (7.7%) | .59 |
| Right aortic-iliac and left aortic femoral | 1 (7.7%) | 0 | .33 |
| Total | 13 (100%) | 26 (100%) | |

Postoperative complications were observed in 7 (53.8%) patients with SRAAA and in 8 (30.8%) patients with AAA ($P = .19$) (Table 4).

Table 4 - Postoperative complications in 13 patients with SRAAA and 26 AAA controls (CAAA). More than 1 complication per patient. (Fischer exact test)

| Postoperative complications | SRAAA n (%) | CAAA n (%) | P |
|-----------------------------|----------------|---------------|-------|
| Vascular | 2 (15.4%) | 0 | .11 |
| Gastrointestinal/abdominal | 3(23.1%) | 2(7.7%) | .31 |
| Pulmonary | 2 (15.4%) | 4 (15.4%) | >.999 |
| Urinary | 1 (7.7%) | 1 (3.8 %) | >.999 |
| Wound infection | 1 (7.7 %) | 3(11.5%) | >.999 |
| Barotrauma | 1 (7.7 %) | 0 | .33 |
| Bleeding | 0 | 2 (7.7%) | .54 |
| Morbidity (total patients) | 7 (53.8%) | 8 (30.8%) | 0.19 |

There was 1 early death (7.7%) from acute myocardial infarction on the 23rd postoperative day in a patient with SRAAA, while no one died during the first 30 days after AAA repair ($P = .33$). The Kaplan-Meyer curves showed that the 5-year survival rate after SRAAA repair (68.4%) was lower than after CAAA repair (84.4%, $P = .04$, log-rank test) (Figure 2). Causes of late deaths after SRAAA repair were the following: pulmonary disease in 2 cases, and 1 case each of ruptured thoracic aneurysm, cardiac failure, gastrointestinal hemorrhage, and multiple organ failure.

DISCUSSION

Deformation of the walls of the aorta and of main arteries are important pathological alterations which require

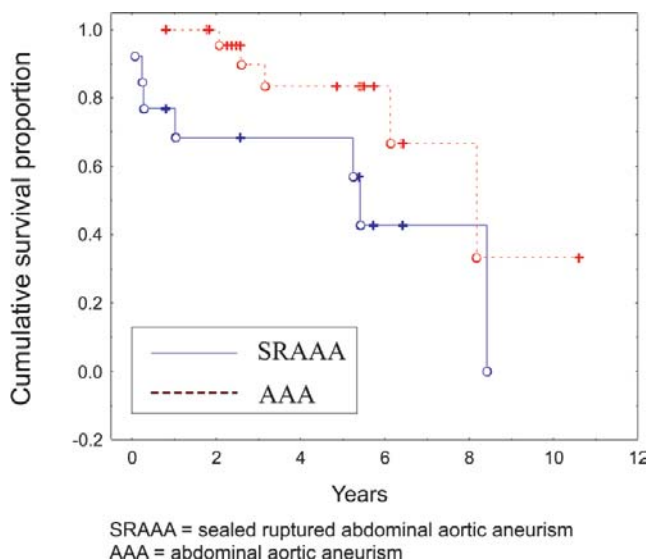


Figure 2 - Kaplan-Meier curves for 13 patients with sealed ruptured AAA (SRAAA) and 26 controls (AAA)

adequate diagnosis and treatment.^{9,10} Our findings are in accordance with most case reports, as our patients with SRAAA were more symptomatic, with a significant increase in lumbar and abdominal pain, weight loss, fever, and leucocytosis than those presenting standard AAA. Most of the contained ruptures (84.6%) were posterior, with local inflammatory reaction present in one third of them, all of which is similar to has been described elsewhere.^{6-8,11} Correction of SRAAA was associated with longer intraoperative duration and greater use of blood transfusion. Early mortality was observed in only 1 patient with SRAAA, while 5-year survival was significantly lower for patients with SRAAA (64.4%) than those with standard AAA (84.4%).

Sealed rupture aneurysms present two main challenges. The first is early detection. In the 1960s when SRAAA was initially described, delayed diagnosis was the rule and mortality was high. In 1965, Szilagyi et al⁷ presented a series of 7 SRAAA patients with a clinical picture suggestive of sepsis. From those, 6 patients underwent surgical treatment, with a mortality of 85%. Correct preoperative diagnosis was possible in only 4 patients, and the patient who did not undergo surgery died on the fifth day receiving antibiotics for a presumed pyelonephritis. Lack of diagnosis could be attributed at that time to the limited availability of imaging exams (abdominal plain radiography and urography) and the unknown clinical picture of SRAAA.⁷

With the development of ultrasonography, AAAs came to be easily detected, but still was there no adequate accuracy for retroperitoneal collections.⁸ Eventually the abdominal CT scan became the gold standard for detecting

SRAAA, which was characterized as an AAA with a posterior rupture, a hematoma in continuity with the abdominal wall, and vertebral body alterations.^{8,11} SRAAA must be suspected whenever an aging patient with AAA presents abdominal or lumbar pain, fever, or leukocytosis. In our series of 13 patients with SRAAA, lumbar pain was the most important symptom. Abdominal CT scanning had a 90% sensitivity and a 100% specificity in diagnosing SRAAA. Aneurysms with a diameter less than 6.0 cm were observed in 53% of the patients with SRAAA. This finding suggests that whenever lumbar pain is detected in association with small aneurysms, an emergency CT scan must be performed.^{12,13} Differential diagnosis must be made with regard to other conditions, principally those suggestive of abdominal sepsis, cancer, and discopathies.^{7,8,14}

The second challenge is the operative management of SRAAA. Although the risk factors were similar to those with standard AAA in our series, patients with SRAAA presented more frequent signs of inflammatory response and weight loss. Moreover, management of SRAAA was more technically difficult than standard AAA, with inflammatory reaction in one third of the SRAAA cases, resulting in a more time-demanding procedure that requires a larger use of blood products. This inflammatory reaction in SRAAA is typically posterior and lateral, which is different from that of the inflammatory AAA, where inflammation affects the anterior and lateral aneurysm walls.^{15,16} In spite of these technical issues, the type of repair was similar between SRAAA and standard AAA.

Some authors have concluded that SRAAA is a condition of immediate risk for free rupture and shock.^{7,16,17} On the other hand, others considered it to be a stable condition that can be managed after a complete preoperative evaluation, thereby decreasing the 15% mortality rates reported for emergency but nonruptured AAA.^{12,17,18} In our series, all patients underwent surgery after a careful preoperative evaluation, resulting in only 1 death during the initial 30-days. Outcome after SRAAA repair was excellent, with complete relief of pain and fever, and with weight gain. The mean survival after SRAAA repair was 40.8 months, and 6 patients remain alive.

Sealed rupture AAA is a rare condition. We believe that our study is a contribution to the understanding of this surgical challenge. Care must be taken in extrapolating our results to other centers. In our study, every patient was operated on by a single surgeon who is dedicated to the repair of aortic diseases. Also, the same anesthetists and intensivists provided care for these patients. We strongly believe that dedication and experience are needed to achieve good results. By using the case-control methodology we avoided bias related to different routines and

techniques that might have changed over this long period of time.

CONCLUSION

We conclude that sealed rupture AAA presents diagnos-

tic and surgical challenges that can be adequately managed, achieving early postoperative mortality and complication rates similar to those of standard AAA. However, patients with SRAAA present higher mortality in the long-term follow-up than do patients with regular AAA.

RESUMO

Bonamigo TP, Becker M, Weber ELSW, Bianco C, Miranda Jr. F, Figueiredo LFP de. Resultado do tratamento operatório do aneurisma da aorta abdominal roto contido crônico: estudo caso-controle. Clinics. 2006;61(1):29-34.

OBJETIVO: Estabelecer, através de um estudo caso-controle, a mortalidade precoce e sobrevida a longo prazo após o tratamento cirúrgico do aneurisma da aorta abdominal roto contido crônico comparada aos respectivos controles, submetidos ao reparo do aneurisma da aorta abdominal não roto, operado eletivamente.

PACIENTES E MÉTODO: De Janeiro de 1992 a Dezembro de 2002, 465 pacientes foram submetidos ao reparo de aneurismas da aorta abdominal. Destes, 13 eram aneurisma da aorta abdominal roto contido crônico (2,8%), que foram comparados a 26 controles nos quais a correção eletiva do aneurisma ocorreu imediatamente antes e após a correção do aneurisma da aorta abdominal roto contido crônico.

RESULTADO: Não houve diferença entre os grupos com relação a idade, sexo, fatores de risco para aterosclerose, doenças associadas e cardiopatia isquêmica. Pacientes com aneurisma da aorta abdominal roto contido crônico apresentaram maior incidência de dor lombar (92,3% ver-

sus 3,9%; $p < 0,001$); febre e perda ponderal foram detectados em cinco (38,5%) dos pacientes com aneurisma da aorta abdominal roto contido crônico e em nenhum dos controles ($p = 0,0022$). A média de transfusão de hemácias também maior no aneurisma da aorta abdominal roto contido crônico (1516 ± 697 vs. 773 ± 463 ml ($p = 0,0003$). As complicações pós-operatórias foram semelhantes entre os grupos. A mortalidade precoce foi de 7,7% nos pacientes com aneurisma da aorta abdominal roto contido crônico e 0% nos controles. A sobrevida em cinco anos foi significativamente menor nos portadores de aneurisma da aorta abdominal roto contido crônico (68,4%) do que no grupo controle (84,4%, $p = 0,04$).

CONCLUSÃO: Concluímos que o aneurisma da aorta abdominal roto contido crônico representa um desafio diagnóstico e terapêutico, que pode ser adequadamente conduzido com mortalidade precoce e taxas de complicações semelhantes ao aneurisma da aorta abdominal eletivo; entretanto, a mortalidade tardia do aneurisma da aorta abdominal roto contido crônico é maior.

UNITERMOS: Aneurisma da Aorta Abdominal. Aneurisma Roto Contido Crônico. Doenças da Aorta.

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