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Intra-abdominal Packing for Uncontrollable Haemorrhage During Ruptured Abdominal Aortic Aneurysm Repair

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Objective. Intra-abdominal packing is a valuable adjunct in patients with abdominal trauma and uncontrollable bleeding but few data exist regarding early and late outcome associated with this technique in patients with ruptured abdominal aortic aneurysm (AAA).

Methods. Interrogation of a prospective vascular surgical database identified 23 patients (22 men; median age 69, range 59–82, years) with ruptured AAA who required intra-abdominal packing for control of coagulopathic haemorrhage after insertion of an aortic graft between January 1982 and December 2003. Co-morbidity, operative and outcome data were retrieved.

Results. Haemostasis was achieved and packs were removed within 48 h in 20 patients. In those patients who had a graft inserted, the peri-operative mortality rate was 12 of 23 (52%) patients (vs. 172 of 455 (38%) patients who were not packed, NS). Three (13%) patients developed early intra-abdominal sepsis, which was universally fatal: graft-enteric fistula, intra-abdominal abscess with necrotizing fasciitis of the abdominal wound, and infected retroperitoneal haematoma. Two of 11 (18%) survivors developed late graft-related infective complications: major aortic graft infection at 6 months and symptomatic infected para-anastomotic aortic false aneurysm at 39 months. Early and late intra-abdominal infective complications were significantly more common in patients who were packed than in those who were not (packed: five of 23, 22% vs. non-packed: five of 455, 1%; $p < 0.001$).

Conclusion. These data demonstrate that intra-abdominal packing in coagulopathic patients with ruptured AAA can achieve an acceptable survival rate. However, this technique may be associated with an increased incidence of early and late intra-abdominal infective complications.

Keywords: Abdominal packing; Ruptured aortic aneurysm.

Introduction

Uncontrollable haemorrhage during ruptured abdominal aortic aneurysm (AAA) repair is a major cause of peri-operative mortality.^{1,2} In patients with coagulopathic haemorrhage, the administration of fresh frozen plasma, platelets, cryoprecipitate and antifibrinolytic agents may be insufficient to restore normal haemostatic function in the face of persistent hypoperfusion, acidosis and hypothermia at the end of the operation.³ In this clinical situation, intra-abdominal packing may tamponade further bleeding and allow optimisation of organ perfusion and correction of metabolic disturbances in the intensive therapy

unit. While the results of intra-abdominal packing have been reported extensively in patients with abdominal trauma,⁴ there are few data in patients with ruptured AAA.^{5,6} The aim of this study was to examine the early and late outcome of patients with ruptured AAA who require intra-abdominal packing for uncontrollable coagulopathic haemorrhage after insertion of an aortic graft.

Methods

Interrogation of a prospective computerized vascular surgical database identified 509 patients (425 men and 84 women; median age 72, range 49–97, years) who underwent attempted repair of ruptured AAA at the Royal Adelaide Hospital between January 1982 and December 2003. In 23 (4.5%) patients (22 men; median

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age 69, range 59–82, years), intra-abdominal packing was performed for uncontrollable coagulopathic haemorrhage after insertion of an aortic graft. Clinico-pathological and co-morbidity data are shown in Table 1. All patients underwent transperitoneal aneurysm repair under general anaesthesia.

Haemorrhage manifest as bleeding from the surgical anastomoses and the area of operative dissection where previously haemostasis had been achieved. In all patients, the aortic graft had been implanted in a technically adequate manner and there were no iatrogenic vascular injuries. A decision was made to proceed to temporary abdominal closure with intra-abdominal packing if bleeding persisted despite a period (usually up to 30 min) of packing, warming, fluid resuscitation and blood product replacement in the operating room. Antifibrinolytic agents were not used during the study period. Intra-abdominal packing was performed in a standard manner: large dry abdominal gauze packs were placed tightly over the area of surgical dissection, the closed aneurysm sac, surgical anastomoses, the supracoeliac aorta if this was exposed for cross-clamping, and the disrupted retroperitoneal haematoma. In all patients, the abdominal wall was closed over the packs using standard abdominal closure techniques. All patients were given broad spectrum intravenous antibiotics until re-laparotomy was performed to remove the intra-abdominal packs.

The following clinico-pathological data were retrieved from the database: co-morbidity, operative details, post-operative complications and outcome. Operative mortality was defined as death within 30 days of surgery or during the same hospital

admission. Post-operative complications were defined as early if they occurred within 30 days of ruptured AAA repair or during the index hospital admission, and late if they occurred beyond 30 days or during a subsequent hospital admission.

The Chi-square and Fisher's exact tests were used for statistical analysis. A probability value of less than 0.05 was considered statistically significant.

Results

Early outcome

Intra-abdominal packs were successfully removed within 24 h in six patients and on the second post-operative day in 13 patients. In one patient, laparotomy was performed using a modified 'Bogota bag' technique on the second post-operative day and the abdomen was subsequently closed on post-operative day 10. In one patient, adequate haemostasis had not been obtained at 24 h and re-packing was performed and the packs successfully removed at 48 h. Three (13%) patients died within 24 h of operation from exsanguination and did not undergo re-laparotomy. Twelve of 23 (52%) patients died in the post-operative period. Causes of death were multiple organ dysfunction ($n=5$), haemorrhage ($n=3$), bowel ischaemia ($n=1$), aorto-enteric fistula ($n=1$) and intra-abdominal sepsis ($n=2$).

Three (11%) patients developed early intra-abdominal infective complications, all of which were fatal. A 70-year-old man with a history of myocardial infarction (MI), ischaemic heart disease (IHD) and coronary artery bypass grafting (CABG) underwent aneurysm repair with a dacron aorto-bi-iliac graft. Abdominal packs were removed on the second post-operative day. On post-operative day 30, the patient presented with a graft-enteric fistula and died during attempted repair. The second patient was a previously healthy 76-year-old man who underwent aneurysm repair with a PTFE aorto-bifemoral graft. Abdominal packs were removed uneventfully on the second post-operative day but over the subsequent 3 days, the patient developed sepsis syndrome in association with a severe infection of the abdominal wound. Exploratory laparotomy confirmed gangrene of the entire thickness of the abdominal wall with widespread purulent peritonitis and no intra-abdominal visceral pathology. After peritoneal lavage and extensive debridement of the abdominal wall, the skin was approximated and the patient returned to the ITU. The patient died on post-operative day 11 from multiple organ

Table 1. Clinico-pathological data in packed and non-packed patients after ruptured AAA repair

	Packed ($n=23$)	Non-packed ($n=455$)	<i>p</i>
Median (range) age	69 (59–82)	72 (49–97)	NS
Gender	22M, 1F	379M, 76F	NS
Graft configuration			
Aorto-aortic	13	284	NS
Aorto-iliac	5	127	NS
Aorto-femoral	5	44	NS
Graft material			
Polytetrafluoroethylene	11	147	NS
Dacron	12	308	NS
Co-morbidity			
Hypertension	11	214	NS
Ischaemic heart disease	9	143	NS
Previous myocardial infarction	4	57	NS
Coronary artery bypass grafting	3	11	0.025
Diabetes mellitus	3	33	NS
Chronic obstructive pulmonary disease	4	86	NS

dysfunction. The final patient was 68-year-old man who underwent emergency aneurysm repair with a dacron aorto-bifemoral graft. Co-morbidity included previous MI, IHD, CABG and hypertension. Abdominal packs were removed uneventfully on the second post-operative day. Post-operative recovery was initially complicated by respiratory failure. On post-operative day 24, the patient developed sepsis syndrome and emergency abdominal computed tomography demonstrated an infected retroperitoneal haematoma, which was treated by percutaneous drainage. The patient's clinical condition deteriorated and he died on post-operative day 28.

Late outcome

Two of 11 (18%) patients who were discharged from hospital alive subsequently developed late graft-related infective complications. One patient (66-year-old man) presented with an aortic graft infection 6 months after ruptured AAA repair with a dacron tube graft and successfully underwent aortic graft excision and reconstruction with superficial femoral vein. Bacteriological culture of the prosthetic graft and peri-graft collection isolated *Staphylococcus epidermidis*, *Streptococcus viridans*, *Pseudomonas aureginosa* and *Candida albicans*. The second patient (62-year-old man) presented with a symptomatic non-ruptured infected distal para-anastomotic false aneurysm 39 months after ruptured AAA repair with a PTFE tube graft. Bacteriological culture of the graft isolated *S. epidermidis* and *Diphtheroid* species. The patient underwent successful open repair of the false aneurysm with an aorto-bi-iliac PTFE graft.

One further patient (69-year-old man) presented with a symptomatic non-ruptured true suprarenal aortic aneurysm 56 months after ruptured AAA repair with dacron tube graft. There was no evidence of graft infection and the patient underwent open aneurysm repair but died within 24 h from an MI.

Comparisons with patients who did not require intra-abdominal packing (Table 1)

An aortic graft was inserted in 455 of 486 patients who were not packed. Of the 455 patients who were not packed, five (1%) developed graft-related infective complications: two died from aortic graft infection during the index hospital admission and three patients underwent successful re-operation for late graft-related infective complications. Early and late intra-abdominal infective complications were significantly more common in patients who were packed than in

those patients who were not (packed: five of 23, 22% *vs.* non-packed: five of 455, 1%; $p < 0.001$). There was no significant difference in peri-operative mortality between the groups (packed: 12 of 23, 52% *vs.* non-packed: 172 of 455, 38%; NS). There was no significant difference in proportion of patients who were men (packed: 22 of 23, 96% *vs.* non-packed: 379 of 455, 83%; NS). Significantly more patients in the packed group had undergone previous coronary artery bypass grafting (packed: three of 23, 13% *vs.* non-packed: 11 of 455, 2.4%; $p = 0.025$).

Discussion

While intra-abdominal packing has gained popularity in patients with abdominal trauma,⁴ few data exist regarding the efficacy and long-term sequelae of this surgical technique in patients with ruptured AAA. In a recent report from The Netherlands,⁵ abdominal packing was used in 46 of 165 (28%) patients with ruptured AAA who survived beyond the immediate peri-operative period and was associated with a survival rate of 41%. More recently, Finlay *et al.*⁶ described three patients who developed coagulopathy during ruptured AAA repair and were successfully managed by intra-abdominal packing and temporary laparostomy.

In our experience, temporary abdominal closure and intra-abdominal packing was only used in patients who remained hypothermic, acidotic and coagulopathic despite intra-operative packing, warming, resuscitation and blood product replacement. In the present study, packing was considered necessary in a small proportion of patients and the survival rate was not significantly different from patients with ruptured AAA in whom packing was not necessary. In the majority of patients, packing achieved sufficient temporary control of bleeding to allow correction of tissue perfusion, hypothermia and haemostatic function before planned return to the operating theatre. In a small proportion of patients, it was evident within a few hours that the technique had not adequately controlled bleeding and, in view of the patients' poor general condition re-exploration was not performed. Emergency re-operation has, however, been advocated in abdominal trauma patients who are normothermic and have evidence of on-going bleeding requiring transfusion of more than two units of red cell concentrate per hour.⁷

While the impressive early salvage rate afforded by intra-abdominal packing seems to justify its use in this difficult clinical situation, one potential adverse consequence is an increased risk of intra-abdominal

septic complications. Prolonged packing has been shown to be associated with increased abscess, sepsis and mortality rates^{4,7-9} and, consequently, pack removal is recommended once acidosis, temperature and coagulopathy have been corrected and preferably within 36 h. A recent report in patients with abdominal trauma demonstrated that microbiological cultures of intra-abdominal packs were positive for skin and gut flora in 69% of cases. While there is little doubt that intra-abdominal packs and haematoma are a nidus for bacterial growth, the clinical significance of this growth in patients with abdominal trauma is uncertain.¹⁰ There are no reports of the results of microbiological culture of intra-abdominal packs used in patients with ruptured AAA. However, in the absence of an iatrogenic bowel injury, one would expect to isolate predominantly skin rather than gut microorganisms from the intra-abdominal packs in ruptured AAA. In the Dutch study, there were no early post-operative wound or intra-abdominal septic complications and no late graft-related infective complications at a median of 39 months. This is in contrast to our experience, where three of 14 patients whose packs were removed at 48 h developed fatal intra-abdominal sepsis and two further patients presented with late graft-related infective complications. There were no cases of intra-abdominal sepsis in the six patients whose packs were removed within 24 h of aneurysm repair. Of the 455 patients with ruptured AAA who had a graft inserted and were not packed, five (1%) developed graft-related infective complications: two died from aortic graft infection during the index hospital admission and three patients underwent successful re-operation for late graft-related infective complications.

In conclusion, intra-abdominal packing can achieve acceptable survival rates in coagulopathic patients with ruptured AAA but concerns exist regarding the possibility of secondary intra-abdominal infective complications. In this group of patients, broad spectrum intravenous antibiotic prophylaxis,

aggressive correction of temperature, acidosis and haemostasis in the ITU, and early pack removal should be mandatory. Routine microbiological culture and antibiotic sensitivity of retrieved abdominal packs may prove useful in the selection of those patients who may benefit from specific and prolonged antibiotic therapy. Further reports are required to determine the early and late outcome associated with this temporary abdominal closure and intra-abdominal packing in coagulopathic patients with ruptured AAA.

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