

Reoperative surgery on the thoracoabdominal aorta

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ABSTRACT

Objective: Since the advent of endovascular repair for aortic aneurysms, many centers have justified the use of endovascular approaches in patients with previous open distal aortic repair by deeming these patients “high risk” because of their previous operation. We sought to determine whether patients who undergo reoperative repair for thoracoabdominal aortic aneurysm (TAAA) have worse outcomes than patients who undergo non-reoperative repair.

Methods: We reviewed our data on 3379 TAAA repairs from 1986 to 2016. We compared patients’ preoperative characteristics, surgical variables, and outcomes among reoperative (n = 726) and non-reoperative (n = 2653) cases. Furthermore, we examined reoperative indications to identify repairs performed because of repair failure (n = 93) and reoperations performed as an adjacent extension of repair (n = 633). A multivariable analysis was conducted to identify predictors of adverse events by using relevant preoperative and intraoperative factors.

Results: The operative mortality rate did not significantly differ between groups (8.1% for reoperative vs 7.3% for non-reoperative; $P = .5$); in addition, reoperative repair was not associated with an increased risk of adverse event. However, Kaplan-Meier survival analysis showed that over the first 10 years, the reoperative groups fared significantly worse than the non-reoperative group ($P < .001$) (survival estimates at 10 years: $23.9\% \pm 4.9\%$ for patients with repair failure, $28.4\% \pm 2.0\%$ for those with extension of repair, and $40.1\% \pm 1.1\%$ for non-reoperative repairs).

Conclusions: We were unable to detect noteworthy differences in early outcomes between reoperative and non-reoperative TAAA repair. However, mid-term results indicate worse survival for patients who undergo reoperative surgery. (J Thorac Cardiovasc Surg 2017; ■:1-11)

Reoperative surgery on the thoracoabdominal aorta is not uncommon. In our recent report of 3309 thoracoabdominal aortic aneurysm (TAAA) repairs,¹ more than one quarter of the repairs (n = 858; 25.9%) involved patients who had undergone a previous repair of the distal aorta (descending

thoracic, thoracoabdominal, or abdominal aorta). Other aortic centers have reported 13% to 22% rates of previous distal aortic repair in patients undergoing TAAA repair, with the bulk of previous repairs involving the infrarenal abdominal aorta.²⁻⁶

Since the advent of endovascular repair for aortic aneurysms, many centers have justified the use of endovascular approaches in patients with previous open aortic repair by deeming these patients “high risk” because of their previous operation.⁷ Concerns about enhanced risk are supported by the well-understood risk of bleeding and

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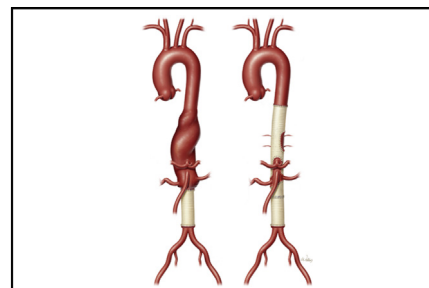
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Illustrations demonstrate a common form of reoperative thoracoabdominal aortic aneurysm repair.

Central Message

Reoperative TAAA repair yields respectable early outcomes that do not significantly differ from those of non-reoperative TAAA repair.

Perspective

Reoperative thoracoabdominal aortic surgery is typically necessitated by (1) complications of a previous open repair or (2) aortic disease that progresses into an aortic segment adjacent to an intact previous open repair. Although reoperative surgery may necessitate a modified approach, such repair produces respectable early outcomes that do not significantly differ from those of non-reoperative TAAA repair.

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Scanning this QR code will take you to supplemental table for this article.

Abbreviations and Acronyms

AAA	= abdominal aortic aneurysm
CSF	= cerebrospinal fluid
DTA	= descending thoracic aneurysm
TAAA	= thoracoabdominal aortic aneurysm

other complications during re-entry of potentially hostile thoracic and abdominal cavities, as well as by evidence suggesting elevated rates of paraplegia after TAAA repair in patients with previous open abdominal aortic aneurysm (AAA) repair.⁸ Conversely, other reports^{9,10} suggest that the risk of postoperative paraplegia can be reduced by “staging” open distal repairs to permit the development of a collateral network of arteries that can improve spinal perfusion between repairs. Despite considerable interest in these issues, the literature contains few reports that specifically describe TAAA repair after previous open descending thoracic aneurysm (DTA), TAAA, or AAA repair or that describe the risks associated with “redo” TAAA repair^{4,5,11-15}; thus, we sought to better assess the risk of paraplegia and other complications after reoperative TAAA repair, both in comparison with non-reoperative repair and by indication for reoperation.

PATIENTS AND METHODS

Study Enrollment and Patient Characteristics

Baylor College of Medicine’s institutional review board approved our clinical research protocol in 2006. For patients who underwent surgery after protocol approval, data were collected prospectively, and informed consent was obtained whenever possible; waiver of consent was approved for patients who could not provide consent because of illness and whose family members were not available. For patients who underwent surgery before protocol approval, data were collected retrospectively from medical records, and consent was waived.

We examined our experience involving 3379 TAAA repairs to identify factors associated with reoperation and to determine whether risk is greater in reoperative TAAA surgery than in non-reoperative surgery. We theorized that reoperative TAAA surgery is typically necessitated by 1 of 2 factors: (1) complications signaling the failure of a previous open repair (Figure 1) or (2) aortic disease that progresses into an aortic segment adjacent to an intact previous open repair (Figure 2).

Of 3379 TAAA repairs performed between 1986 and 2016, 726 repairs (21.5%) were identified as reoperative and the other 2653 repairs (78.5%) were considered non-reoperative (Figure 3). Indications for reoperation were characterized as TAAA repair failure (n = 93; 2.8%) or progression of disease necessitating extension of repair to an adjacent aortic segment (n = 633; 18.7%). To better elucidate the characteristics of patients in need of reoperative surgery after open repair, we did not include in the reoperative group patients who underwent operations performed after entirely endovascular aortic repairs, second-stage operations for completion of elephant trunk repair (if no other distal aortic repair had been performed previously; n = 140), or operations in which the previous repair involved a noncontiguous portion of the distal aorta (such as an extent I TAAA repair after a previous infrarenal AAA repair; n = 110) (Table 1). These repairs remained in the overall series but were categorized as non-reoperative TAAA repairs.

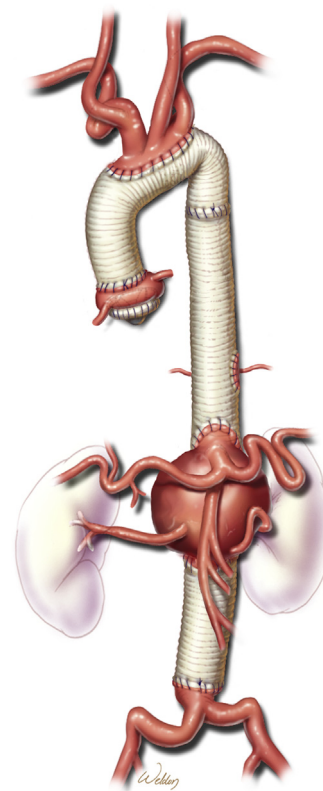


FIGURE 1. Drawing illustrates late repair failure of open TAAA surgery. In the residual native aortic tissue of the visceral patch, an aneurysm has formed.

Of the 93 repair failures, few involved graft infection (n = 5), graft-related fistula (n = 1), graft rupture (n = 2), or expansion after aortoplasty (n = 1). Most repair failures manifested as pseudoaneurysm (n = 44), patch aneurysm (n = 30), or both (n = 10). In the extension-of-repair group (n = 633), the majority of the previous distal open aortic repairs were infrarenal AAA repairs (436/633; 68.9%) (Table 1), and most of these were performed outside our center (572/633; 90.4%). In addition, 10.1% (n = 75) of the 726 reoperative repairs were made in patients with more than 1 previous distal open aortic repair; this proportion was 25.8% in the repair-failure group (ie, 24 of 93 patients had more than 1 previous distal aortic repair).

Study Definitions and Follow-up

As reported in recent publications, all preoperative, operative, and outcomes data were collected with the use of standard definitions.^{1,16} Reoperative surgery was defined as that necessitated by repair failure or that involved extension of a contiguous repair; any procedure that did not meet this criterion was considered non-reoperative. We defined repair failure as any complication of previous open distal aortic repair that necessitated aortic reoperation: pseudoaneurysm, patch aneurysm, expansion after aortoplasty, graft infection, graft rupture, or graft-related fistula. We defined extension of repair as repair necessitated by the progression of disease into aortic segments that are adjacent to and contiguous with the previously repaired segment; in most cases, the previously placed graft was left in place.

Patients were considered symptomatic if they had symptoms indicative of aortic disease (eg, pain, dysphagia, hoarseness). To estimate the glomerular filtration rate, we used the Chronic Kidney Disease Epidemiology Collaboration equation.¹⁷ Repairs were divided into 3 eras based on the adoption and use of key surgical adjuncts: Era 1

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