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REVIEW

Management of Secondary Aorto-enteric and Other Abdominal Arterio-enteric Fistulas: A Review and Pooled Data Analysis

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WHAT THIS PAPER ADDS

There is currently a lack of evidence for the relative effectiveness of open and endovascular techniques in managing arterio-enteric fistulas. The large number of patients ($n = 823$) included in the present review has made possible more accurate and direct comparisons among the various techniques, leading to the conclusion that endovascular surgery is associated with an early survival benefit compared with open surgery, but that this is reduced during long-term follow-up. A staged endovascular approach with early conversion in suitable candidates achieved the best results, which may be augmented by in situ repair, with vein grafts shown to have the best long-term results.

Objectives: To compare management strategies for secondary abdominal arterio-enteric fistulas (AEFs).

Methods: This study is a review and pooled data analysis. Medline and Scopus databases were searched for studies published between 1999 and 2015. Particular emphasis was given to short- and long-term outcomes in relation to AEF repair type.

Results: Two hundred and sixteen publications were retrieved, reporting on 823 patients. In-hospital mortality was 30.7%. Open surgery had higher in-hospital mortality (246/725, 33.9%), than endovascular methods (7/98, 7.1%, $p < .001$, OR 6.7, 95% CI 3–14.7, including staged endovascular to open surgery, 0/13, 0%). In-hospital mortality after graft removal/extra-anatomical bypass grafting was 31.2% (66/226), graft removal/in situ repair 34% (137/403), primary closure of the arterial defect 62.5% (10/16), and for miscellaneous open procedures 41.3% (33/80), $p = .019$. Among the subgroups of in situ repair, homografts were associated with a higher mortality than impregnated prosthetic grafts ($p = .047$). There was no difference in recurrent AEF-free rates between open and endovascular procedures. Extra-anatomical bypass/graft removal and in situ repair had a lower AEF recurrence rate than primary closure and homografts. Late sepsis occurred more often after endovascular surgery (2-year rates 42% vs. 19% for open, $p = .001$). The early survival benefit of endovascular surgery was blunted during follow-up, although it remained significant ($p < .001$). Within the in situ repair group, impregnated prosthetic grafts were associated with the worst overall and AEF related mortality free rates and vein grafts with the best. No recurrence, sepsis, or mortality was reported following staged endograft placement to open repair after a mean follow-up of 16.8 months ($p = .18$, $p = .22$, and $p = .006$, respectively, compared with patients in other groups).

Conclusions: Endovascular surgery, where appropriate, is associated with better early survival than open surgery for secondary AEFs. Most of this benefit is lost during long-term follow-up, implying that a staged approach with early conversion to in situ vein grafting may achieve the best results in selected patients.

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INTRODUCTION

Aorto-enteric and other secondary abdominal arterio-enteric fistulas (AEFs) are traditionally managed by graft explantation, aortic stump closure, and lower limb revascularization with axillo-bifemoral bypass grafting. Less radical solutions like primary closure of the aortic defect are considered inadequate, particularly because infection is not eradicated as the infected prosthetic graft is not removed. The former ("gold standard") procedure has been challenged however, by the possibility of aortic stump blowout, a risk that also remains during long-term follow-up. As a result, in situ bypass grafting using homografts, prosthetic or vein grafts was developed.[1,2] Not to be used in grossly infected fields, the prosthetic grafts can have wider application after extensive debridement of the retroperitoneal space, impregnation of the graft with antimicrobial substances (silver or rifampicin), and omental graft wrapping.[3,4] Nevertheless, the often dismal outcome regardless of the procedure used to repair the AEF has prompted the use of endovascular techniques during the last two decades to seal the leaking point, mostly by endograft deployment, in an effort to provide a minimally invasive solution to this vexing complication of open but also endovascular surgery. Initial enthusiasm soon faded, however, because often fatal recurrent bleeding and infection ensued during long-term follow-up, negating the initially good results, as was indeed shown by original studies and meta-analyses.[5–7] However, direct comparison of open and endovascular surgery remains scant,[5,6,8] and thus underpowered to reliably detect differences in outcome measures between these two treatment modalities and also among various subgroups.

The aim of the present study was to perform a review and pooled data analysis on the management of AEFs, with particular emphasis given to the relative effect of the various repair types on short- and long-term mortality and recurrent sepsis and fistulation.

MATERIALS AND METHODS

Search methodology

On April 23, 2016, Medline and Scopus databases were searched for case-controlled studies, case series, and case reports on secondary abdominal AEFs, published since 1999, when the first endovascular repair of an abdominal AEF was reported, and up to December 31, 2015. The combined search strategy included the following phrase (containing relevant keywords): "aorto-duodenal or aortoduodenal or aorto duodenal or aortoenteric or arterioenteric or aortojejunal or aortoileal or aortocolonic or arteriojejunal or arterioileal or arteriojejunal or aortogastric or arteriogastric or aorto-enteric or arterio-enteric or aorto-jejunal or aorto-ileal or aorto-colonic or arterio-jejunal or arterio-ileal or arterio-jejunal or aorto-gastric or arterio-gastric or aorto enteric or arterio enteric or aorto jejunal or aorto ileal or aorto colonic or arterio jejunal or arterio ileal or arterio jejunal or aorto gastric or arterio gastric". Duplicate records were removed. Studies and patients in which no intervention was performed or outcome reported, in which patients had isolated graft infection (often reported together with those having an AEF), and those describing AEFs resulting from organ transplantation or gastrointestinal surgery were excluded. Only original articles published in the English language were considered. Series on abdominal graft infection were not manually screened for AEF cases, unless identified by the search strategy. Where the outcomes of individual patients were not specified, the authors of the paper were contacted for details. Studies were sorted by the first author and the centre of origin to identify and exclude duplicate patient reports or studies, although those providing additional information in the form of long-term outcome were retained. Multicentre reports were also scrutinized to identify patients reported in either previous or subsequent publications, to exclude those as well. The reference lists of the retrieved articles and previous reviews on this topic were searched for potential studies eligible for inclusion.[7,9–12] In the case of a recurrent AEF, the patient was not excluded, but the first episode was taken into account as the index event.

Information retrieved

Extracted data included the title of the study, the surname of the first author, the centre, country, and geographic region where the study was performed, study specific patient identifiers, study type (e.g. case controlled study, case series, and case report), year of publication, patient age and gender, the type of the previous intervention that was complicated with the secondary AEF and also the time interval between this previous intervention (in case of multiple aortic/arterial procedures the most recent one was considered) and AEF management, patient presentation (bleeding, shock, sepsis), the exact level (arterial tree and GI tract) and type (true, true with anastomotic aneurysm, paraprosthetic)[4] of the AEF, the exact type of the procedure (arterial and GI) performed to treat the AEF but also adjunctive procedures (including omentoplasty), short-term and also long-term outcomes such as persistent or early post-operative sepsis and also in-hospital and 30 day mortality with cause of death, AEF recurrence and time interval, late sepsis and time interval, re-operation type, long-term mortality with cause of death and time interval until this occurred or the patient was censored/recorded as being alive. Missing values for time measures were not imputed. When a summary result (for example in the form of a mean or median age provided for a series of patients) but not the exact information for each characteristic was provided, this information was entered into the database and used only for summary statistics, and not for Kaplan-Meier curve plots.

Post-operative mortality was the primary outcome measure of the study, while recurrence, long-term sepsis, and mortality (including AEF related mortality) constituted the secondary outcomes.

Statistical analysis

All data were entered into a Microsoft Office Access database (Microsoft Inc., Redmond, WA, USA) and analyzed with

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