Eur J Vasc Endovasc Surg (2018) ■, 1—9

REVIEW

Elective Repair of Abdominal Aortic Aneurysm and the Risk of Colonic Ischaemia: Systematic Review and Meta-Analysis

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WHAT THIS PAPER ADDS

This is the largest and most contemporary analysis that demonstrates colonic ischaemia (CI) occurs more frequently in open repair (2.1—3.6%) than in EVAR (0.5—1%) in the elective setting. The majority of cases present within 7 days. There is insufficient evidence to determine whether there is a difference in rates of re-operation for CI between the two techniques but when colectomy is required, the mortality rate is high. Most randomised trials of OR versus EVAR do not specifically report colonic ischaemia and its sequelae and this should be addressed by future trials given the high morbidity and mortality.

Introduction: Colon ischaemia (CI) is a significant complication of open (OR) and endovascular (EVAR) repair of abdominal aortic aneurysm (AAA). With a rapid increase in EVAR uptake, contemporary data demonstrating the differing rates and outcomes of CI between EVAR and OR, particularly in the elective setting, are lacking. The aim was to characterise the risk and consequences of CI in elective AAA repair comparing EVAR with OR.
Methods: A systematic review and meta-analysis of the literature was performed using the Cochrane collaboration protocol and reported according to the PRISMA guidelines. PubMed, MedLine, and EMBASE were searched for studies reporting CI rates after elective AAA repair. Ruptured AAAs were excluded from analysis.
Results: Thirteen studies reporting specific outcomes of CI after elective AAA repair, containing 162,750 evaluable patients (78,151 EVAR and 84,599 OR) were included. All studies found a higher risk of CI with OR than with EVAR. Three studies performed confounder adjustment with CI rates of 0.5—1% versus 2.1—3.6% (EVAR vs. OR) and combined odds ratio of 2.7 (2.0—3.5) for the development of CI with OR versus EVAR. The majority of cases of CI occurred within 30 days and were associated with variable mortality (0—73%) and re-intervention rates (27—54%). GRADE assessment of evidence strength was very low for all outcomes. There was a high degree of heterogeneity between studies both methodologically and in terms of CI rates, re-intervention, mortality, and time to development of CI.
Conclusions: EVAR is associated with a reduced incidence of CI compared with OR.

Article history: Received 16 October 2017, Accepted 5 March 2018, Available online XXX
Keywords: Ischaemia, Colon, Abdominal aortic aneurysm

INTRODUCTION

Despite recent advances in the treatment of abdominal aortic aneurysm (AAA) the post-operative risk of colonic ischaemia (CI) remains. Colonic ischaemia is a serious complication and a significant cause of post-operative mortality.[1—3]

Reported rates of colonic ischaemia after intervention for AAA vary between trials, as does its relationship with mortality. It is currently unclear whether CI is more common after open repair or EVAR, with overlapping rates quoted in different trials.[4—7] Colonic ischaemia has previously been considered to be more common after OR than EVAR and, looking explicitly at ruptured AAA, a Cochrane review found a decreased risk of CI after EVAR compared with OR (odds ratio 0.39, 95% confidence interval 0.07—2.11); however, much of the data were produced by a single trial with only 116 patients.[8] Furthermore, the acceptance of EVAR has increased significantly in the last few years[9,10] and so the rate of colonic ischaemia may have changed.

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1078-5884/
https://doi.org/10.1016/j.ejvs.2018.03.005

Please cite this article in press as: Williamson JS, et al., Elective Repair of Abdominal Aortic Aneurysm and the Risk of Colonic Ischaemia: Systematic Review and Meta-Analysis, European Journal of Vascular and Endovascular Surgery (2018), https://doi.org/10.1016/j.ejvs.2018.03.005

Recent randomised controlled trials of EVAR versus OR were powered to detect differences in survival and all cause mortality;[11] however CI is relatively rare and there are therefore few high quality or powered data to reflect contemporary rates of colonic ischaemia. Furthermore, the incidence of CI may increase with time after EVAR, especially with Type 2 endoleak intervention and embolisation of the inferior mesenteric artery.

The aim of this meta-analysis was to compare and pool data from the literature to identify the contemporary incidence of post-operative colonic ischaemia after elective EVAR and open AAA repair, and to assess whether there is a relationship between the type of AAA intervention and the time when CI develops.

METHODS

Data sources, search strategy, and selection criteria

A systematic review was undertaken utilising the Cochrane collaboration specified protocol,[12] and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for the conduct of meta-analyses of interventional studies.[13] The following sources were searched without date restrictions: PubMed, Medline via OVID, Embase, the Cochrane Library Database, and the Current Controlled Trials register. Details of the protocol for this systematic review were registered on PROSPERO and can be accessed at www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017069624.

Studies reporting CI rates after elective AAA repair were included. Exclusion criteria included articles where ruptured aneurysms could not be analysed separately and aneurysms involving the suprarenal aorta. Definition of colonic ischaemia was based on clinically detectable features of ischaemic colitis including abdominal pain and bloody diarrhoea with or without endoscopic confirmation. There was no limitation on publication type or language in the initial search. An extensive search was also conducted using the "related articles" function in PubMed, of which the results were limited to human research, with review articles excluded. The last search date was June 10, 2017. Outcome events were captured when two or more papers presented extractable data. Non-English language papers were subsequently excluded, as were papers arising, or suspected of arising, from duplicate publications.

Data extraction and outcome measures

Data extraction and assessment of methodological quality were performed independently by two of the authors. For cases of disagreement a consensus was reached among all authors. Extracted data consisted of first author, year of study, study type, and design (including whether retrospective or prospective, single or multiple centres, whether consecutive patients were enrolled), number of participants, modality of treatment (EVAR or OR), numbers of patients experiencing colonic ischaemia, confounder corrected odds ratio, or relative risk of colonic ischaemia, number, nature, and timing of re-interventions for treatment of CI. Where available, data regarding the perioperative patency, embolisation and/or endoleak intervention to visceral arteries were extracted. Data were extracted at the 1 year follow up where available, or if not given at maximum follow up.

Outcome measures were defined as

1. CI rate
2. Mortality related to CI
3. Re-intervention rate for CI and any consequences
4. Time to CI.

Assessment of study quality and evidence rating

Study quality was assessed using the Downs and Black checklist, which assigns points depending on the quality of design (maximum 11 points), external validity (maximum 3 points), study bias (maximum 7 points), confounding and selection bias (maximum 6 points), and study power (maximum 5 points).[14] Studies with a score $\geq$ 17 were considered to be of higher quality.

Rating of the quality of evidence and strength of recommendation was undertaken using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system, according to Cochrane collaboration recommendations.[15] Quality was assessed and depended on risk of bias, indirectness of evidence, heterogeneity, imprecision of results, and publication bias. Cohort studies, by definition, have a "low" quality of evidence prior to further quality assessment. The presence of one or more serious limitations results in a "very low" grade of evidence. A serious effect on quality of evidence was considered to occur when >50% of included papers evidenced a risk of bias. Inconsistency was defined as an I^2 of greater than 50%. Indirectness was assumed not to occur in this setting. Imprecision was defined as fewer than 150 patients in either cohort. A serious effect on quality of evidence was considered to occur when greater than 50% of included papers evidenced a risk of imprecision.

Statistical analysis

Meta-analysis was undertaken in Review Manager version 5.3.5 (RevMan; Nordic Cochrane Centre, Copenhagen, Denmark). Meta-analysis was performed for dichotomous data where confounder corrected odds ratios or relative risks were available, using the odds ratio as the summary statistic, and reported with the 95% confidence interval, in line with the recommendations of the Cochrane Handbook.[12] Random effects models were used where significant heterogeneity between studies was detected. Heterogeneity was assessed using an I^2 calculation.[16]

The protocol specified that publication bias was to be assessed using funnel plots for outcomes with more than 10 studies,[17] although there were no outcomes which satisfied this criterion, so no funnel plots are presented.

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