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REVIEW

The Implications of Non-compliance to Endovascular Aneurysm Repair Surveillance: A Systematic Review and Meta-analysis

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WHAT THIS PAPER ADDS

Surveillance imaging is considered mandatory after endovascular aneurysm repair (EVAR), but many patients are either non-compliant or lost to follow-up, and the impact of this is poorly understood. This review highlights and confirms the great variability in published EVAR surveillance compliance rates. This study also suggests that although compliance may be associated with increased re-interventions after EVAR, surveillance does not appear to confer a survival advantage to compliant patients in the first 5 years after EVAR.

Objective/background: Increasingly, reports show that compliance rates with endovascular aneurysm repair (EVAR) surveillance are often suboptimal. The aim of this study was to determine the safety implications of non-compliance with surveillance.
Methods: The study was carried out according to the Preferred Items for Reporting of Systematic Reviews and Meta-Analyses (PRISMA) guidelines. An electronic search was undertaken by two independent authors using Embase, MEDLINE, Cochrane, and Web of Science databases from 1990 to July 2017. Only studies that analysed infrarenal EVAR and had a definition of non-compliance described as weeks or months without imaging surveillance were analysed. Meta-analysis was carried out using the random-effects model and restricted maximum likelihood estimation.
Results: Thirteen articles (40,730 patients) were eligible for systematic review; of these, seven studies (14,311 patients) were appropriate for comparative meta-analyses of mortality rates. Three studies (8316 patients) were eligible for the comparative meta-analyses of re-intervention rates after EVAR and four studies (12,995 patients) eligible for meta-analysis for abdominal aortic aneurysm related mortality (ARM). The estimated average non-compliance rate was 42.0% (95% confidence interval [CI] 28—56%). Although there is some evidence that non-compliant patients have better survival rates, there was no statistically significant difference in all cause mortality rates (year 1: odds ratio [OR] 5.77, 95% CI 0.74—45.14; year 3: OR 2.28, 95% CI 0.92—5.66; year 5: OR 1.81, 95% CI 0.88—3.74) and ARM (OR 1.47, 95% CI 0.99—2.19) between compliant and non-compliant patients in the first 5 years after EVAR. The re-intervention rate was statistically significantly higher in compliant patients from 3 to 5 years after EVAR (year 1: OR 6.36, 95% CI 0.23—172.73; year 3: OR 3.94, 85% CI 1.46—10.69) year 5: OR 5.34, 95% CI 1.87—15.29).
Conclusion: This systematic review and meta-analysis suggest that patients compliant with EVAR surveillance programmes may have an increased re-intervention rate but do not appear to have better survival rates than non-compliant patients.

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INTRODUCTION

Despite endovascular aneurysm repair (EVAR) being the modern preferred first choice for repair of abdominal aortic aneurysms (AAA),[1,2] studies show that re-interventions after EVAR are common and are undertaken in around 20% of patients within 5 years.[3,4] Consequently, guidelines from learned societies recommend lifelong annual imaging in order to identify and treat aortic complications to prevent aneurysm rupture and death.[5−7] However, published population and observational studies show that patients are not always compliant with their surveillance programmes.[8,9] A number of studies have attempted to evaluate patient characteristics that may be associated with poor compliance rates.[8,10] Despite this, little is known about the consequence of non-compliance with surveillance. Thus, a systematic review and meta-analysis was undertaken to study the implications of non-compliance with EVAR surveillance programmes. The primary outcomes were overall compliance, all cause mortality (ACM), and re-intervention rates and the secondary outcome was aneurysm related mortality (ARM).

METHODS

The study was carried out according to the Preferred Items for Reporting of Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[11] An electronic search was undertaken by two independent authors using the Embase, Medline, and Cochrane databases from 1990 to July 2017. Studies that assessed the compliance rate with surveillance after EVAR and analysed the relationship of re-intervention and mortality rates with compliance rates were identified. The search terms (including medical subject sub-headings) "abdominal aortic aneurysm", "aneurysm", "AAA", "EVAR", "endovascular repair", "compliance", "surveillance", "follow-up", and "survey" were used in combination with Boolean operators AND or OR. The reference lists of articles obtained were investigated to identify relevant citations. Conference abstracts from major vascular meetings, when published online, were also scrutinised through the Web of Science database (full search history is available in the Supplementary Material).

Inclusion criteria encompassed all studies describing endovascular repair of infrarenal AAA. The studies needed to have a definition of non-compliance described as weeks or months without imaging surveillance. Exclusion criteria included non-English language papers, thoraco-abdominal aortic aneurysm repair, suprarenal AAA, fenestrated grafts, parallel grafts, iliac aneurysms, and patients treated with the endovascular aneurysm sealing technique.

Studies that provided follow-up data using statistical methods for survival analysis were used for comparative meta-analyses of ACM and re-intervention rates. Quality assessment was carried out independently by two authors using Grading of Recommendations, Assessment, Development and Evaluations (GRADE),[12] and differences were resolved through discussion between the two authors. Outcome data were obtained from at risk scores provided with the tables and graphs when available, but if not, data were extracted from Kaplan—Meier curves. Attempts were made to contact the authors whenever data required were not readily available.

ARM was standardised by Chaikof et al. as deaths secondary to aneurysm rupture, EVAR to open conversion, and the index or secondary procedure (see Table 7).[13]

As different institutions and studies used different definitions for non-compliance, a laxity index was developed by the authors at the outset of the study. The laxity index is a measure of the stringency of the studies' definition of non-compliance. The laxity index was based on the number of scans missed and the number of months without imaging. A laxity value (from 0 to 1) was attributed to studies. A low laxity index suggests a very rigid application of the surveillance protocol, such that minimal deviation was labelled as non-compliance (detailed explanation is available in the Supplementary Material).

Statistical analysis

Statistical analysis was carried out using 'R package metafor'. Random effects meta-analyses were performed using restricted maximum likelihood estimation.[14] The meta-analysis for the non-compliance rates was performed using the observed rates and standard methods for a non-comparative proportion. For four of the papers,[8,15−17] reported longer-term compliance rates were used to determine the necessary outcome data.

The comparative meta-analyses of ACM and re-intervention rates were performed at five time points (1, 2, 3, 4, and 5 years) after intervention. The outcome data were empirical log-odds ratios (ORs) that compare the all cause mortality and re-intervention rates of the compliant and non-compliant patients. In order to include outcome data where Kaplan—Meier curves indicated that the event rate was negligible, the corresponding outcome data were analysed using the rate where half a person had experienced the event. Random effects meta-analyses were done using standard methods, where a conservative sample size was used for calculating the within study variances, so that censoring resulted in the maximum possible loss of information.[18] This sample size calculation requires the number at risk at each time point. Most papers gave these or values at adjacent time points that could be used for interpolation. Where numbers at risk were not given in study reports, for the purposes of calculating within study variances, the sample sizes were reduced by the average percentage reduction across the other studies that contribute to the analysis. Pooled estimates were transformed to the OR scale, where an OR that is > 1 indicates that the mortality or re-intervention rate is higher in compliant patients. To account for confounding factors, matched cohorts were used where possible. This included the studies by Garg et al. and Hicks et al. for comparative meta-analyses of mortality,[16,19] and the study by Garg et al. for comparative meta-analyses of re-intervention rates.[19]

Five random effects meta-regression models were fitted where the overall survival log-ORs were regressed on the