ELSEVIER

Clinical Research

International Trends in Patient Selection for Elective Endovascular Aneurysm Repair: Sicker Patients with Safer Anatomy Leading to Improved 1-Year Survival

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Background: To review the trends in patient selection and early death rate for patients undergoing elective endovascular repair of infrarenal abdominal aortic aneurysms (EVAR) in 3 countries. For this study, audit data from 4,163 patients who had undergone elective infrarenal EVAR were amalgamated. The data originated from Australia, Canada (Ontario), and England (London, Cambridge, and Leicester).
Methods: Statistical analyses were undertaken to determine whether patient characteristics and early death rate varied between and within study groups and over time. The study design was retrospective analysis of data collected prospectively between 1999 and 2012.
Results: One-year survival improved over time ($P = 0.0013$). Canadian patients were sicker than those in Australia or England ($P < 0.001$). American Society of Anesthesiologists classification (ASA) increased over time across all countries although more significantly in Canada. Age at operation remained constant, although older patients were treated more recently in London ($P < 0.001$). English centers treated larger aneurysms compared with Australia and Canada ($P < 0.001$). Australian centers treated a much larger proportion of aneurysms that were <55 mm than other countries. Preoperative creatinine levels decreased over time for all countries and centers ($P < 0.001$). Infrarenal neck angles have significantly decreased over time ($P < 0.001$). Recent data from London (UK) showed that operations were performed on longer ($P < 0.001$) and wider ($P < 0.001$) infrarenal necks than elsewhere.
Conclusions: In this international comparison, several trends were noted including improved 1-year survival despite declining patient health (as measured by increasing ASA status). This may reflect greater knowledge regarding EVAR that centers from different countries have gained over the last decade and improved medical management of patients with aneurysmal disease.

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INTRODUCTION

Since Volodos, followed by Parodi, reported the first endovascular repair of abdominal aortic aneurysms (EVAR), the procedure has been rapidly assimilated into the armamentarium of vascular surgeons ([1,2]). The procedure gained popularity during the 2000s, probably because of greater surgeon experience, improved devices, and the recognized benefit of fewer in-hospital deaths compared with open repair.[3] Later, trials have shown that patients undergoing EVAR have similar long-term mortality to those undergoing open repair, but with the downside of requiring regular ongoing surveillance coupled with the increased burden of secondary procedures to maintain aneurysm exclusion.[4]

Since 1991, a number of factors have changed that may have affected the incidence, detection, and treatment of abdominal aortic aneurysms (AAAs) by endovascular repair. Although there is some evidence that the incidence of aneurysmal disease is decreasing (despite screening programs),[5,6] the proportion of aneurysms that are treated with EVAR has increased. Technological improvements include the introduction of newer generation devices with lower profiles, fenestrated grafting (FEVAR), and branched endografts. There have been some demographic changes including an increase in residual life expectancy. Improved surgeon experience may affect outcomes and increase the likelihood of choosing EVAR as more surgeons become adept with the newer technology and conversely, less familiar with the open repair procedure. Government policy and funding decisions may also have had an impact on treatment options. Likewise, the reporting and publishing of higher quality trial data can directly or indirectly affect treatment by influencing guideline development (e.g., National Institute for Health and Care Excellence [NICE] technology appraisal TA167: February 2009).

For this study, we combined EVAR data for 4,163 patients from 5 centers in 3 countries, collected over a 14-year interval. The aims of the study were to determine if there had been any significant changes in patient characteristics and mortality over time and between the centers.

METHODS

The study amalgamated EVAR data from 5 specialist EVAR groups: Australia (2 national studies), Canada (Victoria Hospital, London, Ontario), and England (Cambridge, Leicester, and London, with 2 separate data sets from St George's Vascular Institute). The first Australian (Australian Safety and Efficacy Register of New Interventional Procedures - Surgical [ASERNIP-S]) study was conducted on a national basis and included data obtained from 5 states and included public and private hospitals.[7] The second Australian study data (EVAR trial) were from an ongoing trial with data from 4 states and mainly from teaching and/or major public hospitals. The Canadian and English data were from single tertiary referral centers (university teaching hospitals and major public hospitals). Data from 1999 to 2012 were obtained, but no individual collection spanned the entire 14-year period. In Canada and England, data were collected as a part of routine clinical audit. In Australia, the ASERNIP-S data set contains audit data but ethical clearance was obtained from all contributing institutions for the EVAR trial data collection.

Selection Criteria

Procedures for primary elective endovascular aneurysm repair of infrarenal aortic aneurysms were included. Isolated iliac aneurysms, endovascular repairs and patients younger than 50 years at the time of procedure were excluded. Patients were also excluded if the date of procedure was unknown or if they died after hospital admission but before surgery.

Preoperative variables assessed were: date of birth, procedure, and death; gender (male or female); American Society of Anesthesiology (ASA) classification[1−4]; serum creatinine (μmol/L); maximum aneurysm diameter (mm); infrarenal neck length (mm); infrarenal neck diameter (mm); infrarenal neck angle (degrees); and iliac artery tortuosity (grade, 1−4).

Completeness for most variables was >75%, although lower rates were accepted for some comparisons (aortic neck angle, ASERNIP-S data [23% complete]; infrarenal neck diameter, Canadian data [21% complete]; infrarenal neck length and diameter, Cambridge data [55% complete]). Data completeness for each clinical or anatomic variable is shown in Table I.

Data Comparability

Variables were only included when there was little or no variation in definition. Date of birth, date of death, date of procedure, gender, serum creatinine, maximum aneurysm size, infrarenal neck diameter, and infrarenal neck length are unambiguous data items that use standard units and coding systems. All aneurysm diameters were measured using orthogonal preoperative computed tomography images.

Infrarenal neck lengths were obtained using centerline measurements of 3-dimensional reconstructions except at St George's Vascular Institute