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Adjusted Hospital Outcomes of Abdominal Aortic Aneurysm Surgery Reported in the Dutch Surgical Aneurysm Audit

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WHAT THIS PAPER ADDS

The Dutch Surgical Aneurysm Audit (DSAA) is a mandatory registry for risk adjusted hospital outcome measurement and comparison. Thirty day or in hospital mortality for elective abdominal aortic aneurysms (EAAA) and acute AAA (symptomatic [SAAA] and ruptured [RAAA]) was similar to other national registries. Mortality risk prediction by V-POSSUM (physiological and operative variables) showed a significant miscalibration with an overestimation of mortality in EAAA surgery and underprediction in the low risk groups and overprediction in the high risk groups of SAAA and RAAA surgery. EAAA patients with endovascular aneurysm repair had a significantly lower observed than predicted mortality, whereas observed mortality was significantly higher than predicted mortality for RAAA patients receiving open repair. Adjusting hospital mortality for V(p)-POSSUM (physiological variables only) re-estimated on the DSAA population decreased hospital variation in EAAA patients, but mortality between hospitals was not discriminative for hospital comparison. Adjusting hospital mortality by means of V(p)-POSSUM and setting for acute AAA re-estimated on the DSAA was effective and justifies the modified V(p)-POSSUM as a casemix adjustment model for acute AAA surgery.

Objective/Background: The Dutch Surgical Aneurysm Audit (DSAA) is mandatory for all patients with primary abdominal aortic aneurysms (AAAs) in the Netherlands. The aims are to present the observed outcomes of AAA surgery against the predicted outcomes by means of V-POSSUM (Vascular–Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity). Adjusted mortality was calculated by the original and re-estimated V(physiology)-POSSUM for hospital comparisons.

Methods: All patients operated on from January 2013 to December 2014 were included for analysis. Calibration and discrimination of V-POSSUM and V(p)-POSSUM was analysed. Mortality was benchmarked by means of the original V(p)-POSSUM formula and risk-adjusted by the re-estimated V(p)-POSSUM on the DSAA.

Results: In total, 5898 patients were included for analysis: 4579 with elective AAA (EAAA) and 1319 with acute abdominal aortic aneurysm (AAAA), acute symptomatic (SAAA; $n = 371$) or ruptured (RAAA; $n = 948$). The percentage of endovascular aneurysm repair (EVAR) varied between hospitals but showed no relation to hospital volume (EAAA: $p = .12$; AAAA: $p = .07$). EAAA, SAAA, and RAAA mortality was, respectively, 1.9%, 7.5%, and 28.7%. Elective mortality was 0.9% after EVAR and 5.0% after open surgical repair versus 15.6% and 27.4%, respectively, after AAAA. V-POSSUM overestimated mortality in most EAAA risk groups ($p < .01$). The discriminative ability of V-POSSUM in EAAA was moderate (C-statistic: .719) and poor for V(p)-POSSUM (C-statistic: .665). V-POSSUM in AAAA repair overestimated in high risk groups, and underestimated in low risk groups ($p < .01$). The discriminative ability in AAAA of V-POSSUM was moderate (.713) and of V(p)-POSSUM poor (.688). Risk adjustment by the re-estimated V(p)-POSSUM did not have any effect on hospital variation in EAAA but did in AAAA.

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Conclusion: Mortality in the DSAA was in line with the literature but is not discriminative for hospital comparisons in EAAA. Adjusting for V(p)-POSSUM, revealed no association between hospital volume and treatment or outcome. Risk adjustment for case mix by V(p)-POSSUM in patients with AAAA has been shown to be important.

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INTRODUCTION

Auditing hospital outcomes after surgery is a powerful tool with which to monitor healthcare quality.[1] In the Netherlands several audits for surgical outcomes have been developed in cooperation with the Dutch Institute for Clinical Auditing. These audits, meant to improve healthcare, are developed in agreement with several stakeholders, such as insurance companies and the health inspectorate of the ministry of healthcare. Complete registration of data with a minimum of missing values and a motivated administrative culture are essential for robust and accurate conclusions for healthcare quality.[2] Therefore, a reduced set of preoperative patient -or disease related variables, easy to register, is desirable, especially as not every variable registered and of influence on mortality, needs to be included for casemix adjustment.[3,4]

The web based Dutch Surgical Aneurysm Audit (DSAA), introduced in 2012 and mandatory since 2013, registers all primary abdominal aortic aneurysm (AAA) operations in the Netherlands.

Because baseline characteristics of populations may differ between hospitals, with concomitant differences in outcome, risk adjustment by patient and disease specific characteristics for outcome measurement is necessary.[5] This can be achieved by using pre-operative variables of influence on the outcome.[6] Numerous models predicting mortality by pre- or peri-operative variables have been developed for aneurysm surgery. Only a few of them have been validated multiple times and are therefore considered as accurate, such as the Glasgow Aneurysm Score (GAS) or the Vascular Biochemistry and Haematology Outcome Model (VBHOM).[7,8]

The Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (V-POSSUM) is a well known peri-operative mortality risk prediction model.[9,10] However, the operative variables included in the model are not suitable for adjustment to compare hospitals because they are, to a large extent, dependent on surgical care, such as, for example, blood loss. The "physiology-only" score of V-POSSUM (V(p)-POSSUM) only contains patient and disease specific characteristics, which can be suitable as casemix information for hospital comparisons.

Since the introduction of endovascular aneurysm repair (EVAR) mortality has decreased in elective AAA surgery (EAAA); however, the advantage of EVAR over open surgical repair (OSR) in ruptured abdominal aortic aneurysm (RAAA) suggested in observational studies has not been confirmed in randomised trials.[11–18] An explanation for differences between observational research and randomised trials could be selection bias.[16,19] Large registries, of consecutive patients undergoing surgery for acute aneurysms, might add insight to this issue. However, the results from national registries can be difficult to compare owing to differences in prevalence of RAAA in countries with screening programs, the percentage that refrains from operative repair of RAAA, and the variation in percentage of EVAR implemented.[20–22]

The aim of this study was to report the first results of auditing AAA surgery in the Netherlands. Post-operative mortality was the primary outcome parameter. As a secondary outcome parameter, variations in the implementation of EVAR and the possible association with volume were investigated. The performance of V-POSSUM, as prediction model, was assessed. For casemix correction hospital outcomes were compared and adjusted with the original V(p)-POSSUM and the re-estimated V(p)-POSSUM on the DSAA population.

MATERIAL AND METHODS

Clinical data

The DSAA is a mandatory, nationwide, population and web based database with detailed patient, diagnostic, procedural, and outcome data of all patients with a primary infra- or juxtarenal AAA operation in the Netherlands. Under Dutch law, no ethical approval or informed consent was required. In 2017 a project will be initiated to validate the existing data set. Patients prospectively registered in the DSAA, operated on for an AAA between 1 January 2013 and 31 December 2014 were included for analysis. Excluded were patients with secondary or revision surgery, surgery of highly complex aneurysm (suprarenal and thoraco-abdominal), and mycotic or infected aneurysms.[23] Furthermore, patients with incomplete data concerning date of birth, date of surgery, survival state, setting, or type of procedure (EVAR/OSR) were excluded (see "Results", subsection "Baseline characteristics"). Patient and treatment characteristics were described. Procedure for analysis, other than baseline, was calculated following "intention to treat" analysis and the percentage of EVAR (EVAR/(EVAR + OSR)) was tested for the association with hospital volume. For hospital comparisons two groups of patients were analysed: EAAA and AAAA.

AAAA was defined as either acute non-ruptured without extravasation needing surgery within 24h after presentation (SAAA), or ruptured with extravasation requiring immediate surgery (RAAA).

Clinical outcomes

The primary outcome measure was 30 day or in hospital mortality. A sub-analysis was performed, when appropriate,

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