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The Impact of Initial Misdiagnosis of Ruptured Abdominal Aortic Aneurysms on Lead Times, Complication Rate, and Survival

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WHAT THIS PAPER ADDS

This study provides data on the frequency of initial misdiagnosis in patients treated for ruptured abdominal aortic aneurysms and the clinical consequences of misdiagnosis in terms of adjusted mortality and post-operative care.

Objective/Background: To investigate the frequency of initial misdiagnosis and the clinical consequences of an initial misdiagnosis of ruptured abdominal aortic aneurysms (rAAA).

Methods: This was a retrospective cohort study. Data from the Swedish National Registry for Vascular Surgery (Swedvasc) and medical charts were extracted for patients treated for rAAA in the West of Sweden in the period 2008–14. Initially misdiagnosed patients were compared with correctly diagnosed patients.

Results: In all, 261 patients were included in the study. Patients with rAAA were initially misdiagnosed in 33% ($n = 86$) of the cases and this caused a 4.8 hour (median time) additional delay to surgical intervention. There were no differences in 30 day mortality between initially misdiagnosed patients and correctly diagnosed patients (27.9% vs. 28.0%; $p = 1.00$). The adjusted odds ratio for mortality in initially misdiagnosed patients compared with correctly diagnosed patients was 0.78 (95% confidence interval 0.38–1.60). No difference was observed between the groups regarding 90 day mortality, length of intensive care, need for post-operative ventilator support, need of haemodialysis support, and length of hospital stay.

Conclusion: Misdiagnosis is common in patients with rAAA, and treatment is significantly delayed in misdiagnosed patients. The study did not show any survival disadvantage or increased frequency of post-operative complications in misdiagnosed patients despite the delayed treatment. However, only patients who reached surgical intervention were included in the analysis.

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INTRODUCTION

Ruptured abdominal aortic aneurysms (rAAA) have an annual mortality rate of around 150,000 individuals worldwide.[1] The overall prognosis remains poor with a total mortality of around 70% reported in later studies,[2–4] despite advances in modern health care. Although theoretically appealing, randomised trials have failed to demonstrate robust evidence of any survival advantage for endovascular aortic repair (EVAR) compared with open surgical repair (OSR) in patients with rAAA.[5–8] Screening programs have been proven to reduce aneurysm related mortality substantially by identifying AAAs before rupture, allowing for surgical intervention in an elective setting.[9–11] However, as screening programs currently have a very limited coverage throughout the world and will always have non-attenders, the treatment of rAAAs will continue to pose a significant clinical challenge.

An observation made by many surgeons and also described in previous studies is that rAAAs are frequently misdiagnosed in the acute setting.[12–23] Although it is known that misdiagnosis is common in patients with rAAA, the clinical consequences of a misdiagnosis in terms of the patient's prognosis are largely unknown.

It was hypothesized that both the mortality rate and post-operative complications are more frequent in patients treated for rAAA if they are initially misdiagnosed. The aim of this study was to investigate the frequency of misdiagnosis and the clinical consequences of a misdiagnosis of rAAA in terms of treatment and outcome.

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METHODS

Study design

The study was a retrospective cohort study comparing the outcome in two cohorts of patients that were treated for a rAAA: those who were correctly diagnosed at the first clinical assessment by a physician in the emergency department (ED), and those who were initially misdiagnosed. The primary endpoint was 30 day mortality. Secondary endpoints were 90 day mortality, need for post-operative haemodialysis, need for ventilator support, days in the intensive care unit (ICU), and length of hospital stay.

Setting and participants

Patients admitted to any of the 11 EDs within the healthcare organisation in the West of Sweden (Västra Götaland Region) who were subsequently treated by EVAR or OSR for a rAAA from May 2008 to December 2014 were eligible for inclusion.

EDs in the region are generally staffed with residents, with specialists/consultants available on demand. One of the participating hospitals has an ED staffed by an emergency medicine clinic. The other 10 hospitals have EDs staffed by the surgical clinic, the internal medicine clinic, and the orthopaedic clinic together.

Data regarding age, sex, comorbidities, and type of procedure, and peri-operative data were extracted from the Swedish National Registry for Vascular Surgery (Swedvasc). The definition of comorbidities reported in Swedvasc are: *cardiac disease*, history of coronary heart disease or congestive heart failure; *hypertension*, hypertension with medical treatment; *pulmonary disease*, chronic obstructive pulmonary disease or emphysema or other chronic pulmonary disease with symptoms; *previous TIA/stroke*, previous transient ischaemic attack, ischaemic or haemorrhagic stroke.

Data regarding the assessment and treatment during the pre-hospital phase and within the ED, as well as treatment chain time parameters, were extracted from electronic medical charts. The first registered blood pressure (BP) was the first BP recorded by paramedics in the pre-hospital phase for ambulance transported patients and the first BP recorded in the ED for ambulatory patients.

Patients without a Swedish personal identity number were excluded (owing to lack of reliable mortality data), as were thoracic, thoraco-abdominal, and mycotic aneurysms. Patients who were registered as treated for a rAAA in Swedvasc, but on review of the medical charts were found not to have a rAAA or a ruptured iliac aneurysm, and who were thus misclassified in the registry, were excluded. Patients lacking a medical chart from the ED were also excluded (Fig. 1).

Patients with rupture of an AAA during a hospital stay for another condition or after admission for elective treatment of an AAA were excluded as the primary aim of the study was to evaluate the clinical consequences of a misdiagnosis in the ED. To minimise the risk of excluding patients admitted to a hospital ward for treatment of another condition because of a misdiagnosed rAAA in the ED the medical charts of those patients were thoroughly reviewed by two separate reviewers.

Patients were classified as having a *correct diagnosis* at the first assessment in the ED if one or more of the following criteria were fulfilled: (i) aortic aneurysm was mentioned as the primary preliminary diagnosis or a differential diagnosis in the note in the medical chart made by the first physician assessing the patient in the ED; (ii) the patient was referred from the ED for an acute computed tomography scan of the abdomen or aorta, with the words "aortic aneurysm" mentioned in the question to the radiologist; (iii) the patient was taken immediately to theatre for laparotomy for suspected rAAA. Patients who did not fulfill any of the three criteria were classified as having a *misdiagnosis* at the preliminary assessment in the ED.

Patients correctly diagnosed with rAAA at the first assessment in the ED were compared with patients who were initially misdiagnosed regarding comorbidities, time from admission to start of the operative procedure, mortality, need for post-operative haemodialysis, need for ventilator support, days in the ICU, and length of hospital stay.

Ethical approval for the project was obtained from the Regional Ethical Review board in Gothenburg (Dnr 553-14).

The Swedvasc registry

Swedvasc is Sweden's National Quality Registry for Vascular Procedures. The registry has had national coverage since 1994 and includes all vascular centres in Sweden. For all aortic procedures, vascular surgeons or interventional radiologists prospectively register peri-procedural data, patient data, including risk factors, and complications within 30 days. The registry is interconnected with the Swedish Cause of Death Registry and thereby provides reliable mortality data for all registered patients. Swedvasc has proven to be a highly accurate system for collecting data on Swedish vascular surgery with an external validity exceeding 93%.[24,25]

Statistics

All statistical analysis was performed in IBM SPSS statistics 23.0. Descriptive statistics are presented for demographic and baseline variables as mean $\pm$ SD and absolute and relative frequencies. Fisher's exact test was used for intergroup comparisons of dichotomous variables. Student *t* test was used for the comparison of means. The Mann–Whitney test was used for non-normal continuous variables. Binary logistic regression was used to analyse possible confounding factors influencing 30 day mortality. Univariate regression was performed followed by multivariate regression analysis. Misdiagnosis/correct diagnosis, age, sex, type of procedure (EVAR or OSR), and transportation to secondary hospital was a priori introduced to the adjusted model. Significant risk factors in the univariate analysis were introduced to the adjusted model. A two sided p value $< .05$ was considered to be significant.

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