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High Annual Hospital Volume is Associated with Decreased in Hospital Mortality and Complication Rates Following Treatment of Abdominal Aortic Aneurysms: Secondary Data Analysis of the Nationwide German DRG Statistics from 2005 to 2013☆, ☆☆

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WHAT THIS PAPER ADDS

This nationwide study has shown a significant association between high annual hospital volume and low post-operative mortality after AAA repair in German hospitals. Furthermore, it shows lower complication rates after intact AAA repair in high volume hospitals. High hospital volume is also associated with a decreased use of blood products and shorter length of stay after intact and ruptured AAA repair. These real world data support the hypothesis that centralisation of these procedures might lower complication rates. A minimum annual caseload of 75 AAA procedures seems reasonable.

Objectives: The aim of this study was to analyse the association between annual hospital procedural volume and post-operative outcomes following repair of abdominal aortic aneurysms (AAA) in Germany.

Methods: Data were extracted from nationwide Diagnosis Related Group (DRG) statistics provided by the German Federal Statistical Office. Cases with a diagnosis of AAA (ICD-10 GM I71.3, I71.4) and procedure codes for endovascular aortic repair (EVAR; OPS 5–38a.1*) or open aortic repair (OAR; OPS 5–38.45, 5–38.47) treated between 2005 and 2013 were included. Hospitals were empirically grouped to quartiles depending on the overall annual volume of AAA procedures. A multilevel multivariable regression model was applied to adjust for sex, medical risk, type of procedure, and type of admission. Primary outcome was in hospital mortality. Secondary outcomes were complications, use of blood products, and length of stay (LOS). The association between AAA volume and in hospital mortality was also estimated as a function of continuous volume.

Results: A total of 96,426 cases, of which 11,795 (12.6%) presented as ruptured (r)AAA, were treated in >700 hospitals (annual median: 501). The crude in hospital mortality was 3.3% after intact (i)AAA repair (OAR 5.3%; EVAR 1.7%). Volume was inversely associated with mortality after OAR and EVAR. Complication rates, LOS, and use of blood products were lower in high volume hospitals. After rAAA repair, crude mortality was 40.4% (OAR 43.2%; EVAR 27.4%). An inverse association between mortality and volume was shown for rAAA repair; the same accounts for the use of blood products. When considering volume as a continuous variate, an annual caseload of 75–100 elective cases was associated with the lowest mortality risk.

☆ Prior presentations: Trenner M, Kühnl A, Eckstein HH: Positiver Zusammenhang zwischen hoher Krankenhausfallzahl und geringer perioperativer Mortalität beim rupturierten und nicht-rupturierten abdominellen Aortenaneurysma in Deutschland: Sekundärdatenanalyse der DRG-Statistik von 2005 bis 2013, Dreiländertagung ÖGG/DGG/SGG 2016, Bern, 5–8 October 2016.

☆☆ Trenner M, Kühnl A, Salvermoser M, Eckstein HH: Signifikanter Volume-Outcome Zusammenhang bei der operativen Versorgung des nicht-rupturierten abdominalen Aortenaneurysmas: Sekundärdatenanalyse der DRG-Statistik 2005–2013, 33. Jahrestagung der Deutschen Gesellschaft für Gefäßchirurgie und Gefäßmedizin, Frankfurt, 27.-30.09.2017.

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Conclusions: In hospital mortality and complication rates following AAA repair are inversely associated with annual hospital volume. The use of blood products and the LOS are lower in high volume hospitals. A minimum annual case threshold for AAA procedures might improve post-operative results.

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INTRODUCTION

The practice guidelines of the European Society for Vascular Surgery (ESVS) for the treatment of abdominal aortic aneurysms (AAA) recommend a threshold of 50 elective operations per annum,[1] whereas the Society of Vascular Surgery (SVS) states that open aortic repair (OAR) should be performed at centres with a documented in hospital mortality $<5\%$.[2]

In Germany, several statutory regulations were implemented for AAA surgery by the Federal Joint Committee (Gemeinsamer Bundesausschuss; GB-A), for example operations have to be performed by specialist vascular surgeons and the treating hospitals have to offer vascular services 24/7. Apart from this, neither centralisation of vascular services is regulated by law nor is there a statutory quality assurance registry. After a recent decision of the Federal Joint Committee, screening for AAA in Germany is now being rolled out. As a result, optimal treatment for patients has to be ensured and possible structural weaknesses have to be identified.

To date, available data on a volume outcome relationships for AAA repair in Germany are based on a voluntary registry by the German Vascular Society (Deutsche Gesellschaft für Gefäßchirurgie und Gefäßmedizin; DGG). In two separate analyses of these data, an association between annual hospital volume and post-operative mortality was shown for OAR, but not for EVAR, as is the case in many other countries.[3,4] As that registry gathers only about 40% of the AAA cases treated in Germany, about 120 of >500 hospitals which treat AAA participated. In addition, patient sex was not documented, and external validation was lacking; thus, those registry data are viewed with scepticism and might not be representative of the situation of AAA care in Germany.[5,6] Another analysis of nationwide data was limited to the year 2007 and only included intact AAA.[7] In a study published in 2017, an inverse relationship between hospital volume, morbidity, and mortality could be shown for pancreatic surgery in Germany using nationwide administrative inpatient data collected by the Federal Statistical Office.[8] Furthermore, a meta-analysis on the volume outcome relationship after AAA repair in European hospitals pointed out that there is a lack of information on secondary outcomes following AAA repair.[9]

Thus, the purpose of the present study was to evaluate the association between annual hospital volume and in hospital mortality after ruptured (r) and intact (i) AAA repair using routinely collected nationwide data. In addition, the relationship between volume and secondary outcomes (length of hospital stay, LOS; complications; use of blood products) was analysed.

METHODS

Data source

For the present analysis all cases treated for iAAA and rAAA in Germany between January 1, 2005 and December 31, 2013 were identified in a nationwide cohort, based on hospital episode data. Anonymous data are statutorily collected by the Institute for the Hospital Remuneration System ("Institut fuer das Entgeltsystem im Krankenhaus") and then transferred to the German Federal Statistical Office (GFSO) according to §21 of the Hospital Reimbursement Act ("Krankenhausentgeldgesetz", KHEntG). Inpatient episode reporting is mandatory and therefore this study can be considered a full nationwide survey (except military and psychiatry services). Methods of how these administrative data can be used and analysed by controlled remote data processing have been established and were recently described in detail.[8,10–13] Study ethics were approved by the local Ethics Committee of the Medical Faculty, Technical University of Munich (Reference 21/16 S). The analysis was conducted according to Good Practice of Secondary Data Analysis guidelines[14] and reporting follows the STROSA2 guideline (modification of the RECORD guideline that addresses specific characteristics of the German healthcare system).[15,16] Data have been saved and are available on servers of the German Federal Statistical Office. They were accessed using controlled remote data processing, which means individual patient data or institutional identifiers for hospitals were not available to the authors. A protocol for the study was submitted to the German Federal Statistical Office during the application process, but has not been published separately.

Case selection and population

An in hospital episode starts on admission and ends at discharge of a patient. Therefore, in this study only cases, rather than individual patients, are described. All cases with a principal or secondary diagnosis of intact or ruptured AAA (ICD-10 GM I71.3/4) specific treatment (defined as procedure codes for EVAR or infrarenal OAR; Table S1) between 2005 and 2013 were included. Cases with codes for both EVAR and OAR were excluded from this analysis, as the exact strategy of therapy (i.e. hybrid procedures, conversions) cannot be identified using this dataset, and cases with procedure codes for fenestrated, branched, or chimney grafts were also excluded. As there is no individual patient identifier, it is not possible to determine whether a patient received operative treatment in more than one hospital, but the number of these cases was considered negligible. For a detailed overview of case selection see Fig. S1; detailed ICD-10 and OPS codes are available in Table S1.

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