



INTERNATIONAL VALIDATION OF SWEDVASC
The Swedish National Registry for Vascular Surgery

VASCUNET 2014

Validation of the Swedish National Registry for Vascular Surgery

Swedvasc

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Abbreviations

AAA	Abdominal Aortic Aneurysm
AAAOR	Abdominal Aortic Aneurysm open Repair
EVAR	Endovascular Aneurysm Repair
CEA	Carotid endarterectomy
CAS	Carotid Artery Stenting
ID	Identification number
MV	MaaritVenermo
TAAA	Thoraco Abdominal Aortic Aneurysm
TIA	Transient Ischaemic Attack
TL	Tim Lees

Foreword

Vascunet is an international collaboration set up to compare practice between countries for the common vascular interventions. Data analysis, using national and regional registry data has been undertaken for AAA repair, carotid endarterectomy, and infrainguinal bypass and these comparisons of practice have been published in the European Journal of Vascular and Endovascular Surgery.

This has revealed differences in practices and outcomes between countries but it has also highlighted that the extent and quality of data collection vary considerably. A persistent criticism of this type of registry data, from both within the Vascunet committee and from reviewers is therefore that validation of data is insufficient.

International audit also poses a particular problem with regard to how representative the data is of the population within the country from which it is derived. It is quite possible for large numbers of patients to be submitted but for this to only be a small proportion of the total number of cases done. It is therefore important to also examine the processes by which data is collected along with the drivers for data collection.

Vascunet has now embarked on a system of validation of national data, and is committed to improving registry data in order to allow meaningful comparison

of national data, and the improvement of outcomes in vascular intervention. Hungary was the first country to be validated and the results of this validation have been published (Validation of the VASCUNET registry - pilot study. Bergqvist D, Björck M, Lees T, Menyhei G. VASA Mar;43(2):141-4). The second country to be validated was designated to be Sweden and this report details the findings of that validation.

Acknowledgements

The authors are indebted to all those clinicians in Sweden who assisted them in performing a complete, independent and robust validation of clinical data.

Introduction

Swedvasc, like most successful medical databases has developed over a period of many years to reach its current position as a leading national system in the audit of vascular surgery and outcomes. A group of enthusiastic vascular surgeons first started the registry in 1986 and by 1991 most of the population of Sweden was covered. The registry has been developed and refined year on year, now reporting on more than 220,000 procedures. The registry reports annually based on figures submitted by individual vascular

CASE	centres throughout Sweden (current population
IDENTIFICATION	9,636,741)
<p>☞ The ability to correlate cases from national administrative data and Swedvasc via a unique identifier is invaluable in recording accurate data and allowing validation.</p>	<p>Reporting in the database is based on national patient identification numbers and this method is invaluable in allowing correlation between local hospital data and Swedvasc data, therefore enabling</p>

robust validation. In this respect Sweden has a considerable advantage over many other regional and national audit systems.

Contribution to Swedvasc is voluntary and surgeons do not have to submit data. It is clear however that the development of the system over a period of many years and reporting arising out of the database has encouraged surgeons to contribute and now all vascular centres in Sweden submit their data to Swedvasc.

The database is funded by the Swedish government and includes data on all vascular surgical procedures except varicose vein surgery and access surgery. The procedures of abdominal aortic aneurysm repair, carotid endarterectomy and stenting as well as procedures for lower limb ischaemia are reported. Not all amputations are reported, but those following vascular surgical procedures within one year. Recently patient recorded outcome data has also been included, but examination of this data was not included as part of this validation exercise. Annual reporting of outcomes based on submitted data is undertaken following validation of the data by comparing Swedvasc with the Swedish National Patient Register in which all in-patient care episodes are registered. Reporting is based on centre data and individual surgeon data is not published. Patient consent is required for entry of data into Swedvasc. How consent is sought and (in most cases) given differs between centres. Information is provided to patients, for example in the admission letter, and many hospitals have a routine in which a nurse gives the patients structured information.

Methods

The validation of data was performed in 2 ways, comprising internal validation and external validation.

The validation was done by two members of Vascunet (TL, MV).

The validators visited five hospitals in Sweden. These hospitals were picked randomly but in such a way that allowed the 5 hospitals to be visited on 2 site visits to Sweden by the validators. The hospitals included in the first visit in January 2014 were Uppsala University hospital (TL and MV), Vasteråssjukhuset (TL) and SöderSjukhuset in Stockholm (MV). Visits to Malmö (MV) and Helsingborg (TL) took place in April 2014. Both external and internal validation were performed in each hospital.

External validation

The purpose of the external validation was to evaluate how comprehensively all the cases that had been operated on in the hospital during 2012 were recorded within the Swedvasc registry.

Hospital administration provided the information on the hospital registry data. To find all the infrarenal aortic procedures performed in 2012, they searched using procedure codes in Table 1 below during the time period 1.1.12 to

31.12.12. Data included operation codes, operation date and the patient's identity code.

Table 1. Codes used for identifying AAA procedures.

PDG 10	PDG 23	PDQ10
PDG 20	PDG 24	PDQ21
PDG 21	PDG 99	
PDG 22		

Similarly, in order to find all the carotid procedures the procedure codes in Table 2 were used.

Table 2. Codes used for identifying Carotid procedures

PAN 20	PAQ 20
PAN 21	PAQ 21
PAF 20	
PAF 21	

The Swedvasc data were provided by the national representative of the Swedvasc registry (Thomas Troëng). He picked all the procedures that were registered to the aortic module and carotid module that were performed during the period 1.1.12 to 31.12.12.

The data from both registries were extracted to excel spreadsheets.

The external validation was performed by comparing the Swedvasc data with the hospital administrative data. Due to the fact that both registries included individual identity codes, it was possible to crosslink the two registries in order to find missing cases in both. Thereafter, all the cases that were in hospital records but not in Swedvasc data were checked one by one using both Swedvasc and hospital case records. Similarly all the cases that were found in the Swedvasc registry but were missing from the Hospital records were reviewed.

Internal validation

Internal validation was performed by comparing the data in the Swedvasc registry with patients' case histories. In each hospital, we aimed to evaluate 20 aortic cases and 15 carotid cases randomly, although in practice due to time constraints on the day this number could not be achieved in all hospitals visited. 15 data fields in the carotid cases and 13 data fields in AAA-cases were checked (Figures 1 and 2 below). This comparison was done manually by interrogating the hospital data which was provided electronically with Swedvasc data which was also available electronically. One validator (MV) was able to do much of this work independently as she was able to understand Swedish. TL relied on assistance from the local team for this part of the validation for translation from Swedish into English.

The initial validation visit was to Uppsala and it took some time on that first visit to identify the precise data that was required and to refine the methodology for comparing administrative data with Swedvasc data. This relied on accurate coding both in the hospital administrative data and in Swedvasc. Initially in Uppsala we were provided with different figures for Swedvasc data depending on search criteria used and this created 2 sets of comparative data. The data presented in this report are those obtained on the second comparison once we had refined the search criteria both in Swedvasc and in local administrative data.

Figure 1.

Datafields compared for Carotid Endarterectomy

	SWEDVASC	PATIENT RECORD
SEX		
AGE		
SIDE		
SMOKING		
DIABETES		
INDICATION		
DEGREE OF STENOSIS		
TYPE OF SURGERY		
USE OF SHUNT		
USE OF PATCH		
POST OP CRANIAL NERVE INJURY		
POST OP ACUTE CORONARY SYNDROME		
POST OP TIA		
POST OP STROKE		
REOPERATION		
30 DAY MORTALITY		
90 DAY MORTALITY		

Figure 2. Datafields compared for Aortic Aneurysm Treatments

	SWEDVASC	PATIENT RECORD
SEX		
AGE		
DIABETES		
SMOKING		
AAA DIAMETER		
OPERATION TYPE (EVAR/OPEN/Conversion)		
OPERATION DATE		
RUPTURED/NON-RUPTURED		
PLANNED/UNPLANNED		
BLOOD LOSS		
POSTOPERATIVE CORONARY EVENT		
RENAL FAILURE		
LIMB ISCHAEMIA		
CONVERSION EVAR TO OPEN		
ABDOMINAL COMPARTMENT SYNDROME		
30 DAY MORTALITY		
90 DAY OR 1 YEAR MORTALITY		

Results

Uppsala

External Validation

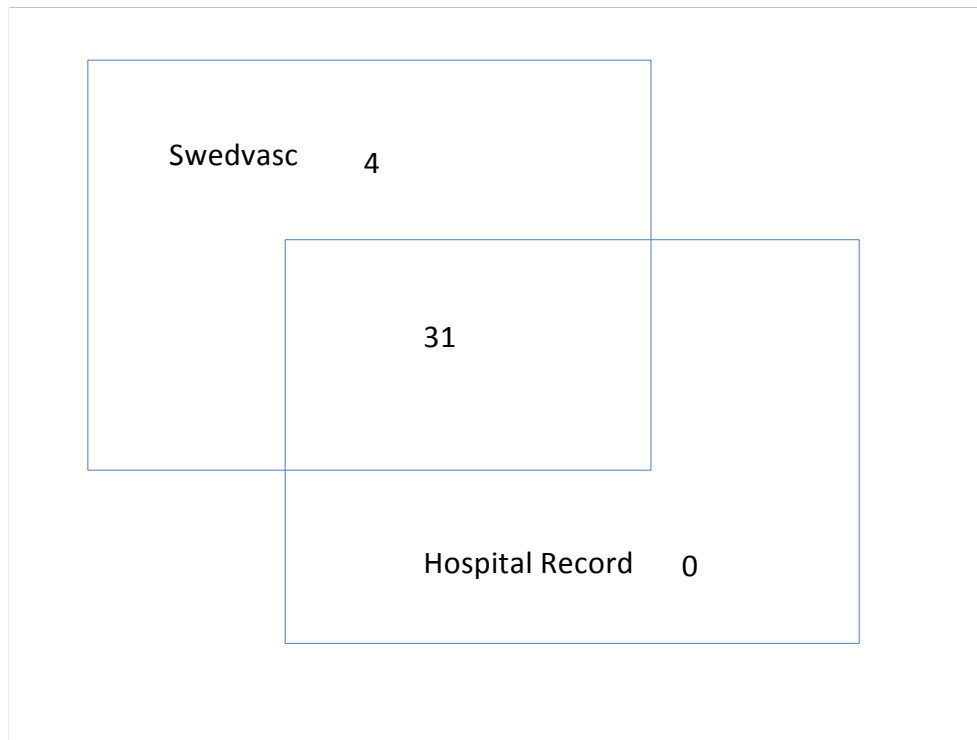
Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Interrogation of Swedvasc data identified 35 carotid procedures. Administrative data identified 31 procedures (30 CEA and 1 CAS). Further interrogation of both Swedvasc and local hospital data identified the following numbers:

- 31 procedures common to local data and Swedvasc
- 35 procedures in total in Swedvasc
- 31 procedures in total in hospital data
- 4 procedures in Swedvasc but not in local data
- 0 procedures in local data but not in Swedvasc

TOTAL = 35

This data included 1 patient who was in twice due to having both sides operated on.



Further examination was then performed on the 4 patients that were in Swedvasc but not in the local patient list.

Patient 1: Patient underwent CEA for TIA and was appropriately included in Swedvasc. It was not clear why this patient did not appear in the local patient list.

Patient 2: Patient underwent carotid subclavian bypass surgery for a TIA and was therefore appropriately included in Swedvasc but not picked up locally due to different code for bypass to CEA.

Patient 3: Patient underwent CEA for TIA and was appropriately included in Swedvasc. No reason was found why this patient was not picked up by the data search from hospital records.

Patient 4: Patient underwent stenting of the brachiocephalic artery and was appropriately included in Swedvasc but was not picked up locally due to different code used for the procedure.

SUMMARY: In external validation all carotid cases that were operated in Uppsala during 2012 were found in Swedvasc registry and the external validation was 100%.

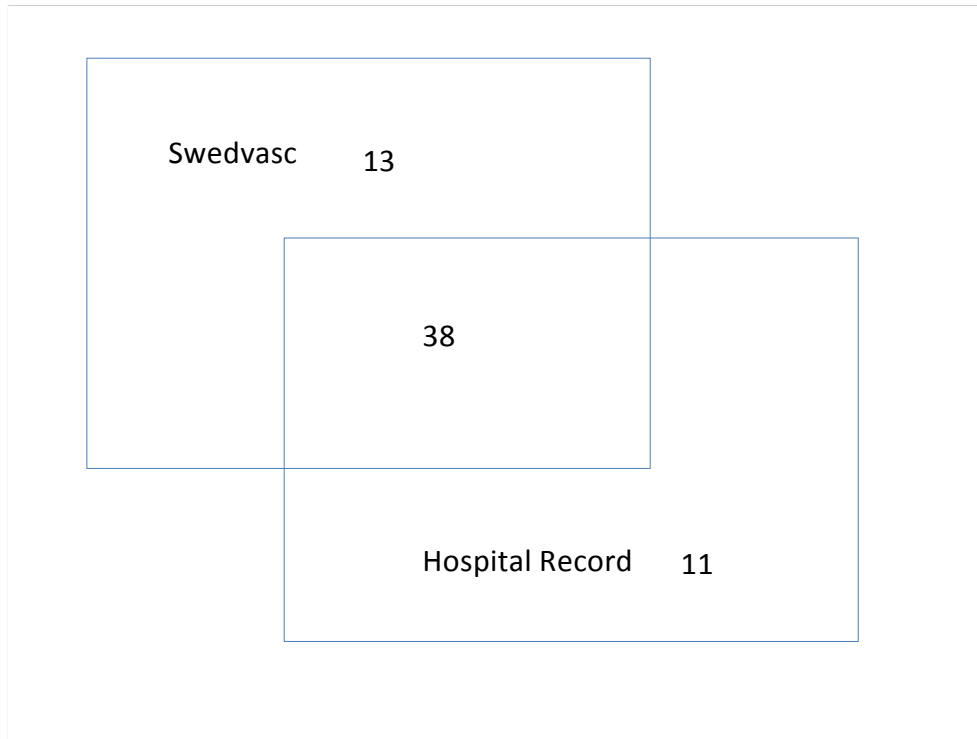
Although the initial search revealed that there were patients in Swedvasc that were not in the local administrative data further interrogation of the data at individual patient level did not confirm this. The discrepancy between the two datasets appeared entirely due to the patients not being identified in local administrative data on the code search criteria that were used. This may in part have been due to the difficulty identifying the appropriate codes for the search as Uppsala was the first centre studied. This process was clearer for subsequent centres having gained experience from the data search in Uppsala.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

A direct comparison of the patients provided from Swedvasc and from the local administrative data identified the following:

- 38 procedures common to both datasets
- 51 procedures in total in Swedvasc
- 49 procedures in total in hospital data
- 11 procedures in local data but not in Swedvasc
- 13 procedures in Swedvasc but not in local data list

TOTAL = 62



Further interrogation of individual patient data revealed the following:

Patients in local data but not in Swedvasc

- Patient 1** Juxtarenal AAA and reimplantation of renal artery. Patient was entered in Swedvasc under TAAA which was appropriate.
- Patient 2** Patient who underwent Palmaz stent insertion for endoleak, coding incorrectly in local data. Patient was in Swedvasc under the re-operation section.
- Patient 3** Thoracoabdominal AAA treated with stenting. Coding includes infrarenal component and therefore picked up on code search. In Swedvasc under TAAA.

- Patient 4** Thoracoabdominal AAA treated with hybrid procedure. In Swedvasc as TAAA.
- Patient 5** Symptomatic TAAA. Not in Swedvasc at all, should have been in TAAA section. (Case remembered by local team, lasted many hours and finished at 4am).
- Patient 6** Suprarenal AAA. In Swedvasc under TAAA
- Patient 7** Saddle embolus treated with embolectomy and aortobifemoral bypass graft. In Swedvasc under other arterial procedure
- Patient 8** Patient with claudication treated with stenting of aorta and iliac arteries. Registered under other arterial procedure in Swedvasc.
- Patient 9** Treatment of a type II endoleak following previous EVAR. Registered under re-intervention procedure in Swedvasc
- Patient 10** Aorto iliac stenting for occlusive disease. Registered under other arterial procedure in Swedvasc.
- Patient 11** Aorto iliac procedure for claudication. Registered under other arterial procedure in Swedvasc.

Patients in Swedvasc but not in local data

- Patient 1** Aorto bi-iliac stent graft for AAA. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 2** TEVAR. Incorrectly entered into infrarenal AAA section in Swedvasc, should have been in thoracic AAA section.
- Patient 3** Standard EVAR. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 4** Aortobifemoral bypass for AAA. Appropriate corresponding details in local hospital records, not picked up by code search.

- Patient 5** Standard EVAR. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 6** Standard EVAR. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 7** EVAR. Code incorrect in local data, coded as angioplasty
- Patient 8** Aortobifemoral bypass for AAA. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 9** Standard EVAR. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 10** EVAR for mycotic AAA. Appropriate corresponding details in local hospital records, not picked up by code search.
- Patient 11** Juxtarenal AAA. Wrong code in hospital records.
- Patient 12** Re-operation on a suprarenal AAA. Should have been in TAAA section in Swedvasc
- Patient 13** Standard EVAR. Appropriate corresponding details in local hospital records, not picked up by code search.

SUMMARY: There was only 1 patient identified in local records that had not been entered into Swedvasc. This case, patient 5, was TAAA and thus the external validity of the infrarenal abdominal aortic repair was 100%.

The discrepancies we found between the 2 datasets were almost exclusively due to coding differences. In addition several of the cases were not picked up on the search of local data even though all the clinical details that had been entered were correct. This may have represented local administrative issues on the day in performing these searches and also “inexperience” of the local team and investigators in identifying codes and running the searches. As for carotid procedures the experience gained in Uppsala allowed a more robust comparison process in the other centres studied. On

some occasions the local codes used were correct but the patient was entered into the incorrect part of Swedvasc and on other occasions the local hospital codes used were incorrect.

Internal Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Internal validation was performed on 15 cases that were picked randomly from the dataset common to both local data and Swedvasc. The variables listed in the methods section were compared for local data and from Swedvasc as previously described. There were 17 variables checked, although the age and sex of the patients were fixed in the patient codes and therefore not subject to possible error, and so in practice 15 variables were checked.

Overall 225 data entries were checked. Of these 7(3%) variables were missing in local data compared to Swedvasc, although this was mainly for the presence of diabetes and may represent difficulty in locating this information in the hospital record. Different responses were obtained from local data and from Swedvasc in 6 patients resulting in an internal validity of 97%. 4 out of these 6 (67%) were for the datafield of smoking. Many of the more important data fields such as post-operative stroke and TIA had 100% agreement between the two different systems. Details of the comparison are in Figure 3.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Internal validation was performed on 21 cases that were picked randomly from the dataset common to both local data and Swedvasc. 13 variables presented in the methodology section were checked on each patient. This means that altogether 273 details were reviewed. 13 variables (5%) were missing, 5 due to the fact that the follow-up of the patient was in Falun and not in Uppsala. Thus, the prevalence of “true” missing cases was 3% (n=8). From 260 variables that were recorded the data was in accordance with the information the validator (MV) extracted from the case records in 245 resulting in an internal validity of 94%.

The data fields with a discrepancy between the Swedvasc and hospital case records were bleeding details (n=3), other complications (n=3), diabetes (n=1) and smoking (n=1) status as well as aneurysm diameter (discrepancy ≥ 3 mm) (n=4). In all cases here there was a difference in the existence of a complication, i.e. there was “yes” in Swedvasc although the complication did not exist according to the Swedvasc criteria leading to an overestimation of the complication incidence. Details of the comparison are in Figure 4.

Västerås

External Validation

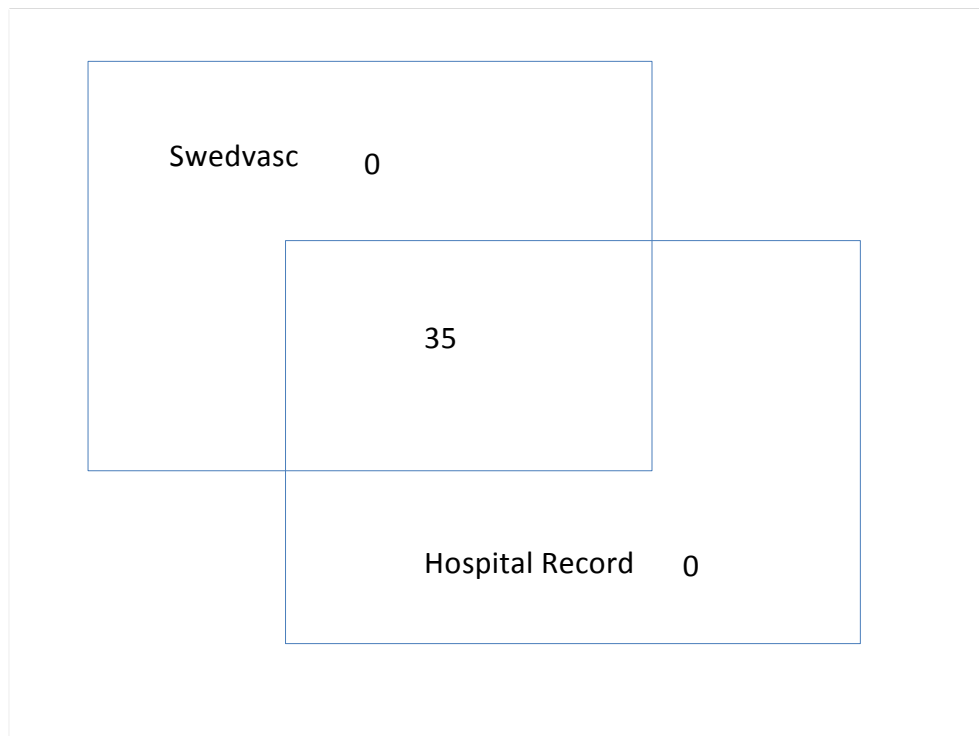
We were provided with a list of patients obtained from local hospital records including all patients who had undergone CEA, CAS, AAAR and

EVAR. It was not possible to do an electronic comparison of the numbers of the patients in the local data list with those in Swedvasc and therefore a manual comparison of numbers was performed.

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

The comparison between Swedvasc and local hospital data revealed the following:

- 35 procedures were common to local hospital data and Swedvasc
- 35 procedures in total in Swedvasc
- 35 procedures in total in hospital data
- 0 procedures in local hospital data that were not in Swedvasc
- 0 procedures in Swedvasc that were not in local hospital data



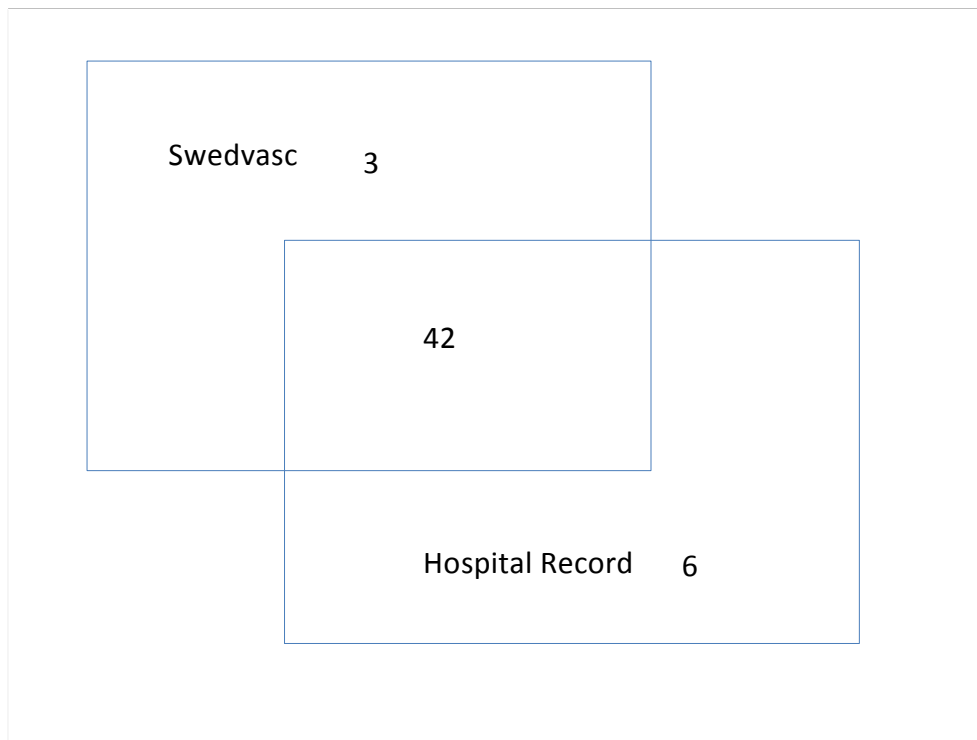
SUMMARY: In external validation all carotid cases that were operated in Vesterås during 2012 were found in Swedvasc registry and the external validation was 100%.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Local data identified a total of 51 aortic cases. Comparison of data sources revealed the following:

- 45 procedures in total in Swedvasc
- 48 procedures in total in local data
- 42 procedures common to Swedvasc and to local data
- 3 procedures in Swedvasc but not in local data
- 6 procedures in local data but not in Swedvasc

TOTAL = 51



Further interrogation of individual patient data revealed the following:

Patients in local data but not in Swedvasc

- Patient 1** Patient had treatment of a suprarenal aortic aneurysm and was correctly coded in Swedvasc under other AAA. The patient should not have appeared in the local patient list.
- Patient 2** Patient underwent iliac stent and limb extension following previous EVAR and should therefore have been a re-operation. This was correctly coded in Swedvasc.
- Patient 3** Patient had aortobifemoral bypass for occlusive disease and was correctly coded in Swedvasc under other artery bypass.
- Patient 4** A thrombectomy was performed in a patient who had had a previous femoro-femoral bypass graft, and a local groin exploration and iliac stenting was performed. This was

correctly coded in Swedvasc but incorrectly picked up under AAA in local data.

Patient 5 An aortobifemoral bypass graft was performed for acute ischaemia. This was correctly coded under other arterial procedure in Swedvasc.

Patient 6 An aortobifemoral bypass graft was performed for occlusive disease. This was correctly coded under other arterial procedure in Swedvasc.

Patients in Swedvasc but not in local data

Patient 1 Patient underwent EVAR and was correctly coded in Swedvasc. On searching local patient data this procedure was present but had been coded incorrectly in the operation codes.

Patient 2 Patient underwent EVAR and was correctly coded in Swedvasc and in local patient data. It was not clear why this patient did not appear in the local patient list.

Patient 3 Patient underwent EVAR and was correctly coded in Swedvasc. In local data the procedure was coded as an iliac stent for left CIA aneurysm, but should have been coded as EVAR.

SUMMARY: All cases that were operated on during 2012 according to the hospital records were registered to Swedvasc. External validity was 100%

Internal Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Internal validation was performed on 13 cases that were picked randomly from the dataset common to both local data and Swedvasc. The variables listed in the methods section were compared for local data and from Swedvasc as previously described. There were 17 variables checked, although the age and sex of the patients were fixed in the patient codes and therefore not subject to possible error, and so in practice 15 variables were checked.

Overall 195 data entries were checked. Of these 1(0.5%) variables were missing in local data compared to Swedvasc, and this was for the datafield of smoking. Different responses were obtained from local data and from Swedvasc in 5 patients resulting in an internal validity of 97%. 3 out of these 5 (60%) were for the datafield of indication and the discrepancy was the recording of TIA or minor stroke. 1 out of the 5 was for the datafield of diabetes and the remaining 1 was for the field of smoking. The comparison is shown in Figure 5.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Internal validation was performed by picking 15 random cases from the Swedvasc registry. There were 15 variables checked, although the age and sex of the patients were fixed in the patient codes and therefore not subject to possible error, and so in practice 13 variables were checked. Altogether 195 data fields were reviewed. 7 variables (4%) were missing, blood loss

being the commonest (4 cases). Different responses between the hospital data and Swedvasc were identified in 13 fields giving an internal validity of 93%. The differences were spread across different data fields: smoking (3); AAA diameter (4); operation date (3); blood loss (2); post-operative dialysis (1). The comparison is shown in Figure 6.

Södersjukhuset, Stockholm

External validation

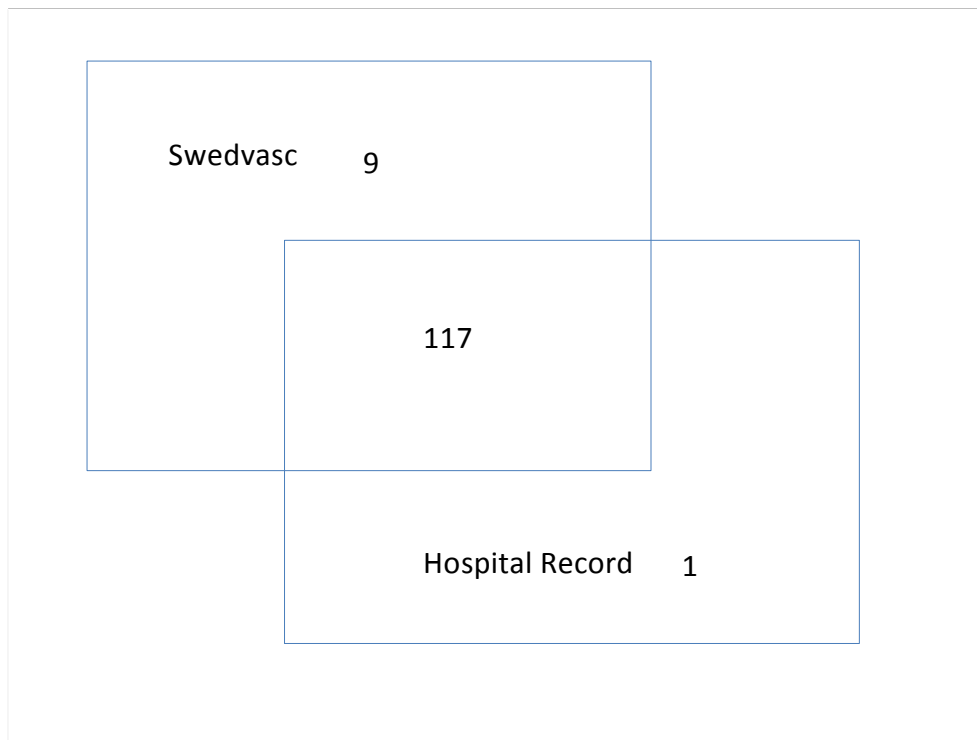
Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Data comparison identified the following numbers:

- 117 procedures common to both datasets
- 118 procedures in hospital administrative data
- 126 procedures in Swedvasc registry
- 9 procedures in Swedvasc not in hospital administrative data
- 1 procedure in hospital administrative data not in Swedvasc

TOTAL=127

This data included 4 patients who were in twice due to having both sides operated on.



Patients in local data but not in Swedvasc

Patient 1 This case had been operated on in 2011, but left the hospital in 2012. Due to this, patient entered the hospital data for 2012 procedures. This patient was found in Swedvasc, but was in the year 2011 data.

Patients in Swedvasc but not in local data

Patients 1-3 3 patients had left the hospital without any discharge records in the hospital administrative system, and due to that they failed to appear in the local data search

Patient 4 1 patient was operated on in 2012 but left the hospital in 2013 (year 2013 in hospital data)

Patient 5 This patient had the operation code PAE25 which was not included in the search criteria.

Patient 6 This patient had the operation code PAH which was not included in the search criteria.

Patient 7-9 There was no explanation found for these patients as to why they did not appear in the hospital dataset.

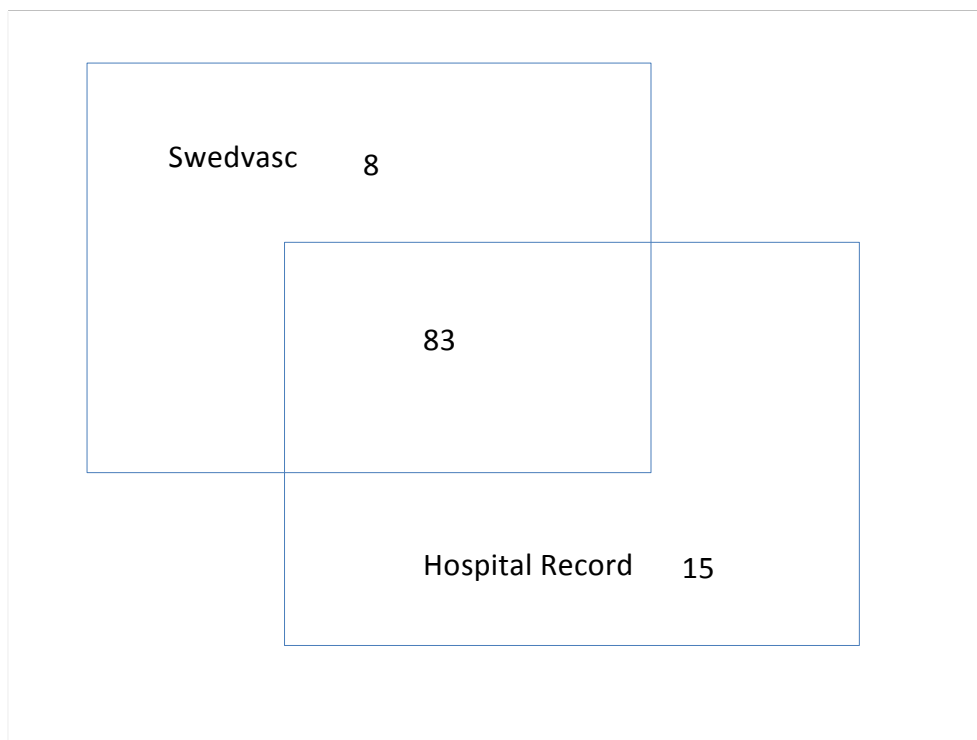
SUMMARY: The external validity for operations for carotid stenosis in 2012 was 100%

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Data comparison identified the following numbers of cases:

- 83 procedures common to both datasets
- 98 procedures in hospital administrative data
- 91 procedures in Swedvasc registry
- 8 procedures in Swedvasc not in hospital administrative data
- 15 procedures in hospital administrative data but not in Swedvasc.

Total = 106



All the case records of the patients that did not match (8 and 15) were reviewed and Swedvasc data checked.

Patients in local data but not in Swedvasc

- Patients 1-2** These were true missing cases that had not been recorded in Swedvasc.
- Patients 3-7** 5 procedures were found correctly in Swedvasc in the re-operation module.
- Patients 8-14** 7 procedures were found correctly in Swedvasc in “övrigaartär” (other procedures) module
- Patient 15** Procedure recorded correctly in Swedvasc in infrainguinal module (PDQ10=iliac artery stenting)

Patients in Swedvasc but not in local data

- Patient 1** was operated in KarolinskaSjukhuset (common on call system)
- Patient 2** No operation code in the discharge summary and due to that no code in hospital registry
- Patient 3** Operation code was PDG 53, which was not included in the search criteria
- Patient 4** No discharge summary and due to that no code in hospital system
- Patient 5** The wrong year was entered in Swedvasc, the patient had been operated in 2013 not in 2012, hence was not included in the local data search which covered 2012 only.
- Patient 6** No explanation was found in this case
- Patient 7** No explanation was found in this case

SUMMARY: In 2012, 95 infrarenal aortic operations belonging to Swedvasc infrarenal aortic module were performed in SÖS. Two of these were not recorded in Swedvasc. The external validity was 98%.

Internal Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

The number of carotid procedures checked was 14. The datafieldvariables reviewed per patient were 14 making a total of 196 data fields. One of these

was missing from Swedvasc and in one variable the recorded value was "data not known". From 194 possible variables data between Swedvasc and case records did not match in 6, thus the internal validity was 97%. The six variables that did not match were indication (TIA in Swedvasc, minor stroke in hospital neurological records) in three cases, smoking in 2 cases and degree of stenosis in one case.

The comparison is shown in Figure 7.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Internal validation was performed by picking 20 random cases from the Swedvasc registry. Altogether 260 data fields were reviewed. There were no missing fields in Swedvasc but there were 3 "do not know" responses (1%) compared to available data in the hospital record. In three variables the data was not found from hospital case records. Altogether 254 fields were possible to check for internal validation. Different responses between the hospital data and Swedvasc were identified in 7 fields giving an internal validity of 97%. The 7 fields included smoking (n=3), urgency of the operation (n=1), bleeding (n=1) and other complication (n=1) (in Swedvasc there was abdominal compartment syndrome although the Swedvasc criteria for this complication were not fulfilled). The comparison is shown in Figure 8.

Helsingborg

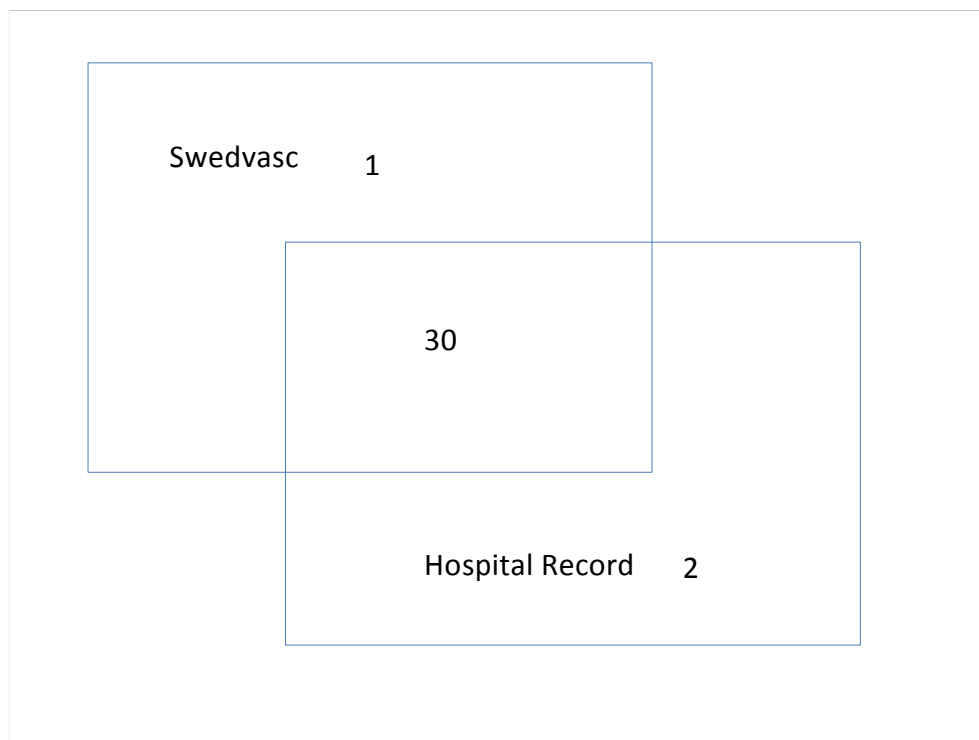
External Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Comparison of Swedvasc data and local hospital administrative data demonstrated the following numbers:

- 30 procedures common to Swedvasc and administrative data
- 31 procedures in Swedvasc
- 32 procedures in local administrative data
- 2 procedures in local administrative data but not in Swedvasc
- 1 procedure in Swedvasc but not in local administrative data

Total = 33



The 2 cases that were in the local administrative dataset but were not in Swedvasc were as follows:

Patient 1 Carotid stenting procedure, present in the re-operation module of Swedvasc

Patient 2 Common carotid artery stenting procedure, also recorded in the re-operation module in Swedvasc.

The 1 case that was in Swedvasc but not in the local administrative data was as follows:

Patient 1 Patient underwent bilateral procedures on separate occasions. The patient had been entered into Swedvasc but was not picked up in the administrative data codes for the second side, although the patient details were correct in the hospital records. .

SUMMARY: All cases were recorded to Swedvasc. External validity 100%.

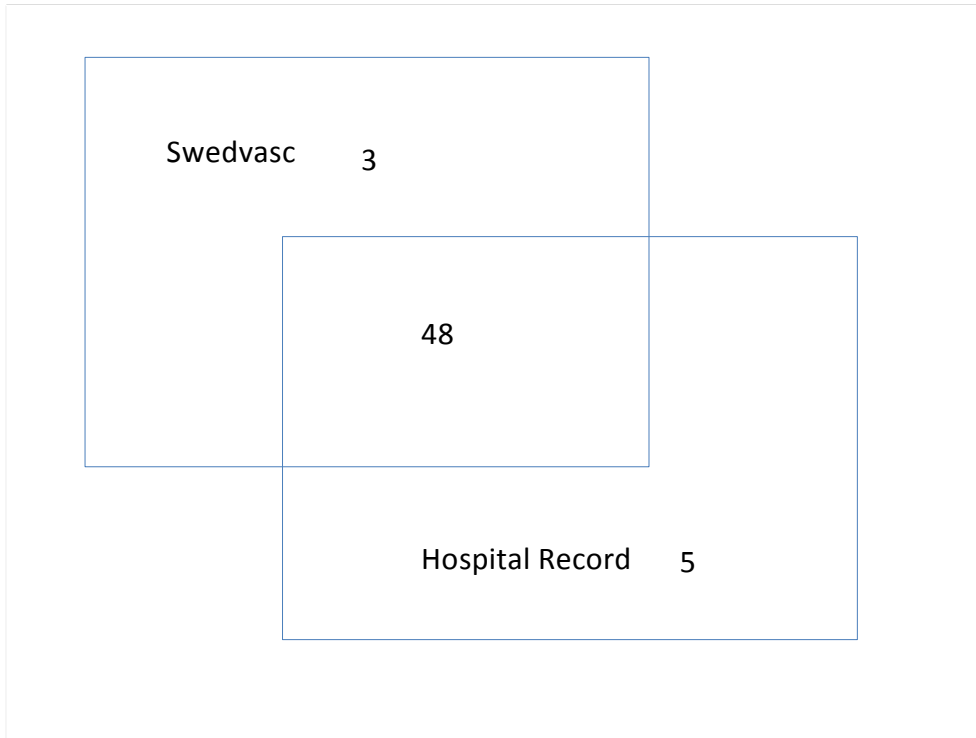
Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Data comparison between Swedvasc and local hospital administrative data identified the following number of cases:

- 48 procedures common to Swedvasc and administrative data
- 51 procedures in Swedvasc
- 53 procedures in local administrative data

- 5 procedures in local administrative data but not in Swedvasc
- 3 procedures in Swedvasc but not in local administrative data

Total = 56



Patients in local data but not in Swedvasc

- Patient 1** Aorta stented for occlusive disease Patient was registered in other module on Swedvasc but with incorrect ID code.
- Patient 2** EVAR for AAA. Ruptured. True missing case in Swedvasc
- Patient 3** Open AAA for Ruptured AAA. Operated on on 23.11.11 and correctly registered in Swedvasc in 2011. Care continued in hospital until 2012 and therefore was registered in hospital administration system in 2012.

Patient 4 Endovascular procedure for aortoiliac disease – atherosclerosis. Patient was registered in other module in Swedvasc.

Patient 5 Atherosclerotic disease and re-operation. Entered in Swedvasc in re-operation module

Patients in Swedvasc but not in local data

Patient 1 Patient was operated in Eksjö (by a Helsingborg surgeon), a district hospital in another county and was therefore not included as an operation in the Helsingborg administration system.

Patient 2 The last 4 digits of the patient ID were wrong in the matching process. Subsequent analysis showed this patient was present in the Helsingborg patient records and in Swedvasc.

Patient 3 This patient had a planned EVAR, but was entered with the incorrect patient-ID in Swedvasc. The surgeon confused the patient's ID number with a male patient that he had operated on at a different district hospital. Allowing for this the patient was present in both datasets.

SUMMARY: One patient that had been operated during 2012 was not registered to Swedvasc. The External validity was 99%.

Internal Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Internal validation was performed on 15 cases that were picked randomly from the dataset common to both local data and Swedvasc. The variables listed in the methods section were compared for local data and from Swedvasc as previously described. There were 17 variables checked, although the age and sex of the patients were fixed in the patient codes and therefore not subject to possible error, and so in practice 15 variables were checked.

Overall 225 data entries were checked. Of these 4 (2%) variables were missing in local data compared to Swedvasc, 2 of which were for the datafield of diabetes, 1 for the datafield of smoking, and 1 for degree of carotid stenosis (although it was reported in local data as “very tight”). Different responses were obtained from local data and from Swedvasc in 4 records resulting in an internal validity of 98%. These 4 fields were smoking, degree of carotid stenosis, type of carotid procedure and post operative coronary syndrome. The comparison is shown in Figure 9.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Internal validation was performed by picking 15 random cases from the Swedvasc registry. There were 15 variables checked, although the age and sex of the patients were fixed in the patient codes and therefore not subject to possible error, and so in practice 13 variables were checked. Altogether 195 data fields were reviewed. 21 variables (7%) were missing, blood loss

being the commonest (9 cases). 2 of these fields were missing data for aneurysm size in the hospital record, but the validators were not give access to the CT records of the patient and this data may have been available in the record. Different responses between the hospital data and Swedvasc were identified in 5 fields giving an internal validity of 97%. The differences were spread across different data fields: smoking (2); AAA diameter (1); diabetes (1); post-operative coronary event (1), although it should be noted that this patient died on table with a ruptured AAA. The comparison is shown in Figure 10.

SkåneUniversty Hospital, Malmö

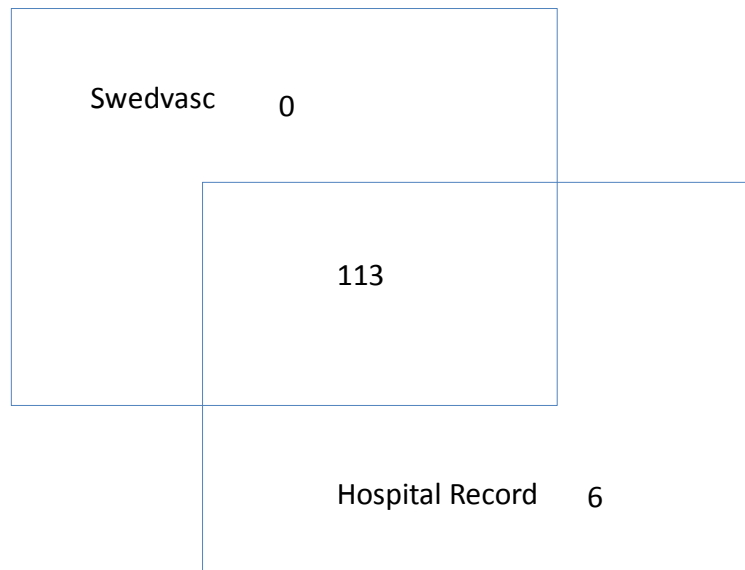
External Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

The external validity of carotid operations was checked against paper prints including information on the scheduled carotid operations. Stenting procedures came from another source. Hospital data included altogether 115 procedures. The number of procedures in Swedvasc was 113. Six procedures (5 open operation and 1 stenting) seemed to be missing from Swedvasc registry.

- 113 procedures common to Swedvasc and administrative data
- 113 procedures in Swedvasc
- 119 procedures in local administrative data
- 6 procedures in local administrative data but not in Swedvasc

0 procedures in Swedvasc but not in local administrative data



Patients in local data but not in Swedvasc

- Patient 1** This patient was in the hospital files twice (the first time when she was scheduled for CEA, but was not operated on because of heart failure. She was operated on 3 weeks later and recorded then in Swedvasc)
- Patient 2-4** These 3 patients had undergone caroticosubclavian bypass and were registered in Swedvasc to the other artery module
- Patient 5** This patient had undergone repair of the aortic arch together with a carotid endarterectomy and was registered in the other artery module
- Patient 6** This patient had undergone stenting of the brachiocephalic trunk and was registered in Swedvasc in the other artery module.

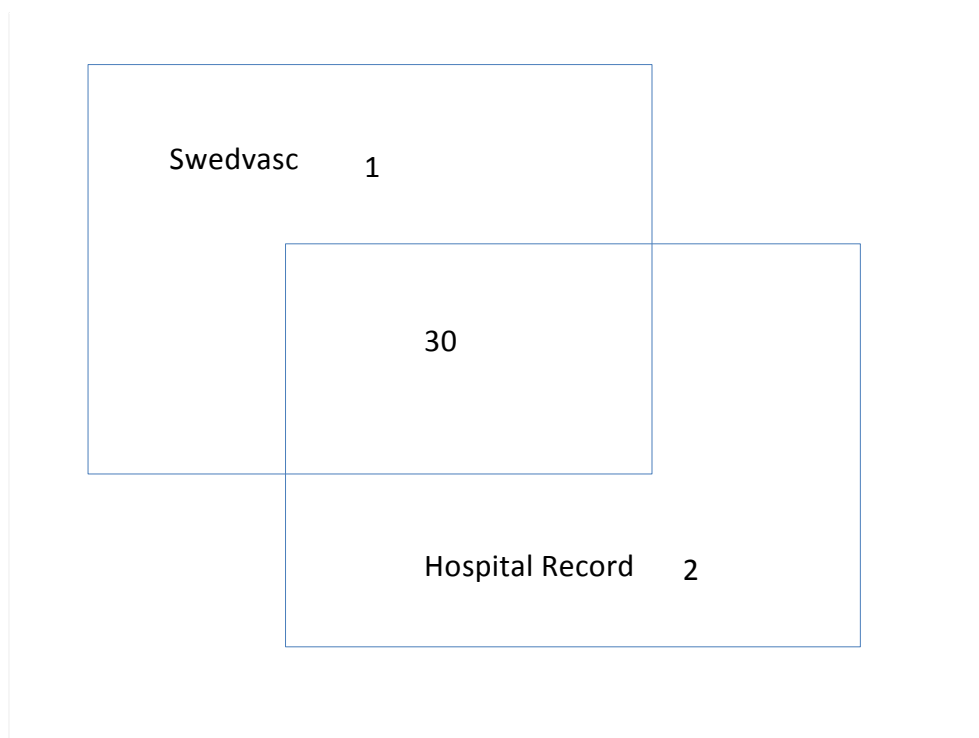
All the cases that were registered in Swedvasc could be found from hospital files.

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Comparison of Swedvasc data and local hospital administrative data demonstrated the following numbers:

- 30 procedures common to Swedvasc and administrative data
- 31 procedures in Swedvasc
- 32 procedures in local administrative data
- 2 procedures in local administrative data but not in Swedvasc
- 1 procedure in Swedvasc but not in local administrative data

Total = 33



The 2 cases that were in the local administrative dataset but were not in Swedvasc were as follows:

Patient 1 Carotid stenting procedure, present in the re-operation module of Swedvasc

Patient 2 Common carotid artery stenting procedure, also recorded in the re-operation module in Swedvasc.

The 1 case that was in Swedvasc but not in the local administrative data was as follows:

Patient 1 Patient underwent bilateral procedures on separate occasions. The patient had been entered into Swedvasc but was not picked up in the administrative data codes for the second side, although the patient details were correct in the hospital records. .

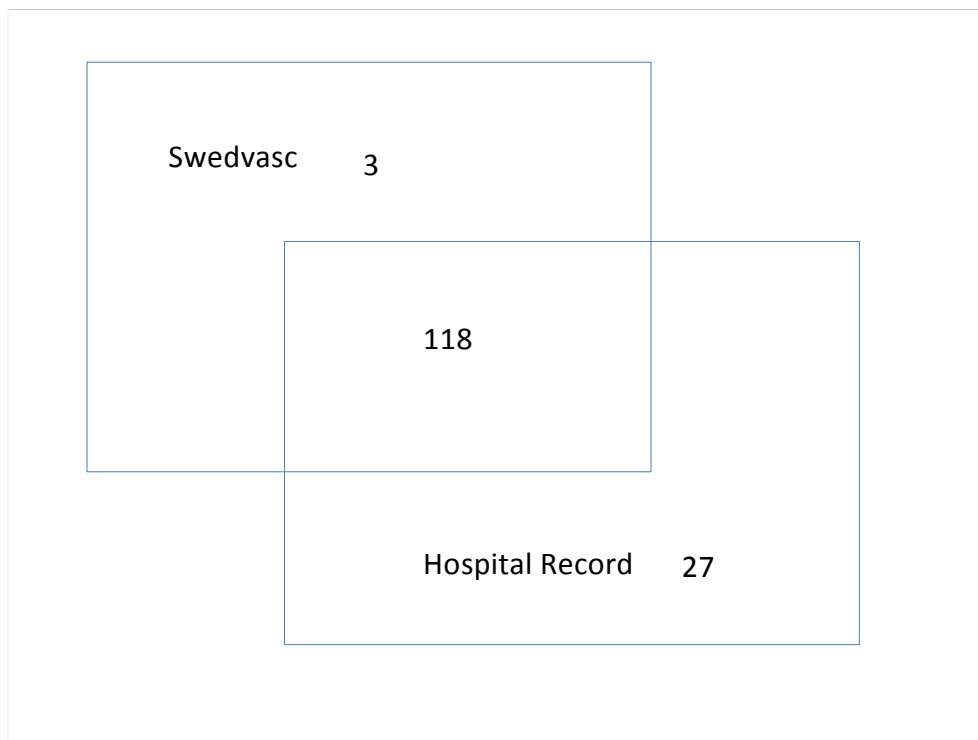
SUMMARY: All cases were recorded to Swedvasc. External validity 100%.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

In Skåne University Hospital external validation was performed against the procedure lists from the operating theatre. The electronic list was not available and therefore checking was performed by comparing all the identity codes one-by-one with the Swedvasc data.

- 117 procedures common to Swedvasc and administrative data
- 145 procedures in hospital data
- 121 procedures in Swedvasc
- 27 procedures in local administrative data but not in Swedvasc
- 3 procedures in Swedvasc but not in local administrative data

TOTAL = 148



After reviewing all 30 (3+27) cases the results were as follows:

Patients in local data but not in Swedvasc

Patients 1-18 18 cases were found in Swedvasc in the TAAA module

Patients 19-24 6 cases were in Swedvasc in the module of “other artery” module

Patients 25-26 2 cases were in “reoperation” module

Patient 27 1 true missing case

Patients in Swedvasc but not in local data

Patient 1 The patient was coded incorrectly to the infrarenal aortic module in Swedvasc. The case was found from the hospital registry

Patients 2 & 3 These patients were not in the current case record system but were found in the old one.

SUMMARY: Altogether 122 infrarenal aortic operations including both open and endovascular operations were done in Skåne University Hospital in 2012. 121 were recorded correctly to the Swedvasc-registry, 1 case was missing. The external validity was 99%. 26 patients that seemed to be missing from Swedvasc had been recorded correctly to a different module to the infrarenal AAA module.

Internal Validation

Carotid Endarterectomy (CEA) & Carotid Stenting (CAS)

Internal validation was performed on 15 cases that were picked randomly from the dataset. In all cases the preoperative risk factors diabetes and smoking were missing from Swedvasc (n=30, 14%). All these data were available from the case records. For internal validation, 180 fields were available. In 5 cases the data between Swedvasc and the case records did

not match, thus the internal validity was 97%. 4 of the 5 fields were degree of stenosis and 1 field reoperation data.

The comparison is shown in Figure 11.

Abdominal Aortic Aneurysm Open Repair (AAAOR) and Endovascular Aneurysm Repair (EVAR)

Internal validation was performed by picking 20 random cases from the Swedvasc registry. There were 15 variables checked, although the age and sex of the patients were fixed in the patient codes and therefore not subject to possible error, and so in practice 13 variables were checked in each patient. Altogether 260 data fields were reviewed. In all but 1 case the pre-operative risk factors that were checked (diabetes and smoking) were missing in Swedvasc. In total the number of missing variables was 21 (8%). In 2 of these cases the data was also missing from the hospital record. Of the cases recorded (239 data fields) only 3 fields had different responses between the local hospital data and Swedvasc giving an internal validity of 98%. The comparison is shown in Figure 12.

Discussion

Vascular registries are of utmost importance in the quality control of a vascular surgical unit. They serve as a source of data in population based studies and allow monitoring of outcomes in a large number of patients that are treated in daily practice. The data contained in a registry, and publications and quality reports based on this data are of no value however if the registry data are unreliable. The biggest criticism and concern related to registry based studies is the validity of the data. A common opinion expressed by medical practitioners is that registry based data is unreliable. Validation of a registry therefore becomes important and mandatory. Two validation questions are important when assessing registry data: (i) are all the cases recorded in the registry and; (ii) is the recorded data valid? External validation as described in this report answers the first question and internal validation answers the second.

The Swedvasc registry was found to have very good correlation with local hospital clinical and administrative data in both external and internal

validation. With only a very small number of exceptions all the patients that were operated on in the validated hospitals during the year examined (2012), were also registered to the Swedvasc registry. Altogether five cases were missing from the Swedvasc when all procedures in 2012 for carotid stenosis and AAAs were checked against hospital records. Most of the discrepancies that were found between the two data systems were due to either registration in Swedvasc under different modules, or to patients being coded as a different procedure in local administrative data. In some cases it was felt by the local teams that there was no satisfactory code available. There were a handful of cases found in Swedvasc that were not in the hospital administrative data due to errors in the hospital recording systems. The data accuracy was good in internal validation. In one of the validated hospitals the preoperative risk factors (diabetes and smoking) were missing systematically. The preoperative and postoperative data was correct in all hospitals giving more than 95% internal data validity in all five hospitals.

The independence of the validators is a key issue to achieve unbiased results in a validation process. In the current project 5 out of 20 hospitals that perform vascular surgery in Sweden and participating Swedvasc were validated. The validators were able to influence the centres selected (Malmö, Stockholm), although two of them were selected due to geographical reasons i.e. the hospitals were near the other hospitals that were chosen for the validation (Vasterås and Helsingborg). Only one centre was selected by the representatives from Swedvasc (Uppsala). Due to this selection policy the validators were confident that the selection of the 5 hospitals was unbiased. The hospitals did know before the visit that aortic and carotid surgery in 2012 would be validated. This gave a theoretical possibility to influence the registry data before the visit. On the other hand,

the fact that all the studied preoperative risk factors were missing in one of the selected hospitals, does not support that. The validators were given detailed access to relevant data in order to be able to perform the validation and found no evidence of local centres failing to provide required information. Patients for the internal validation were selected randomly in order to prevent bias. One of the two validators had language skills that allowed her to review the case histories independently but the other needed a local person or representative from Swedvasc to help with the patient records. This could be seen as another limitation of the method (in addition to the fact that the hospitals were aware of the validation year), but is inevitable in international validation.

Almost all of the few differences between the case histories and Swedvasc data were in the pre-operative data, such as indication for the surgery, aneurysm diameter, degree of carotid stenosis and risk factors (diabetes and smoking). Postoperative complications were recorded carefully and in all cases where discrepancy was found between Swedvasc and case records, the definition of a complication was not fulfilled (e.g. a few cases with significant creatinine elevation without dialysis were recorded as renal complications although the definition of a renal complication in Swedvasc is one that requires dialysis). This suggests that postoperative complications were not underestimated in the registry. The few cases that were missing from the Swedvasc were all emergency cases, all of them survived. Mortality data, both at 30-days and at 12 month was correct in all the studied cases.

The most significant problem in the current validation process was getting correct lists of hospital records from the official hospital records and the structure of Swedvasc with several different modules. The vast majority of

the cases that seemed to be missing from Swedvasc were just recorded to a different module and a lot of the module "mistakes" were found. This of course does not affect the internal and external validity in the end but does have an influence on the reliability of the reports extracted from Swedvasc. As a result the numbers of different type of operations based on modules in Swedvasc could be seen as unreliable.

RECOMMENDATIONS

1. Procedure codes for identification of procedures in local hospital data and in Swedvasc should be identical.
2. Agreement should be reached (or followed more accurately locally if agreement already exists) at a national level regarding which procedures map to which codes.
3. It should be clear in Swedvasc how to record procedures done for different indications (e.g. an aortobifemoral bypass graft for aneurysmal disease or occlusive disease)
4. Consideration should be given to revising the different modules within Swedvasc as there appears to be a lack of consistency with regard to which cases are entered into the different modules.
5. A small number of data fields are responsible for the majority of the variations found between Swedvasc and local data. However, the validators were able to find this information from the case records. Consideration should be given as to the benefit of collecting the data fields that are prone to missing data. If these are not used for analysis they could be removed, if they are used then centres should try and complete these fields.

CONCLUSIONS

Swedvasc registry was found to have a high validity in both external and internal validation. Only 3 out of over 500 cases in five hospitals were not recorded in Swedvasc. In internal validation, one hospital did not record the risk factors studied, diabetes and smoking, otherwise internal validation showed >95% data validity. Data on postoperative complications was correct. The most significant issues the validators found were the use of several modules within Swedvasc leading to some confusion as to where cases should be recorded, and some discrepancies between Swedvasc and local coding.

Appendix

FIGURE 3. CAROTID DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR UPPSALA

	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA
PATIENT ID	A		B		C		D		E		F		G	
SIDE	L	L	R	R	L	L	R	R	R	R	R	R	R	R
AGE														
SMOKING	DK	Y	DK	Y	STOPPED > 5 YRS	STOPPED 2005	STOPPED > 5 YRS AGO	STOPPED 1 YR AGO	Y	Y	STOPPED > 5/52 < 5 YEARS	RECENT EX SMOKER	STOPPED > 5 YRS	MD
DIABETES	N	MD	N	MD	N	Y	N	MD	N	MD	Y	Y	N	MD
INDICATION	TIA	TIA	TIA	TIA	AM FU	AM FU	ASYMP	ASYMP	MINOR CVA	MINOR CVA	MINOR CVA	MINOR CVA	AM FU	AM FU
DEGREE OF STENOSIS	70-99	70-99	50-69	70-99	70-99	70-99	50-69	50-69	70-99	95	MD	70-99	50-69	70-99
TYPE OF SURGERY	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CAS	CAS	CEA	CEA
USE OF SHUNT	Y	Y	Y	Y	N	N	Y	Y	Y	Y	FILTER	FILTER	N	N
USE OF PATCH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y
POST OP CRANIAL NERVE INJURY	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
POST OP ACUTE CORONARY SYNDROME	N	N	N	N	N	N	N	N	N	N	N	N	N	N
DATE OF OPERATION	22.12.12	22.12.12	7.11.12	7.11.12	3.1.12	3.1.12	4.4.12	4.4.12	8.3.12	8.3.12	20.06.12	20.06.12	12.07.12	12.07.12
POST OP TIA	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POST OP STROKE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
REOPERATION	N	N	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	N	N	N	N	N	N
COMMENTS							NO WOUND OR URTI RECORDABLE	WOUND INFECTION REQUIRING READMISSION & ANTIBIOTICS - ?			SECRETION FROM WOUND.			VOCAL CORD PALSY - BUT MAY BE LEFT-OVER FROM PREVIOUS OPERATION OTHER

	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA
PATIENT ID	H		I		J		K		L		M		N	
SIDE	L	L	L	L	L	L	L	L	L	L	L	L	R	R
AGE														
SMOKING	DK	N	STOPPED > 5 YRS	EX SMOKER	Y	Y	N	N	Y	Y	Y	Y	DK	DK
DIABETES	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
INDICATION	TIA	TIA	TIA	TIA	AM FU	AM FU	TIA	TIA	MINOR CVA	MINOR CVA	TIA	TIA	TIA	TIA
DEGREE OF STENOSIS	70-99	70-99	70-99	70-99	70-99	20-50	70-99	70-99	70-99	70-99	TIGHT - NO FIGURE	70-99	70-99	70-99
TYPE OF SURGERY	CEA	CEA	CAS	CAS	INTERPOSITIO N BYPASS PTFE	CAROTID SUBCLAVIAN BYPASS	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA
USE OF SHUNT	N	N	FILTER	FILTER	N	N	Y	Y	Y	Y	Y	Y	Y	Y
USE OF PATCH	Y	Y					Y	Y	Y	Y	Y	Y	N	N
POST OP CRANIAL NERVE INJURY	N	N	MD	MD	N	N	Y - HYPOGLOSS AL	Y - HYPOGLOSSAL	N	N	N	N	N	N
POST OP ACUTE CORONARY SYNDROME	N	N	MD	MD	N	N	N	N	N	N	N	N	N	N
DATE OF OPERATION	21.01.12	21.01.12	20.10.12	20.10.12	15.06.12	12.06.12 - THIS MAY BE WRONG DATE IN NOTES	8.5.12	8.5.12	27.03.12	27.03.12	13.10.12	13.10.12	24.11.12	24.11.12
POST OP TIA	N	N	MD	MD	N	N	N	N	N	N	N	N	N	N
POST OP STROKE	N	N	MD	MD	N	N	N	N	N	N	N	N	N	N
REOPERATION	N	N	MD	MD	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	MD	MD	N	N	N	N	N	N	N	N	N	N
COMMENTS		FU < 30 DAYS		FU in another county - know he is not dead	YES - BYPASS OCCLUDES	YES - BYPASS OCCLUDES. ALSO WOUND INFECTION AND & PHRENIC N PALSY	SUP WOUND INFECTION	SUP WOUND INFECTION		2/12 FU ONLY. POOR DOCUMENTATIO N		KORSAKOV'S ALSO. ALSO DEVELOPED AF		

	SWEDVASC	LOCAL DATA
PATIENT ID	O	
SIDE	R	R
AGE		
SMOKING	N	N
DIABETES	N	MD
INDICATION	TIA - SPEECH	TIA - NO AFFECTED SPEECH
DEGREE OF STENOSIS	70-99	70-99
TYPE OF SURGERY	CEA	CEA
USE OF SHUNT	Y	Y
USE OF PATCH	Y	Y
POST OP CRANIAL NERVE INJURY	N	N
POST OP ACUTE CORONARY SYNDROME	N	N
DATE OF OPERATION	25.05.12	25.05.12
POST OP TIA	Y	N
POST OP STROKE	N	N
REOPERATION	N	N
30 DAY MORTALITY	N	N
COMMENTS		SEEN DAY AFTER DISCHARGE TRANSIENT NUMBNESS LITTLE FINGER - SENT HOME.

FIGURE 4. AORTIC ANEURYSM DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR UPPSALA

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	no	no	Nej	Kostbehandlad DM	No	No	no	No	no	No	no	no	no	no
SMOKING	stopped >6kk	stopped>6kk	Yes	Yes	No	No	yes	yes	yes	Yes	yes	yes	slutat 4vk-5 yrs	slutat 5 vk
AAA DIAMETER	65	65	70	70	70	71	70	70	65	65	80	80	53	57
OPERATION TYPE EVAR/OPEN/CONVERSION	evar	evar	open	open	open	open	open	open	tevar (registrerad i fel modul)	tevar	evar	evar	open	open
RUPTURED/NONRUPTURED	noruptur	nonruptur	nonr	nonr	nonr	nonr	rupture	rupture	non	non	non	non	non	non
PLANNED/UNPLANNED/ACUTE	planerad	planerad	planerat	planerat	plan	plan	acute	acute	planerad	akut	akut	akut	planned	planned
BLOOD LOSS	<1000 ml	300ml	<1000ml	2000	2000-4999	5000	>5000ml	11000ml	<1000ml	0	<1000	300	2000-4999	4000
POSTOPERATIVE CORONARY EVENT (AMI)	No	No	No	No	No	No	Yes	Yes	data missing	no	No	No	no	no
RENAL FAILURE (dialysis, peritoneal or hemodialysis)	No	No	No	No	No	No	Yes	Yes	data missing	no	No	No	no	no
LIMB ISCHAEMIA	No	No	No	No	No	No	no	no	data missing	no	No	No	no	no
COMPARTMENT SYNDROME (pressure>20 AND	No	No	No	No	No	No	no	no	data missing	no	No	No	no	no
30 DAY MORTALITY	No	No	No	No	Åland, no control	No	yes	yes	data missing	no	No	No	no	no
90 DAY MORTALITY	No	No	No	No	Åland, no control	No	yes	yes	data mssing	no	No	No	no	no

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	no	no	no	no	no	no			no	no	no	no	yes	yes
SMOKING	stopped 4vk-6kk	stopped 1kk-6kk sitten	yes	yes	stopped>5yrs ago	stopped 6 months ago	slutat 1mån-5år	slutat 3 månader	slutat>5åt	slutat 5-6 år sen	slutat>5 år	slutat 1990	slutat 6mo-5yrs	slutat>6 mo
AAA DIAMETER	57	58	43	43 (iliaka) 37 (aorta)	missing	nästan 90	46	49 (aaa) 40 (iliaca communis)	60	55	41	45	58	58
OPERATION TYPE EVAR/OPEN/CONVERSION	open	open	open	open	evar	evar	open	open	evar	evar	open	open	evar	evar
RUPTURED/NONRUPTURED	non	non	non	non	ruptured	ruptured	non	non	rupt	non	nonr	nonr	non	non
PLANNED/UNPLANNED/ACUTE	planned	planned	plan	plan	acute	acute	plan	plan	akut	akut	plan	plan	planned	planned
BLOOD LOSS	2000-4999	3500	2000-4999	3500	<1000ml	200	2000-4999	3600	<1000	no value found	2000-4999	4300	<1000	150
POSTOPERATIVE CORONARY EVENT (AMI)	no	no	no	no	no	no	no	no	not registered, patient went back to falun	no	no	no	no	no
RENAL FAILURE (dialysis, peritoneal or hemo)	no	no	no	no	no	no	no	no	not registered, patient went back to falun	no	yes	no (not in dialysis, urine was alcalized)	no	no
LIMB ISCHAEMIA	no	no	no	no	no	no	no	no	not registered, patient went back to falun	no	yes	yes	no	no
COMPARTMENT SYNDROME (pressure>20 AND	yes	the definition >20 and organ failure_NO,	no	no	no	no	no	no	not registered, patient went back to falun	no	no	no	no	no
30 DAY MORTALITY	no	no	no	no	no	no	no	no	not registered, patient went back to falun	no	yes	yes	no	no
90 DAY MORTALITY	no	no	no	no	no	no	no	no	not registered, patient went back to falun	no	yes	yes	no	no

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	no	no	n	no	no	no	no	no	no	no	no	no	no	no
SMOKING	yes	yes	>5	stopped 6 years ago	yes	yes	do not know	no information	no	no	stopped >6kk	stopped>6kk	never smoked	stopped>5 yrs
AAA DIAMETER	52	55	45 iliac 43	45 iliac 43	65	65	85	85	80	78	65	65	71	71
OPERATION TYPE EVAR/OPEN/CONVERSION	evar	evar	open	open	open	open	open	open	open	open	evar	evar	evar	evar
RUPTURED/NONRUPTURED	non	non	non	non	non	non	rupt	rup	non	non	noruptur	nonruptur	noruptur	nonruptur
PLANNED/UNPLANNED/ACUTE	akut	akut	plan	plan	plan	plan	akut	akut	planned	planned	planerad	planerad	planerad	planerad
BLOOD LOSS	<1000	50	2000-4999	4274	2000-4999	3500	>5000ml	49000ml	1000-1999	2700	<1000 ml	300ml	<1000 ml	300ml
POSTOPERATIVE CORONARY EVENT (AMI)	no	no	no	no	no	no	no not know	yes	no	no	No	No	No	No
RENAL FAILURE (dialysis, peritoneal or hemo)	no	no	no	no	no	no	yes	no	no	no	No	No	No	No
LIMB ISCHAEMIA	no	no	no	no	no	no	no	no	no	no	No	No	No	No
COMPARTMENT SYNDROME (pressure>20 AND	no	no	no	no	no	no	no	no	no	no	No	No	No	No
30 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	No	No	No	No
90 DAY MORTALITY	no	no	no	no	no	no	yes	yes	no	no	No	No	No	No

FIGURE 5. CAROTID DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR VÄSTERÅS

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
	A		B		C		D		E		F		G	
SEX														
SIDE	L	L	R	R	L	L	L	L	R	R	R	R	L	L
AGE														
SMOKING	NEVER	NEVER	N	N	NEVER	MD	Y	Y	Y	Y	STOPPED > 5 YRS AGO	STOPPED 30 YRS AGO	N	N
DIABETES	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N
INDICATION	ASYMP	ASYMP	TIA	TIA	TIA	TIA	MINOR CVA	TIA	ASYM	ASYMP	TIA	MINOR CVA	TIA	TIA
DEGREE OF STENOSIS	70-99	70-99	70-99	70-99	70-99	70-99	50-70	50-70	70-99	70-99	70-99	70-99	20-49	20-49 PLAQUE WITH ULCERATION
TYPE OF SURGERY	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA
USE OF SHUNT	N	N	N	N	N	N	N	N	N	N	N	N	N	N
USE OF PATCH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
POST OP CRANIAL NERVE INJURY	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POST OP ACUTE CORONARY SYNDROME	N	N	N	N	N	N	N	N	N	N	N	N	N	N
DATE OF OPERATION	17.01.12	17.01.12	04.05.12	04.05.12	18.04.12	18.04.12	08.11.12	08.11.12	18.9.12	18.9.12	28.05.12	28.05.12	29.02.12	29.02.12
POST OP TIA	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POST OP STROKE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
REOPERATION	N	N	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	POST OP HAEMATOMA - NO REOPERATION	POST OP HAEM - NO REOP. RETRUNED DAY 9 SMALL WOUND LEAK	CHEST PROBLEM	HEIMLICH FOR PROBLEM - ? CRACKED RIB										

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
	H		J		K		L		M		N	
SEX												
SIDE	L	L	L	L	R	R	L	L	R	R	L	L
AGE												
SMOKING	STOPPED > 5 YRS	STOPPED 1996	N	N	STOPPED > 5 YRS AGO	STOPPED 97	STOPPED > 5 YR	STOPPED 2009	DK	N	N	N
DIABETES	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
INDICATION	AM F/RETINAL STROKE	AM F/RETINAL STROKE	TIA	TIA	ASYMP	ASYMP	TIA	TIA	TIA	MINOR CVA	TIA	TIA
DEGREE OF STENOSIS	70-99	70-99	70-99	70-99	70-99	70-99	50-69	50 - CCA STENOSIS	70-99	70-99	20-49	20-49
TYPE OF SURGERY	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA	CEA
USE OF SHUNT	N	N	N	N	N	N	N	N	Y	Y	N	N
USE OF PATCH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
POST OP CRANIAL NERVE INJURY	N	N	N	N	N	N	N	N	N	N	N	N
POST OP ACUTE CORONARY SYNDROME	N	N	N	N	N	N	N	N	N	N	N	N
DATE OF OPERATION	8.8.12	8.8.12	26.06.12	26.06.12	18.12.12	18.12.12	27.03.12	27.03.12	28.02.12	28.02.12	17.08.12	17.08.12
POST OP TIA	N	N	N	N	N	N	N	N	N	N	N	N
POST OP STROKE	N	N	N	N	N	N	N	N	N	N	N	N
REOPERATION	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	N	N	N	N
				ENT REFERRAL DUE TO HOARSE VOICE DAY 1 - SETTLED NO INTERVENTION					HAD GA - ALL REST LA			

FIGURE 6. AORTIC ANEURYSM DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR VÄSTERÅS

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
	A		B		C		D		E		F		G	
SEX														
AGE														
SMOKING	STOPPED > 5 YRS	STOPPED 1991	STOPPED > 5 YRS	STOPPED 98	N	N	N	N	N	STOPPED < 5 YRS AGO	STOPPED 2000	Y	Y	Y (CORRECT)
DIABETES	N	N	N	N	N	N	N	N	N	N	N	N	N	N
AAA DIAMETER	55	53	56	55	59	60	54	53	58	> 5CM < 5.5CM	57 US	57 US	54	53
OPERATION TYPE - EVAR/OPEN/CONVERSION	OPEN	OPEN	OPEN	OPEN	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR	OPEN	OPEN	OPEN BIFURC	OPEN BIFURC
OPERATION DATE	02.01.12	02.01.12	16.01.12	16.01.12	19.01.12	18.01.12	16.07.12	16.07.12	07.11.12	07.11.12	16.04.12	16.04.12	23.07.12	23.07.12
RUPTURED/NON-RUPTURED	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON
PLANNED/UNPLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED
BLOOD LOSS	2000-5000	2400	1000-2000	2700	<1000	MD - Probably too small to record. No transfusion	<1000	400	1000-2000	MD - TRANSFUSED 3 UNITS	< 1000	1200	2000-5000	2500
POSTOPERATIVE CORONARY EVENT	N	N	N	N	N	N	N	N	N	N	N	N	N	N
DIALYSIS - PERITONEAL OR HAEMO	N	N	Y	NO DIALYSIS - INCREASED CREAT	N	N	N	N	N	N	N	N	N	N
LIMB ISCHAEMIA	Y - REOP	Y - REOP	N	N	N	N	N	N	N	N	N	N	Y	Y
ABDOMINAL COMPARTMENT SYNDROME	N	N	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Minor wound infection				Other comp		SHOULD THIS HAVE BEEN RECORDED - NOT SURE?	POST OP BLEEDING RETROPERIT - WENT TO ANGIO AND HAD ANGIO - NO INTERVENTION		GROIN INFECTION			FASCIOTOMY AND TEA FEM ART	CLAMP ABOVE RENAL ARTERY

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD		
	H		J		K		L		M		N		O			
SEX																
AGE																
SMOKING	STOPPED > 5 YRS	STOPPED ? WHEN	DK	STOPPED 97 (IN FU DATA)	STOPPED > 5 YR	MD	DK	N - FU NOTES	DK	STOPPED 2 YRS	STOPPED > 5 YR	STOPPED 1960	STOPPED < 5 YRS	STOPPED 1995 - ALSO RECORDS STOPPED 2008		
DIABETES	N	N	N	N	DK	MD	Y	Y	N	N	N	N - MD?	N	N		
AAA DIAMETER	33 CT ILIAC	33 CT ILIAC L, 23 ON R, AORTA 23	80 CLINICAL	NOT MEASURED	78 CT		78	100CT		100	50	65	60	60	54	54 (51 US)
OPERATION TYPE - EVAR/OPEN/CONVERSION	EVAR	L ILIAC STENT ONLY	OPEN	OPEN	EVAR	EVAR	OPEN BIFURC	OPEN BIFURC	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR
OPERATION DATE	07.06.12	05.06.12	30.01.12	30.01.12	13.04.12	13.04.12	17.08.12	17.08.12	09.11.12	09.11.12	23.05.12	23.05.12	03.09.12	03.09.12		
RUPTURED/NON-RUPTURED	NON	NON	RUPT	RUPT	RUPT	RUPT	RUPT	RUPT	NON	NON	NON	NON	NON	NON		
PLANNED/UNPLANNED	PLANNED	PLANNED							ACUTE	UNPLANNED	PLANNED	PLANNED	PLANNED	PLANNED		
BLOOD LOSS	<1000	<100	2000-5000	2500	<1000	NOT LISTED - OPERATION STOPPED, DIES ON TABLE	2000-5000	4500	<1000	MD - RECEIVED 2 UNITS	<1000	450	<1000	MD		
POSTOPERATIVE CORONARY EVENT	N	N	N	N			N	N	N	N	N	N	N	N		
DIALYSIS - PERITONEAL OR HAEMO	N	N	N	N			N	N	N	N	N	N	N	N		
LIMB ISCHAEMIA	N	N	N	N			N	N	N	N	N	N	N	N		
ABDOMINAL COMPARTMENT SYNDROME	N	N	N	N			N	N	N	N	N	N	N	N		
30 DAY MORTALITY	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N		
									DON'T RECORD THIS IN SWEDVASC	FALSE ANEURYSM GROIN - NO INTERVENTION	DON'T RECORD	GROIN HAEMATOMA		WOUND HEALING PROBLEM LEFT GROIN?		

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD
	P	
SEX		
AGE		
SMOKING	STOPPED > 5 YR	STOPPED 1999
DIABETES	N	N
AAA DIAMETER	60	AT LEAST 60
OPERATION TYPE - EVAR/OPEN/CONVERSION	OPEN	OPEN
OPERATION DATE	27.06.12	28.06.12
RUPTURED/NON-RUPTURED	NON	NON
PLANNED/UNPLANNED	PLANNED	PLANNED
BLOOD LOSS	<1000	<1000
POSTOPERATIVE CORONARY EVENT	N	N
DIALYSIS - PERITONEAL OR HAEMO	N	N
LIMB ISCHAEMIA	N	N
ABDOMINAL COMPARTMENT SYNDROME	N	N
30 DAY MORTALITY	N	N

FIGURE 7. CAROTID DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR STOCKHOLM

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	no	no	no	no	no	no	no	no	yes	yes	no	no
SMOKING	yes	yes	no	no	slutat <5	slutat 7 år	no	no	aldrig rökt	tidigare rökt	no	no
INDICATION	as	as	tia	tia	minor stroke	minor	tia	tia	minor stroke	minor stroke	tia	tia
DEGREE OF STENOSIS	70-99	70-80	50-69	50-70	70-99	100	70-99	70-79	70-99	kraftig	70-99	80-99
TYPE OF SURGERY	cea	cea	cea	cea	bypass	bypass	cea	cea	cas	cas	cea	cea
USE OF SHUNT	no	no	no	no	no	no	no	no	no	no	no	no
USE OF PATCH	yes	yes	yes	yes	no	no	yes	yes	no	no	yes	yes
POST OP CRANIAL NERVE INJURY	no	no	no	no	no	no	no	no	no	no	no	no
POST OP ACUTE CORONARY SYNDROME	no	no	no	no	no	no	no	no	no	no	no	no
POST OP TIA	no	no	no	no	no	no	no	no	no	no	no	no
POST OP STROKE	no	no	no	no	no	no	no	no	no	no	no	no
REOPERATION	no	no	no	no	no	no	no	no	no	no	no	no
30 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no
90 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	no	no	no	no	no	no	no	no	no	no	no	no
SMOKING	yes	yes	no	no	no	no	do not know	tidigare rökt	slutat	slutat	no	no
INDICATION	tia	minor stroke	tia	minor stroke	minor stroke	minor strok	af	af	tia	tia	af	af
DEGREE OF STENOSIS	70-99	90	70-99	80	70-99	70-99	70-99	80	70-99	80	data missing 70-79	
TYPE OF SURGERY	cea	cea	cea	cea	cea	cea	bypass	bypass	cea	cea	cea	cea
USE OF SHUNT	yes	yes	yes	yes	no	no	no	no	no	no	no	no
USE OF PATCH	yes	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes
POST OP CRANIAL NERVE INJURY	no	no	no	no	no	no	no	no	no	no	yes	yes
POST OP ACUTE CORONARY SYNDROME	no	no	no	no	no	no	no	no	no	no	no	no
POST OP TIA	no	no	no	no	no	no	no	no	no	no	no	no
POST OP STROKE	no	no	no	no	no	no	no	no	no	no	no	no
REOPERATION	no	no	no	no	no	no	no	no	no	no	no	no
30 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no
90 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	yes	yes	yes	yes
SMOKING	yes	yes	no	no
INDICATION	tia	minor stroke	minor stroke	minor stroke
DEGREE OF STENOSIS	50-69	50-70	70-99	90
TYPE OF SURGERY	cea	cea	stent	stent
USE OF SHUNT	no	no	no	no
USE OF PATCH	yes	yes	no	no
POST OP CRANIAL NERVE INJURY	no	no	no	no
POST OP ACUTE CORONARY SYNDROME	no	no	no	no
POST OP TIA	no	no	no	no
POST OP STROKE	no	no	no	no
REOPERATION	no	no	no	no
30 DAY MORTALITY	no	no	no	no
90 DAY MORTALITY	no	no	no	no

FIGURE 8. AORTIC ANEURYSM DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR STOCKHOLM

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	yes	yes	no	no	no	no	yes	yes	no	no	no	no	yes	yes
SMOKING	never smoked	stopped 6 weeks ago	no	no	no	no	yes	yes	do not know	no data on smoking available Ct in referring hospital, no possibility to check the size	no	no	stopped >5 yrs sen	slutat 1985
AAA DIAMETER	45	43	60	60	57	57	54	52	90	90	62	62	60	64
OPERATION TYPE														
EVAR/OPEN/CONVERSION	evar	evar	evar	evar	evar	evar	open	open	reva	evar	evar	evar	evar	evar
RUPTURED/NONRUPTURED	non	non	non	non	non	non	non	non	rupture	rupture	no	n	no	no
PLANNED/UNPLANNED/ACUTE	plan	plan	plan	plan	planned	planned	planned	planned	acute	acute	planned	planned	acute	unplanned (halv akut)
BLOOD LOSS	<1000ml	500	<1000	obetydlig	<1000	300	<1000	700	<1000	no data	<1000	0	<1000	200
POSTOPERATIVE CORONARY EVENT (AMI)	no	no	no	no	no	no	no	no	no	no	no	no	no	no
RENAL FAILURE (dialysis, peritoneal or hemo-)	no	no	no	no	no	no	no	no	yes	yes	no	no	no	no
LIMB ISCHAEMIA	no	no	no	no	no	no	no	no	no	no	yes	yes	no	no
ABDOMINAL COMPARTMENT SYNDROME (pressure >20 AND ORGAN FAILURE)	no	no	no	no	no	no	no	no	no	no	yes	no	no	no
30 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no	no	no
90 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no	no	no

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	y	y	no	no	no	no	yes	yes	no	no	no	no	no	no
SMOKING	aldrig rökt	smokes 3-4 cigarets per day	>5 yr slutat	slutat 30 y se	slutat>5	slutat 20 år	do not know	yes	stopped>5 years ago	never smoked	yes	yes	slutat>5 yrs	slutat>5 yrs
AAA DIAMETER	64	64	76	76	70	70	90	90	61	61	55	55	60	60
OPERATION TYPE	evar	evar	open	open	evar	evar	open	open	evar	evar	evar	evar	evar	evar
RUPTURED/NONRUPTURED	no	no	nonruptured	nonruptured	nonr	nonr	ruptured	ruptured	nonr	nonr	nonr	nonr	ruptured	ruptured
PLANNED/UNPLANNED/ACUTE	planned	planned	planned	planned	planned	planned	akut	akut	planned	planned	planned	planned	acute	acute
BLOOD LOSS	<1000	200	<1000	3500	<1000	150	2000-4999	no information found	<1000	400	<1000	700	<1000	500
POSTOPERATIVE CORONARY EVENT AMI)	no	no	no	no	no	no	no	no	no	no	no	no	no	no
RENAL FAILURE (diaölysis, peritoneal or hemo-)	no	no	no	no	no	no	no	no	no	no	no	no	no	no
LIMB ISCHAEMIA	no	no	no	no	no	no	no	no	no	no	yes	yes	no	no
ABDOMINAL COMPARTMENT SYNDROME (pressure>20 AND ORGAN FAILURE)	no	no	no	no	no	no	no	no	no	no	no	no	no	no
30 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no	no	no
90 DAY MORTALITY	no	no	no	no	no	no	no	no	no	no	no	no	no	no

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	no	no			no	no	no	no	no	no	no	no
SMOKING	slutat>5	slutat>5	do not know	no	yes	yes	slutat>5	slutat>5	no	no	no	no
AAA DIAMETER	54	54	67	67	51	51	66	66	65	65	70	70
OPERATION TYPE												
EVAR/OPEN/CONVERSION	evar	evar	evar	evar	open	open	open	open	open	open	evar	evar
RUPTURED/NONRUPTURED	nonr	nonr	non	non	nonr	nonr	no	no	ruptured	ruptured	nonr	nonr
PLANNED/UNPLANNED/ACUTE	planned	planned	acute	acute	planned	planned	planned	planned	acute	acute	planned	planned
BLOOD LOSS	<1000	400	1000-1999	1900	1000-1999	1400	2000-4999	2300	2000-4999	3000	<1000	200
POSTOPERATIVE CORONARY EVENT (AMI)	no	no	no	no	no	no	no	no	no	no	no	no
RENAL FAILURE (dialysis, peritoneal or hemo-)	no	no	no	no	no	no	no	no	no	no	no	no
LIMB ISCHAEMIA	no	no	no	no	no	no	no	no	no	no	no	no
ABDOMINAL COMPARTMENT SYNDROME (pressure>20 AND ORGAN FAILURE)	no	no	no	no	no	no	no	no	no	no	no	no
30 DAY MORTALITY	no	no	no	no	no	no	no	no	yes	yes	no	no
90 DAY MORTALITY	no	no	no	no	no	no	no	no	yes	yes	no	no

FIGURE 9. CAROTID DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR HELSINGBORG

	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
RANDOM SAMPLE OF PATIENTS	A		B		C		D		E		F		G	
	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA
SEX	F	F	M	M	M	M	F	F	M	M			M	M
SIDE	R	R	L	L	R	R	R	R	R	R	R	R	R	R
AGE														
SMOKING	N	N	EX 4 weeks to 5 yrs	EX	Y stopped < 4 weeks	Y	N	N	EX > 5YRS	NEVER	Y	Y	EX > 5YRS	EX > 5 YRS
DIABETES	N	MD	Y	Y - IDDM	N	N	N	N	N	MD	N	N	N	N
INDICATION	TIA	WEAK LEG	TIA	TIA (stroke on other side)	Minor CVA	Minor CVA	TIA	TIA	MINOR CVA	MINOR CVA	ASYMPTOMATIC	ASYMPTOMATIC	TIA	MINOR CVA
DEGREE OF STENOSIS	70-99%	99%	70-99%	95%	70-99%	60-70%	70-99%	90%	70-99%	95%	70-99%	95%	70-99%	VERY TIGHT
TYPE OF SURGERY	CEA-EVERSION	CEA-EVERSION	CEA	CEA	LIGATION Carotid	LIGATION carotid	CEA	CEA - eversion	CEA - EVERSION	CEA - EVERSION	CEA EVERSION	CEA EVERSION	CEA - EVERSION	CEA - EVERSION
USE OF SHUNT	N	N	Y	Y	N/A	N/A	Y	Y	N	N	N	N	N	N
USE OF PATCH	N	N	Y	Y	N/A	N/A	Y	N	N	N	N	N	N	N
POST OP CRANIAL NERVE INJURY	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POST OP ACUTE CORONARY SYNDROME	N	N	N	Y - referred to med ECG changes	N	N	N	N	N	N	N	N	N	N
DATE OF OPERATION	15.06.12	15.06.12	08.11.12	08.11.12	28.11.12	28.11.12	10.04.12	10.04.12	20.02.12	20.02.12	17.04.12	17.04.12	24.04.12	24.04.12
POST OP TIA	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POST OP STROKE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
REOPERATION	N	N	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	N	N	N	N	N	N
COMMENTS								Chest infection						

	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
RANDOM SAMPLE OF PATIENTS	H		J		K		L		M		N	
	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA	SWEDVASC	LOCAL DATA
SEX			F	F	F	F	M	M	F	F	F	F
SIDE	R	R	L	L	R	R	L	L	L	L	R	R
AGE												
SMOKING	EX 4/52-5YRS	MD	Y	Y	EX > 5YRS	EX	Y	Y	Y	Y	EX - 4/52 - 5 YRS	EX - 4/52 - 5 YRS
DIABETES	N	N	N	N	N	N	N	N	N	N	N	N
INDICATION	ASYMPTOMATIC	ASYMPTOMATIC	MINOR CVA	MINOR CVA	AMAUIROSIS	AMAUIROSIS	TIA	TIA	AMAUIROSIS	AMAUIROSIS	ASYMPTOMATIC	ASYMPTOMATIC
DEGREE OF STENOSIS	70-99%	90%	50-69%	75%	70-99	95%	70-99%	85%	70-99%	95%	70-99%	95-99%
TYPE OF SURGERY	CEA	CEA	CEA EVERSION	CEA EVERSION	CEA EVERSION	CEA EVERSION	CEA	CEA	CEA	CEA	CEA-EVERSION	CEA-EVERSION
USE OF SHUNT	N	N	N	N	N	N	Y	Y	Y	Y	N	N
USE OF PATCH	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N
POST OP CRANIAL NERVE INJURY	N	N	N	N	N	N	N	N	N	N	N	N
POST OP ACUTE CORONARY SYNDROME	N	N	N	N	N	N	N	N	N	N	N	N
DATE OF OPERATION	12.01.12	12.01.12	14.02.12	14.02.12	4.6.12	4.6.12	22.02.12	22.02.12	11.04.12	11.4.12	5.7.12	5.7.12
POST OP TIA	N	N	N	N	N	N	N	N	N	N	N	N
POST OP STROKE	N	N	N	N	N	N	N	N	N	N	N	N
REOPERATION	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	N	N	N	N
COMMENTS		ALSO HAS AAA						SMALL HAEMATOMA		STENOSIS ON OTHER SIDE -		HAEMATOMA IN NECK

FIGURE 10. AORTIC ANEURYSM DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR HELSINGBORG

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
	A		B		C		D		E		F		G	
SEX	M	M	F	F	M	M			F	F	M	M		
AGE														
SMOKING	EX - > 5YRS	EX - 20 YRS	N- never	MD	N	MD	EX 4/52 TO 5 YRS	EX since 20 yrs	Y	Y	EX > 5 YRS	EX - 10 YRS	EX > 5YRS	EX
DIABETES	N	N	N	MD	N	MD	N	N	N	N	N	N	N	MD
AAA DIAMETER	6.3	6.3	4.4	4.4	5.5	5.5	6	6	6	6	6	6	5.8	5.8
OPERATION TYPE - EVAR/OPEN/CONVERSION	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR - FENESTRATED	EVAR - FENESTRATED	EVAR - UNILIAC AND CROSS OVER	EVAR - UNILIAC AND CROSS OVER	EVAR	EVAR	EVAR	EVAR
OPERATION DATE	28.02.12	28.02.12	14.05.12	14.05.12	15.03.12	15.03.12	25.09.12	25.09.25	12.06.12	12.06.12	12.01.12	12.01.12	14.06.12	14.06.12
RUPTURED/NON-RUPTURED	NON-RUPTURED	NON-RUPTURED	RUPTURED	RUPTURED	NON-RUPTURED	NON-RUPTURED	NON-RUPTURED	NON-RUPTURED	RUPTURE	RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE
PLANNED/UNPLANNED	PLANNED	PLANNED	UNPLANNED	UNPLANNED	PLANNED	PLANNED	PLANNED	PLANNED	UNPLANNED	UNPLANNED	PLANNED	PLANNED	PLANNED	PLANNED
BLOOD LOSS	<1000	250ML	<1000	300	<1000	MD	<1000	MD	<1000	MD	<1000	MD	<1000	MD
POSTOPERATIVE CORONARY EVENT	Y - MI	Y-MI	N	N	N	N	Y - CARDIAC FAILURE	Y - CARDIAC FAILURE & PLEURAL EFFUSION	N	N	N	N	N	N
DIALYSIS - PERITONEAL OR HAEMO	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LIMB ISCHAEMIA	N	N	N	N	N	N	N	N	N	N	N	N	N	N
ABDOMINAL COMPARTMENT SYNDROME		N	N	N	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	N	N	N	N	N	Y AT 4 DAYS	Y	N	N	N	N
				CHEST INFECTION - READMITTED	BUTTOCK CLAUDICATION			READMITTED WITH HAEMATURIA	MULTIORGAN FAILURE, INTESTINAL ISCHAEMIA	ISCHAEMIC COLON		MALIG SIGMOID POLYP - HAD FEVER POST OP		

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
SEX	H		J		K	M		L		M		N		O		P
AGE						M	M									
SMOKING	EX > 5 YRS	EX > 1 YR	EX > 5 YRS	EX - 15 YRS	EX > 5YRS	EX	Y	y	NOT KNOWN	NEVER	Y	Y	NOT KNOWN	EX	EX 4/52 - 5YRS	EX
DIABETES	N	MD	Y	Y	N	N	N	N - Borderline	N	Y	N	N	N	N	N	N
AAA DIAMETER	5.5	5.5	7	7	5.8	MD (NO ACCESS TO CT DATA)	6.2	MD (NO ACCESS TO CT DATA)	5	4.5	6	6	5.5	5.5	5.5	5.5
OPERATION TYPE - EVAR/OPEN/CONVERSION	EVAR	EVAR	EVAR	EVAR	OPEN	OPEN	OPEN	OPEN	EVAR - BRANCHED	EVAR PLUS ILIAC BIFURCATION GRAFT	EVAR	EVAR	EVAR	EVAR	EVAR	EVAR
OPERATION DATE	4.10.12	4.10.12	25.10.12	25.10.12	4.09.12	4.9.12	24.07.12	24.07.12	09.02.12	9.2.12	20.03.12	20.03.12	14.02.12	14.02.14	3.04.12	3.4.12
RUPTURED/NON-RUPTURED	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	RUPTURED	RUPTURED	RUPTURED	RUPTURED	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE	NON-RUPTURE
PLANNED/UNPLANNED	PLANNED	PLANNED	PLANNED	PLANNED	UNPLANNED	UNPLANNED	UNPLANNED	UNPLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED	PLANNED
BLOOD LOSS	<1000	MD	<1000	MD	2000-5000	MD	<1000	300	<1000	MD	<1000	MD	<1000	350	<1000	MD
POSTOPERATIVE CORONARY EVENT	N	N	N	N	Y - MI	NA	N	N	N	N	N	N	N	N	N	N
DIALYSIS - PERITONEAL OR HAEMO	N	N	N	N	N	NA	N	N	N	N	N	N	N	N	N	N
LIMB ISCHAEMIA	N	N	N	N	N	NA	N	N	N	N	N	N	N	N	N	N
ABDOMINAL COMPARTMENT SYNDROME	N	N	N	N	N	NA	N	N	N	N	N	N	N	N	N	N
30 DAY MORTALITY	N	N	N	MD	Y	Y	N	MD	N	N	N	N	N	N	N	N
	TYPE II ENDOLEAK				MI	CLAMP ABOVE RENALS. Vf ARREST AFTER TOP ANASTOMOSIS - DIED ON			4.5CM R COMMON ILIAC ANEURYSM			MINOR MIGRATION	WOUND INFECTION	HAEMATOMAS IN GROINS - READMITTED		BLEED FROM GROINS - NO RETURN TO THEATRE

FIGURE 11. CAROTID DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR MALMO

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	data missing	yes	data missing	n	data missing	n	data missing	n	data missing	n	data missing	n
SMOKING	data missing	slutat 1970	data missing	slutade 2007	data missing	n	data missing	no information found	data missing	slutade 8 år sedan	data missing	aldrig rökt
INDICATION	asyp	asyp	tia	tia	asyp	asyp	asyp	asyp	minor stroke	minor stroke	afx	afx
DEGREE OF STENOSIS	70-99	95	70-99	90	70-99	90	70-99	80-90	20-49	70-75	70-88	90
TYPE OF SURGERY	eversion	eversion	CAS	CAS	eversio	eversio	cas	cas	conventional	conventional	eversion	eversion
USE OF SHUNT	n	n	n	n	n	n	n	n	y	y	n	n
USE OF PATCH	n	n	n	n	n	n	n	n	y	y	n	n
POST OP CRANIAL NERVE INJURY	n	n	n	n	n	n	n	n	n	n	n	n
POST OP ACUTE CORONARY SYNDROME	n	n	n	n	n	n	n	n	n	n	n	n
POST OP TIA	n	n	n	n	n	n	n	n	n	n	n	n
POST OP STROKE	n	n	n	n	n	n	n	n	n	n	n	n
REOPERATION	n	n	no	acute limb ischemia	n	n	n	n	n	n	n	n
30 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n
90 DAY MORTALITY	n	n	n	n	n	n	n	n	y	y	n	n

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	data missing	n	data missing	n	data missing	y	data missing	n	data missing	n	data missing	y
SMOKING	data missing	n	data missing	aldrig rökt	data missing	slutat 91	data missing	slutat många år sen	data missing	rökar	data missing	aldrig rökt
INDICATION	minor stroke	minor stroke	tia	minor stroke	minor stroke	minor stroke	afx	afx	tia	tia	tia	tia
DEGREE OF STENOSIS	50-69	65	70-99	95	58	58	70-99	85	20-49	65	20-49	65
TYPE OF SURGERY	eversion	eversion	conventional	conventional	conventional	conventional	eversion	eversion	eversion	eversion	conventional	conventional
USE OF SHUNT	n	n	n	n	n	n	n	n	n	n	n	n
USE OF PATCH	n	n	y	y	n	n	n	n	n	n	y	y
POST OP CRANIAL NERVE INJURY	n	n	n	n	n	n	n	n	n	n	n	n
POST OP ACUTE CORONARY SYNDROME	n	n	n	n	n	n (tnt elev ad 258)	n	n	n	n	n	n
POST OP TIA	n	n	n	n	n	n	n	n	n	n	n	n
POST OP STROKE	n	n	n	n	n	n	n	n	n	n	n	n
REOPERATION	n	n	n	n	y	y (beeding)	n	n	n	n	n	n
30 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n
90 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n
	some kind of neu kompl											

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	data missing	no	data missing	no	data missing	n
SMOKING	data missing	slutat>1mo senar	data missing	no data found	data missing	rökar
INDICATION	minor stroke	minor stroke	minor stroke	minor stroke	asymp	asymp
DEGREE OF STENOSIS	20-49	90	70-99	95	70-99	95
TYPE OF SURGERY	eversion	eversion	eversion	eversion	cas	cas
USE OF SHUNT	n	n	n	n	n	n
USE OF PATCH	n	n	n	n	n	n
POST OP CRANIAL NERVE INJURY	n	n	n	n	n	n
POST OP ACUTE CORONARY SYNDROME	n	n	n	n	n	n
POST OP TIA	n	n	n	n	n	n
POST OP STROKE	n	n	n	n	n	n
REOPERATION	n	n	n	n	n	n
30 DAY MORTALITY	n	n	n	n	n	n
90 DAY MORTALITY	n	n	n	n	n	n

FIGURE 12. AORTIC ANEURYSM DATA COMPARISON BETWEEN SWEDVASC AND LOCAL DATA FOR MALMÖ

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	data missing	no	data missing	n	data missing	n	data missing	n	data missing	n	data missing	n	data missing	n
SMOKING	data missing	no	data missing	y	data missing	y	data missing	slutat röka många år sedan	data missing	y	data missing	y	data missing	exrökare
AAA DIAMETER	66	66	60	60	60	60	55	50	40	(2008 evar i Jonköping) 40	60	62	62	62
OPERATION TYPE EVAR/OPEN/CONVERSION	evar	evar	open	open	evar	evar	evar	evar	e	e (chimney)	e	e	e	e
RUPTURED/NONRUPTURED	data missing	no	ruptured	ruptured	non	non	non	non	non	non	non	non	non	non
PLANNED/UNPLANNET/ACUTE	planned	planned	acute	acute	planned	planned	planned	planned	planned	planned	planned	planned	planned	planned
BLOOD LOSS	<1000	200	>5000	3500	<1000	500	<1000	250	<1000	350	<1000	100	<1000	200
POSTOPERATIVE CORONARY EVENT AMI)	n	n	n	n	n	n	n	n	n	n	n	n	n	n
RENAL FAILURE (diaöysis, peritoneal or hemo-)	n	n	n	n	n	n	n	n	n	n	n	n	n	n
LIMB ISCHAEMIA	n	n	n	n	n	n	n	n	n	n	n	n	n	n
ABDOMINAL COMPARTMENT SYNDROME (pressure>20 AND ORGAN FAILURE)	n	n	n	n	n	n	n	n	n	n	n	n	n	n
30 DAY MORTALITY	n	n	y	y	n	n	n	n	n	n	n	n	n	n
90 DAY MORTALITY	n	n	y	y	n	n	n	n	n	n	n	n	n	n

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	data missing	n	data missing	n	data missing	n	data missing	e	data missing	n	data missing	n	n	n
SMOKING	data missing	y	data missing	slutat röka >1 månad för 13 år sedan	data missing	no information found	data missing	smoke, no information on the smoking in the past	data missing	only information found: ej rökare	data missing	y	y	y
AAA DIAMETER	73	73	60	65	pseudoaneurysm, 30 no diameter found	45	45	60	60	50	50	65	65	65
OPERATION TYPE EVAR/OPEN/CONVERSION	e	e	e	e	e	e	e	e	e	fevar	e	e	e	e
RUPTURED/NONRUPTURED	non	non	non	non	non	non	non	non	non	non	non	non	ruptured	ruptured
PLANNED/UNPLANNET/ACUTE	planned	planned	planned	planned	planned	planned	planned	planned	planned	planned	planned	planned	acute	acute
BLOOD LOSS	<1000	250	<1000	50	<1000	150	<1000	500	<1000	200	<1000	500	<1000	700
POSTOPERATIVE CORONARY EVENT AMI)	n	n	n	n	n	n	n	n	n	n	n	n	n	n
RENAL FAILURE (diaöysis, peritoneal or hemo-)	n	n	n	n	n	n	n	n	n	n	n	n	n	n
LIMB ISCHAEMIA	n	n	n	n	n	n	n	n	n	n	n	n	n	n
ABDOMINAL COMPARTMENT SYNDROME (pressure>20 AND ORGAN FAILURE)	n	n	n	n	n	n	n	n	n	n	n	n	n	n
30 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n	n	n
90 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n	n	n

RANDOM SAMPLE OF PATIENTS	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD	SWEDVASC	PATIENT RECORD
DIABETES	data missing	n	data missing	n	data missing	n	data missing	n	data missing	no	data missing	n
SMOKING	data missing	no information found	data missing	y	data missing	icke rökare	data missing	slutat 20 år sen	data missing	slutat röka 3 år sen	data missing	slutat röka 92
AAA DIAMETER	87	87	62	70	53	53	66	65	55	50	63	60
OPERATION TYPE EVAR/OPEN/CONVERSION	evar	evar	open	open	e	e	evar	fevar	evar	evar	evar	evar
RUPTURED/NONRUPTURED	ruptured	ruptured	ruptured	ruptured	non	non	n	n	ruptured	ruptured	non	non
PLANNED/UNPLANNET/ACUTE	acute	acute	acute	acute	planned	planned	planned	planned	acute	acute	planned	planned
BLOOD LOSS	<1000	100	1000-1999	1200	<1000	200	<1000	200	<1000	150	<1000	100
POSTOPERATIVE CORONARY EVENT (AMI)	data missing	n	n	n	n	n	n	n	n	n	n	n
RENAL FAILURE (diaöysis, peritoneal or hemo-)	data missing	n	y	y	n	n	n	n	n	n	n	n
LIMB ISCHAEMIA	data missing	n	y	y	n	n	n	n	n	n	n	n
ABDOMINAL COMPARTMENT SYNDROME (pressure>20 AND ORGAN FAILURE)	data missing	n	n	n	n	n	n	n	n	n	n	n
30 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n
90 DAY MORTALITY	n	n	n	n	n	n	n	n	n	n	n	n

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