

Swissvasc Performance Report 2020 - 2023

Lorenz Meuli MD MSc

01 May 2024

Contents

1	Introduction	2
1.1	Statistical Analysis	2
1.2	SwissVasc Dataexport	3
1.3	Use of Figures and Tables	3
1.4	Errors	3
2	Abdominal Aortic Aneurysms - Overall Analysis	4
2.1	Baseline Characteristics	4
2.2	Multivariable Analysis on Survival at Discharge	6
3	Elective repair of AAA	7
3.1	Diameter Analysis 2020 - 2023	7
3.2	Baseline Characteristics and Treatment Approach	9
3.3	Elective open repair for AAA	11
3.4	Elective endovascular repair for AAA	13
4	Emergent repair of ruptured AAA	15
4.1	Diameter Analysis 2020 - 2023	15
4.2	Baseline Characteristics	16
4.3	Treatment Details	17
4.4	Inhospital Outcomes	19
4.5	Outcomes during follow-up	20
5	Carotid Artery Stenosis	21
5.1	Overview	21
5.2	Proportion of symptomatic patients	21
5.3	Indication for Carotid Interventions (ESVS 2023 Guidelines)	22
5.4	Symptomatic Patients	23
5.5	Asymptomatic Patients	29
6	Bypass Surgery for Femoro-Popliteal Occlusive Disease	35
6.1	Baseline Characteristics	35
6.2	Treatment Details	36
6.3	Critical Limb Ischemia	37
6.4	Chronic Relative Ischemia (Claudication)	39
7	Appendix I	41
7.1	Missing Data in the AAA Cohort	41
8	R Session Info	43

1 Introduction

The aim of this report is to transparently present the treatment results of a series of vascular interventions performed in Switzerland. To maximize comparability, the cases compared are defined within narrow limits. This automatically leads to lower case numbers compared to the figures in the Swissvasc Annual Report, where a broader filter is intended to reflect the annual case number (i.e. workload) for each clinic. To increase the number of cases (and events), this report includes cases treated within a period of four years, i.e. between 2020 and 2023.

1.1 Statistical Analysis

Number of procedures and patient’s characteristics are summarized and presented by tables. Continuous variables were summarized by mean and standard deviation if normally distributed or by median and range if skewed. Continuous variables are compared using student’s t-test if normally distributed or Mann-Whitney-U test if skewed, respectively. Categorical variables were summarized with counts and percentages for each level of the variable and compared using Pearson’s Chi2 test. All p-values are two-sided.

1.1.1 Multivariable Analysis on Survival

The multivariable analysis on survival at discharge of the overall AAA cohort (described in detail below) was performed as follows:

- Missing survival information at discharge was counted as “not documented alive at discharge”. The analysis compares “alive at discharge” with “not documented alive at discharge” which includes missing survival information and documented death.
- A multivariable logistic regression model on survival at discharge is built including baseline characteristics (age and sex), comorbidities (diabetes, renal function, hearth failure, and COPD), procedural factors (asymptomatic vs symptomatic vs rupture; supra- vs. infrarenal; endovascular vs. open-repair), and your clinic vs the rest of Switzerland
- Some factor levels were merged to avoid small numbers per level (e.g. KDIGO G4 & G5 are merged to one categor; NYHA III & IV are merged to one category).
- Outliers for the continuous variable age were removed (i.e. patients with age < 40)
- Multiple imputations were performed for missing comorbidities. This is a statistical method used to analyze datasets where some values are missing. Predictive mean matching was used for age, multinomial logistic regressions were used to impute factor variables. The number of imputed datasets was m=25. Details on the missingness of data are available in Appendix I.
- Data imputation is generally preferred to a complete case analysis. This method intends to reduce bias due to a selection of complete cases only.

1.1.2 Density Plots

Density plots are used to visualize continuous variables such as aneurysm diameter. Density plots are a variation of a classical histogram. Instead of bins, a weighted average of neighboring observations is used (i.e. Kernel smoother).

1.1.3 Funnel Plots

The funnel plots shown reflect the proportion of patients for whom the event in question did not occur (i.e. living patients; patients without stroke; patients with open reconstruction). Missing information was not counted as “event-free”. Missing information therefore includes both the occurrence of the event (i.e. death, stroke, occluded reconstruction) as well as missing information.

Each participating clinic is represented by a grey dot on the diagram, your clinic is indicated by a red dot. On the x-axis is the total number of procedures performed. On the y-axis is the proportion of event-free

patients (“higher is better”). The blue dashed line shows the mean value in Switzerland (=benchmark). The black lines indicate the 95% “control limit” for the benchmark, which is based on a normal approximation to the binomial distribution. The control limit separates samples that differ significantly from the population from those that do not. However, it does not allow statistical comparisons between samples.

Further reading:

Spiegelhalter D. J. (2005). Funnel plots for comparing institutional performance. *Statistics in medicine*, 24(8), 1185–1202. <https://doi.org/10.1002/sim.1970>

Rakow, T., Wright, R. J., Spiegelhalter, D. J., & Bull, C. (2015). The pros and cons of funnel plots as an aid to risk communication and patient decision making. *British journal of psychology* (London, England : 1953), 106(2), 327–348. <https://doi.org/10.1111/bjop.12081>

1.2 SwissVasc Dataexport

Date of data export: 19th of April 2024.

A minimum set of information is required to be included in this analysis:

- Date of procedure, date of admission, and date of discharge must be reported.

Data must be plausible:

- Length of Stay must be >0 days (i.e. date of discharge must be $>$ than date of admission).
- Age must be > 0 years (i.e. date of birth must be $>$ than date of admission).
- Date must be plausible (i.e. segment and treatment must be a plausible combination).

1.3 Use of Figures and Tables

Reprint of this report or any of the figures is not allowed without permission by the authors. Requests to: lorenz.meuli@pm.me.

1.4 Errors

Please report inconsistencies or mistakes of this report to lorenz.meuli@pm.me

2 Abdominal Aortic Aneurysms - Overall Analysis

To increase comparability, the cohort was defined as follows: Open or endovascular procedures at the native suprarenal or infrarenal aorto-iliac segment for true aneurysms; only sterile procedures for patients with no clinical problem, symptomatic patients or bleeding and no previous intervention at the same location. Further, only patients where the vascular intervention was either a “vascular graft” or a “bifurcated graft”, were included. Thus, complex open or endovascular abdominal aortic aneurysm repairs are excluded.

2.1 Baseline Characteristics

Table 1: Patients treated for AAA (asymptomatic, symptomatic, or ruptured)

	2020 (N=619)	2021 (N=616)	2022 (N=655)	2023 (N=739)	p value
Segment					0.391
Aorto-iliac including suprarenal segment	104 (16.8%)	108 (17.5%)	124 (18.9%)	149 (20.2%)	
Aorto-iliac including infrarenal segment	515 (83.2%)	508 (82.5%)	531 (81.1%)	590 (79.8%)	
Clinical Problem					0.010
No problem	453 (73.2%)	489 (79.4%)	518 (79.1%)	606 (82.0%)	
Symptomatic	84 (13.6%)	60 (9.7%)	64 (9.8%)	63 (8.5%)	
Bleeding	82 (13.2%)	67 (10.9%)	73 (11.1%)	70 (9.5%)	
Sex					0.808
N-Miss	0	1	0	1	
Male	537 (86.8%)	532 (86.5%)	564 (86.1%)	648 (87.8%)	
Female	82 (13.2%)	83 (13.5%)	91 (13.9%)	90 (12.2%)	
Age (years)					0.132
N-Miss	0	0	1	1	
Mean (SD)	73.0 (8.7)	74.0 (8.4)	73.9 (8.4)	73.6 (8.6)	
Median (Q1, Q3)	74.0 (67.0, 79.0)	75.0 (69.0, 80.0)	74.5 (69.0, 80.0)	74.0 (68.0, 80.0)	
Renal Failure					< 0.001
G1 eGFR > 90	72 (11.6%)	64 (10.4%)	84 (12.8%)	96 (13.0%)	
G2 eGFR 60-89	201 (32.5%)	239 (38.8%)	273 (41.7%)	297 (40.2%)	
G3a eGFR 45-59	67 (10.8%)	89 (14.4%)	96 (14.7%)	121 (16.4%)	
G3b eGFR 30-44	34 (5.5%)	45 (7.3%)	30 (4.6%)	51 (6.9%)	
G4 eGFR 15-29	13 (2.1%)	13 (2.1%)	7 (1.1%)	19 (2.6%)	
G5 eGFR <15 or dialysis	7 (1.1%)	5 (0.8%)	4 (0.6%)	4 (0.5%)	
Unknown	225 (36.3%)	161 (26.1%)	161 (24.6%)	151 (20.4%)	
COPD					0.611
N-Miss	123	112	80	88	
No COPD	331 (66.7%)	316 (62.7%)	368 (64.0%)	433 (66.5%)	
COPD w/o medication	39 (7.9%)	56 (11.1%)	48 (8.3%)	61 (9.4%)	
COPD with medication	42 (8.5%)	40 (7.9%)	47 (8.2%)	41 (6.3%)	
COPD with O2 therapy	1 (0.2%)	2 (0.4%)	5 (0.9%)	5 (0.8%)	
Unknown	83 (16.7%)	90 (17.9%)	107 (18.6%)	111 (17.1%)	
Heart Failure					0.108
N-Miss	123	112	80	89	
No heart failure	278 (56.0%)	297 (58.9%)	347 (60.3%)	381 (58.6%)	
NYHA I	70 (14.1%)	57 (11.3%)	73 (12.7%)	105 (16.2%)	
NYHA II	45 (9.1%)	40 (7.9%)	52 (9.0%)	68 (10.5%)	

	2020 (N=619)	2021 (N=616)	2022 (N=655)	2023 (N=739)	p value
NYHA III	14 (2.8%)	15 (3.0%)	18 (3.1%)	9 (1.4%)	
NYHA IV	1 (0.2%)	2 (0.4%)	0 (0.0%)	1 (0.2%)	
Unknown	88 (17.7%)	93 (18.5%)	85 (14.8%)	86 (13.2%)	

2.2 Multivariable Analysis on Survival at Discharge

This multivariable analysis on survival at discharge of the overall AAA cohort (described above) was performed as described in detail in section 1.1.1.

Note 1: The event of interest included “death” and “missing information at discharge” and was compared to being discharged alive.

Note 2: Odds ratios that are greater than 1 indicate that the event (not being discharged alive) was more likely for the level of the variable compared to the reference level. Odds ratios that are less than 1 indicate that the event (not being discharged alive) was less likely at level of the variable compared to the reference level.

Variable	N	Odds ratio	OR with 95%-CI	p-value
Age	2024		1.05 (1.00, 1.11)	0.048
Sex				
Male	1763		Reference	
Female	261		0.96 (0.31, 2.40)	0.929
Diabetes				
No (incl. only diet)	1636		Reference	
Oral antidiabetics	309		1.15 (0.40, 2.82)	0.775
Insulin	79		1.91 (0.28, 7.31)	0.414
RenalFailure				
G1 eGFR > 90	347		Reference	
G2 eGFR 60–89	1062		0.87 (0.27, 3.30)	0.815
G3a eGFR 45–59	378		1.73 (0.51, 6.88)	0.400
G3b eGFR 30–44	165		0.82 (0.14, 4.34)	0.812
G4–5 eGFR <30 or dialysis	72		1.35 (0.28, 6.62)	0.704
HeartFailure				
No heart failure, incl. NYHA I	1672		Reference	
NYHA II	227		1.15 (0.27, 3.50)	0.823
NYHA III / IV	125		3.87 (1.28, 10.66)	0.011
COPD				
No COPD	1517		Reference	
COPD w/o medication	234		0.84 (0.19, 2.56)	0.783
COPD with medication	273		0.79 (0.25, 2.13)	0.661
Presentation				
Asymptomatic	1642		Reference	
Symptomatic	212		1.62 (0.45, 4.66)	0.405
Rupture	170		7.31 (3.28, 16.21)	<0.001
Segment				
Aorto–iliac including suprarenal segment	368		Reference	
Aorto–iliac including infrarenal segment	1656		0.71 (0.32, 1.61)	0.402
Approach				
Open surgery	740		Reference	
Endovascular intervention	1284		0.36 (0.16, 0.82)	0.015

3 Elective repair of AAA

To increase comparability, the cohort was defined as follows: Open or endovascular procedures at the native suprarenal or infrarenal aorto-iliac segment for true aneurysms; only sterile procedures for patients with no clinical problem and no previous intervention at the same location. Further, only patients where the vascular intervention was either a “vascular graft” or a “bifurcated graft” were included. Thus, complex open or endovascular abdominal aortic aneurysm repairs are excluded.

3.1 Diameter Analysis 2020 - 2023

Table 2: AAA Diameter (overall)

	2020 (N=453)	2021 (N=489)	2022 (N=518)	2023 (N=606)	P value
Aneurysm Diameter (mm)					0.916
N-Miss	1	2	1	3	
Mean (SD)	57.5 (11.4)	57.6 (10.7)	57.4 (10.7)	57.1 (12.7)	
Median (Q1, Q3)	56.0 (53.0, 62.0)	56.0 (53.0, 60.0)	56.0 (53.0, 61.0)	56.0 (53.0, 61.0)	
Sex					0.446
N-Miss	0	1	0	1	
Male	398 (87.9%)	419 (85.9%)	447 (86.3%)	537 (88.8%)	
Female	55 (12.1%)	69 (14.1%)	71 (13.7%)	68 (11.2%)	

3.1.1 AAA Diameter Females

Table 3: AAA Diameter (female only)

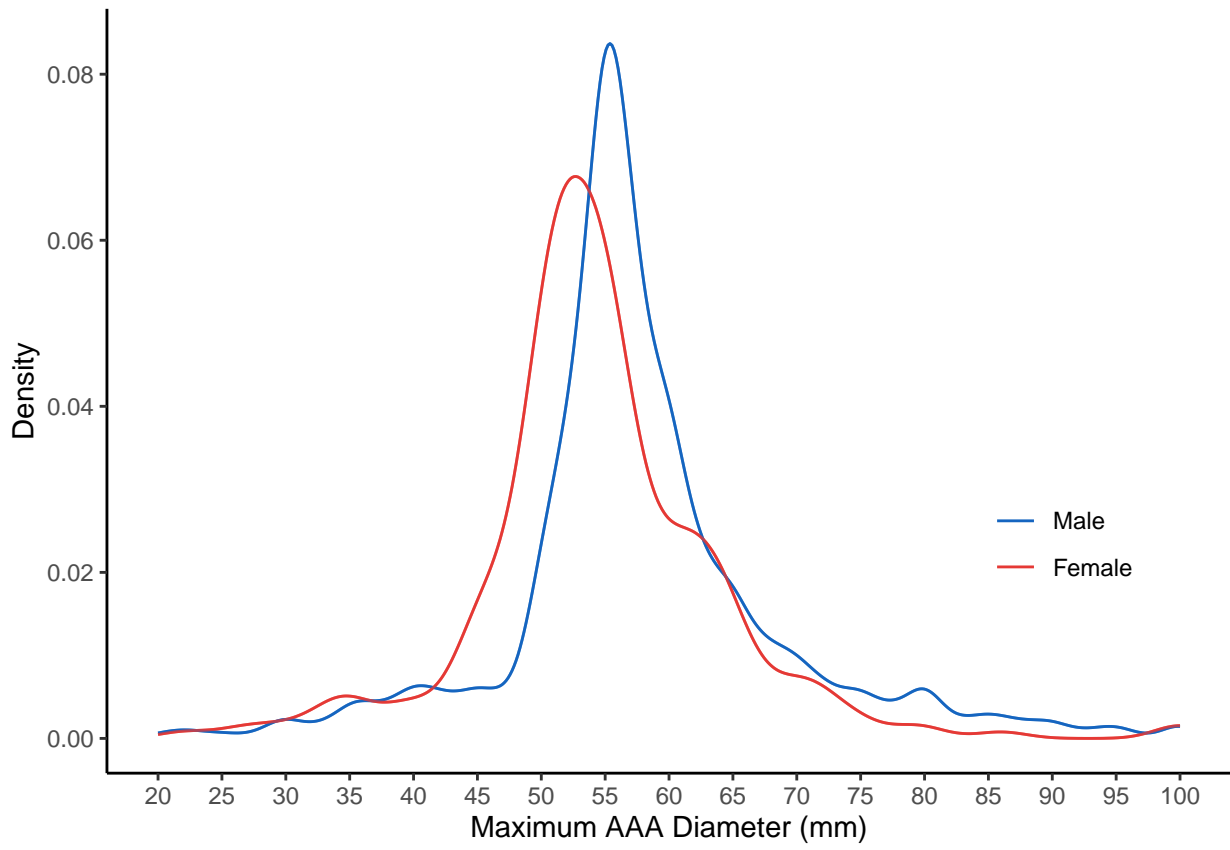
	2020 (N=55)	2021 (N=69)	2022 (N=71)	2023 (N=68)	P value
Aneurysm Diameter (mm)					0.031
N-Miss	1	0	0	0	
Mean (SD)	56.4 (7.8)	56.2 (9.8)	52.3 (10.4)	53.0 (11.1)	
Median (Q1, Q3)	55.0 (52.0, 61.0)	54.0 (51.0, 59.0)	52.0 (50.0, 56.0)	53.0 (48.8, 57.2)	

3.1.2 AAA Diameter Males

Table 4: AAA Diameter (male only)

	2020 (N=398)	2021 (N=419)	2022 (N=447)	2023 (N=537)	P value
Aneurysm Diameter (mm)					0.878
N-Miss	0	2	1	3	
Mean (SD)	57.7 (11.8)	57.8 (10.9)	58.2 (10.5)	57.7 (12.8)	
Median (Q1, Q3)	56.0 (53.0, 62.0)	56.0 (53.0, 60.0)	56.0 (54.0, 62.0)	56.0 (53.0, 62.0)	

3.1.3 Density Plot AAA Diameter

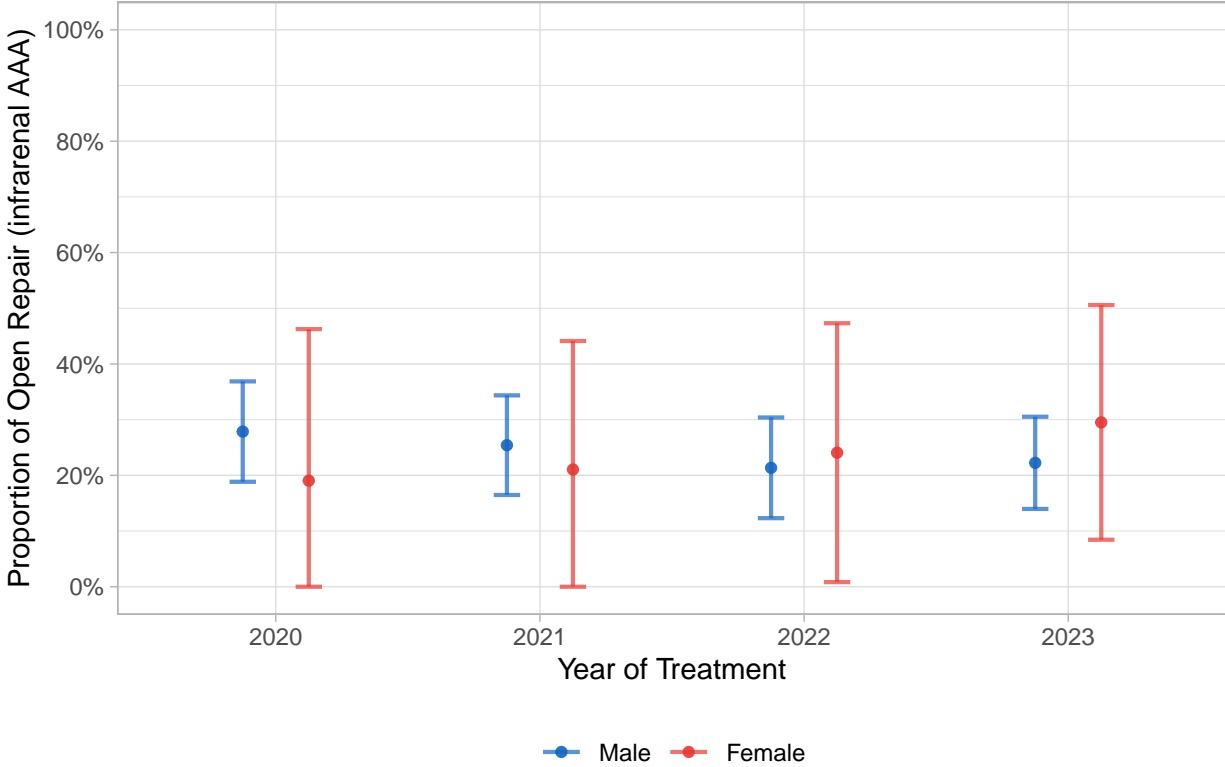


3.2 Baseline Characteristics and Treatment Approach

Table 5: Patients treated for asymptomatic AAA

	2020 (N=453)	2021 (N=489)	2022 (N=518)	2023 (N=606)	p value
Technical Approach					0.559
Open surgery	165 (36.4%)	164 (33.5%)	172 (33.2%)	196 (32.3%)	
Endovascular intervention	288 (63.6%)	325 (66.5%)	346 (66.8%)	410 (67.7%)	
Segment					0.401
Aorto-iliac, suprarenal	70 (15.5%)	73 (14.9%)	94 (18.1%)	108 (17.8%)	
Aorto-iliac, infrarenal	383 (84.5%)	416 (85.1%)	424 (81.9%)	498 (82.2%)	
Sex					0.446
N-Miss	0	1	0	1	
Male	398 (87.9%)	419 (85.9%)	447 (86.3%)	537 (88.8%)	
Female	55 (12.1%)	69 (14.1%)	71 (13.7%)	68 (11.2%)	
Age (years)					0.172
N-Miss	0	0	0	1	
Mean (SD)	72.9 (8.7)	74.0 (8.2)	73.7 (8.1)	73.8 (8.4)	
Median (Q1, Q3)	74.0 (68.0, 79.0)	75.0 (69.0, 80.0)	74.0 (68.2, 79.0)	74.0 (68.0, 80.0)	
Renal Failure					< 0.001
G1 eGFR > 90	56 (12.4%)	54 (11.0%)	63 (12.2%)	75 (12.4%)	
G2 eGFR 60-89	164 (36.2%)	201 (41.1%)	235 (45.4%)	253 (41.7%)	
G3a eGFR 45-59	47 (10.4%)	71 (14.5%)	71 (13.7%)	102 (16.8%)	
G3b eGFR 30-44	21 (4.6%)	34 (7.0%)	24 (4.6%)	37 (6.1%)	
G4 eGFR 15-29	3 (0.7%)	7 (1.4%)	4 (0.8%)	14 (2.3%)	
G5 eGFR <15 or dialysis	5 (1.1%)	3 (0.6%)	2 (0.4%)	2 (0.3%)	
Unknown	157 (34.7%)	119 (24.3%)	119 (23.0%)	123 (20.3%)	
COPD					0.364
N-Miss	101	87	63	76	
No COPD	249 (70.7%)	253 (62.9%)	304 (66.8%)	355 (67.0%)	
COPD w/o medication	28 (8.0%)	46 (11.4%)	34 (7.5%)	53 (10.0%)	
COPD with medication	28 (8.0%)	34 (8.5%)	46 (10.1%)	38 (7.2%)	
COPD with O2 therapy	1 (0.3%)	2 (0.5%)	5 (1.1%)	3 (0.6%)	
Unknown	46 (13.1%)	67 (16.7%)	66 (14.5%)	81 (15.3%)	
Heart Failure					0.389
N-Miss	101	87	63	77	
No heart failure	202 (57.4%)	247 (61.4%)	282 (62.0%)	315 (59.5%)	
NYHA I	59 (16.8%)	49 (12.2%)	69 (15.2%)	85 (16.1%)	
NYHA II	39 (11.1%)	37 (9.2%)	45 (9.9%)	65 (12.3%)	
NYHA III	10 (2.8%)	12 (3.0%)	15 (3.3%)	8 (1.5%)	
NYHA IV	0 (0.0%)	1 (0.2%)	0 (0.0%)	1 (0.2%)	
Unknown	42 (11.9%)	56 (13.9%)	44 (9.7%)	55 (10.4%)	

3.2.1 Proportion Plot on Treatment Approach



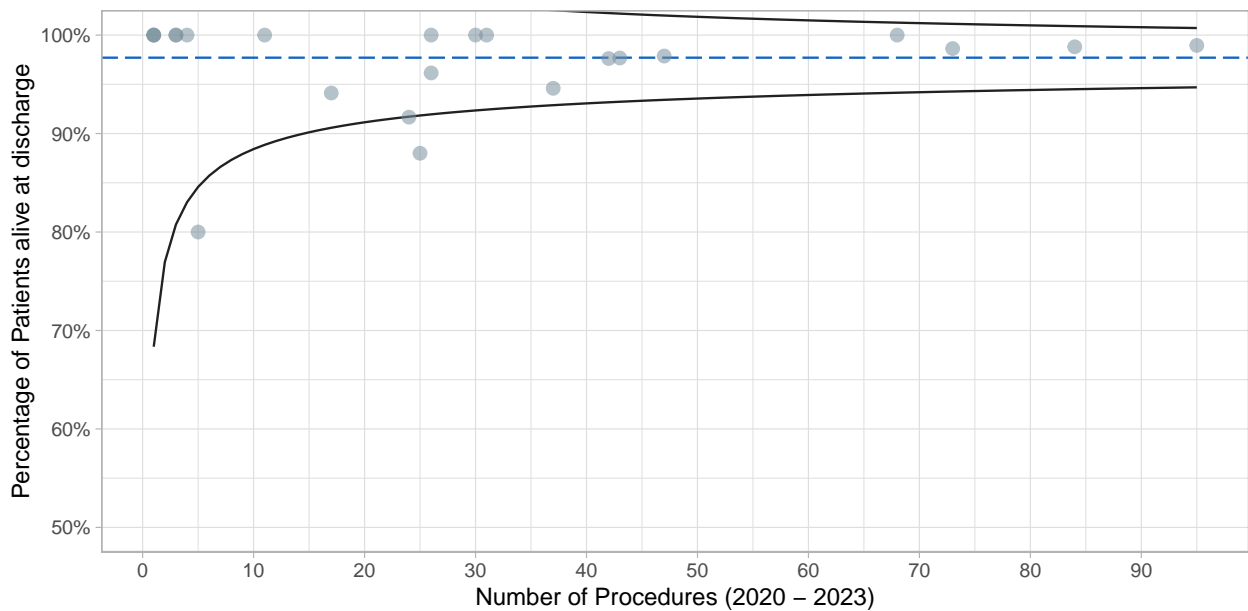
3.3 Elective open repair for AAA

3.3.1 Inhospital outcomes

Table 6: Inhospital outcomes for open repair of asymptomatic AAA

	2020 (N=165)	2021 (N=164)	2022 (N=172)	2023 (N=196)	p value
Segment					0.268
Aorto-iliac, suprarenal	62 (37.6%)	61 (37.2%)	80 (46.5%)	81 (41.3%)	
Aorto-iliac, infrarenal	103 (62.4%)	103 (62.8%)	92 (53.5%)	115 (58.7%)	
Inhospital Mortality					0.527
Dead	4 (2.4%)	5 (3.0%)	4 (2.3%)	2 (1.0%)	
Alive	160 (97.0%)	159 (97.0%)	168 (97.7%)	194 (99.0%)	
Missing	1 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Clavien Dindo at Discharge					< 0.001
Grade 0 - No Complication	82 (49.7%)	93 (56.7%)	99 (57.6%)	112 (57.1%)	
Grade I	6 (3.6%)	4 (2.4%)	7 (4.1%)	19 (9.7%)	
Grade I disability	0 (0.0%)	0 (0.0%)	3 (1.7%)	2 (1.0%)	
Grade II	17 (10.3%)	16 (9.8%)	36 (20.9%)	34 (17.3%)	
Grade II disability	1 (0.6%)	0 (0.0%)	4 (2.3%)	2 (1.0%)	
Grade IIIa	3 (1.8%)	0 (0.0%)	1 (0.6%)	3 (1.5%)	
Grade IIIa disability	0 (0.0%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	
Grade IIIb	4 (2.4%)	12 (7.3%)	3 (1.7%)	7 (3.6%)	
Grade IIIb disability	1 (0.6%)	1 (0.6%)	0 (0.0%)	1 (0.5%)	
Grade IVa	3 (1.8%)	1 (0.6%)	2 (1.2%)	2 (1.0%)	
Grade IVb	1 (0.6%)	1 (0.6%)	0 (0.0%)	1 (0.5%)	
Grade IVb disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	
Grade V - Death	4 (2.4%)	5 (3.0%)	4 (2.3%)	2 (1.0%)	
Missing	43 (26.1%)	31 (18.9%)	12 (7.0%)	10 (5.1%)	

3.3.2 Survival at Discharge



Note: This plot does NOT show mortality at discharge! For Inhospital Mortality, see Table above.

3.3.3 Outcomes during Follow-up

	2020 (N=165)	2021 (N=164)	2022 (N=172)	2023 (N=196)	p value
30d Mortality					0.022
Alive	110 (66.7%)	119 (72.6%)	136 (79.1%)	127 (64.8%)	
Dead	3 (1.8%)	5 (3.0%)	4 (2.3%)	2 (1.0%)	
Missing	52 (31.5%)	40 (24.4%)	32 (18.6%)	67 (34.2%)	
30d Stroke					0.074
Yes	0 (0.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	
No	114 (69.1%)	118 (72.0%)	139 (80.8%)	135 (68.9%)	
Missing	51 (30.9%)	45 (27.4%)	33 (19.2%)	61 (31.1%)	
30d Myocardial infraction					0.133
Yes	1 (0.6%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	
No	113 (68.5%)	119 (72.6%)	137 (79.7%)	133 (67.9%)	
Missing	51 (30.9%)	44 (26.8%)	35 (20.3%)	63 (32.1%)	

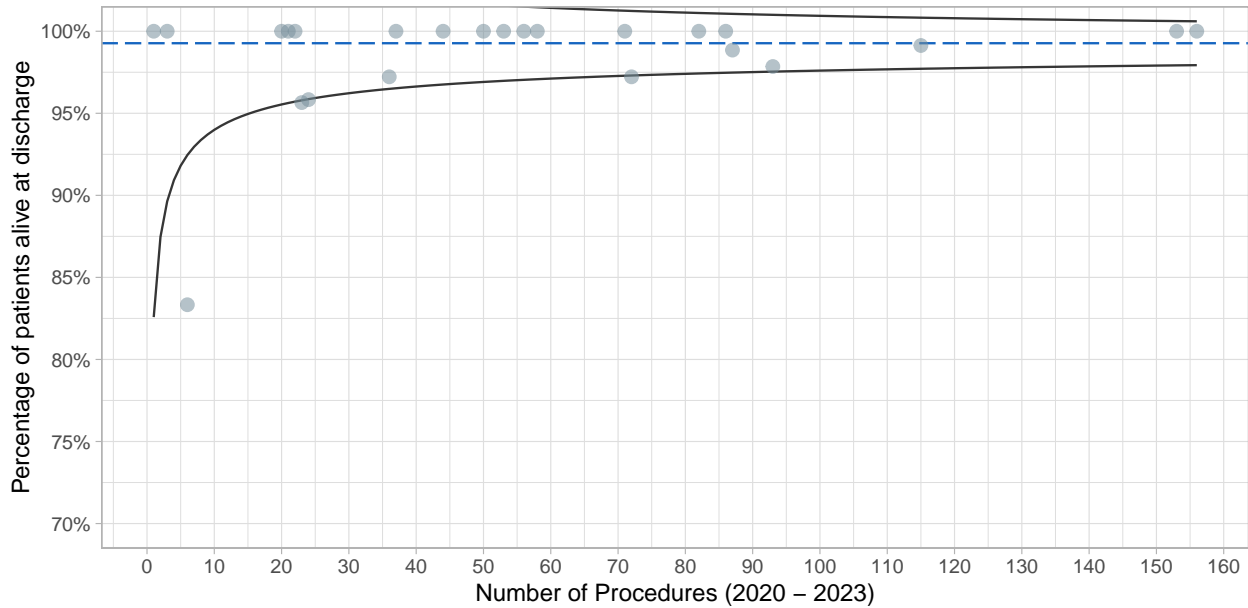
3.4 Elective endovascular repair for AAA

3.4.1 Inhospital Outcomes

Table 8: Inhospital outcomes for endovascular repair of asymptomatic AAA

	2020 (N=288)	2021 (N=325)	2022 (N=346)	2023 (N=410)	p value
Inhospital Mortality					0.027
Dead	0 (0.0%)	1 (0.3%)	3 (0.9%)	3 (0.7%)	
Alive	285 (99.0%)	324 (99.7%)	343 (99.1%)	407 (99.3%)	
Missing	3 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Clavien Dindo at Discharge					0.029
Grade 0 - No Complication	194 (67.4%)	228 (70.2%)	263 (76.0%)	292 (71.2%)	
Grade I	13 (4.5%)	6 (1.8%)	9 (2.6%)	21 (5.1%)	
Grade I disability	0 (0.0%)	1 (0.3%)	2 (0.6%)	5 (1.2%)	
Grade II	10 (3.5%)	13 (4.0%)	17 (4.9%)	26 (6.3%)	
Grade II disability	1 (0.3%)	2 (0.6%)	0 (0.0%)	1 (0.2%)	
Grade IIIa	4 (1.4%)	3 (0.9%)	5 (1.4%)	4 (1.0%)	
Grade IIIa disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	
Grade IIIb	5 (1.7%)	9 (2.8%)	7 (2.0%)	10 (2.4%)	
Grade IIIb disability	0 (0.0%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	
Grade IVa	0 (0.0%)	3 (0.9%)	2 (0.6%)	3 (0.7%)	
Grade IVa disability	0 (0.0%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	
Grade IVb disability	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Grade V - Death	0 (0.0%)	1 (0.3%)	3 (0.9%)	3 (0.7%)	
Missing	60 (20.8%)	59 (18.2%)	36 (10.4%)	44 (10.7%)	

3.4.2 Survival at Discharge



Note: This plot does NOT show mortality at discharge! For Inhospital Mortality, see Table above.

3.4.3 Outcomes during Follow-up

	2020 (N=288)	2021 (N=325)	2022 (N=346)	2023 (N=410)	p value
30d Mortality					< 0.001
Alive	196 (68.1%)	212 (65.2%)	197 (56.9%)	196 (47.8%)	
Dead	0 (0.0%)	1 (0.3%)	3 (0.9%)	3 (0.7%)	
Missing	92 (31.9%)	112 (34.5%)	146 (42.2%)	211 (51.5%)	
30d Stroke					0.008
Yes	1 (0.3%)	1 (0.3%)	1 (0.3%)	1 (0.2%)	
No	219 (76.0%)	246 (75.7%)	247 (71.4%)	262 (63.9%)	
Missing	68 (23.6%)	78 (24.0%)	98 (28.3%)	147 (35.9%)	
30d Myocardial infraction					0.003
Yes	2 (0.7%)	1 (0.3%)	0 (0.0%)	1 (0.2%)	
No	218 (75.7%)	245 (75.4%)	249 (72.0%)	262 (63.9%)	
Missing	68 (23.6%)	79 (24.3%)	97 (28.0%)	147 (35.9%)	

4 Emergent repair of ruptured AAA

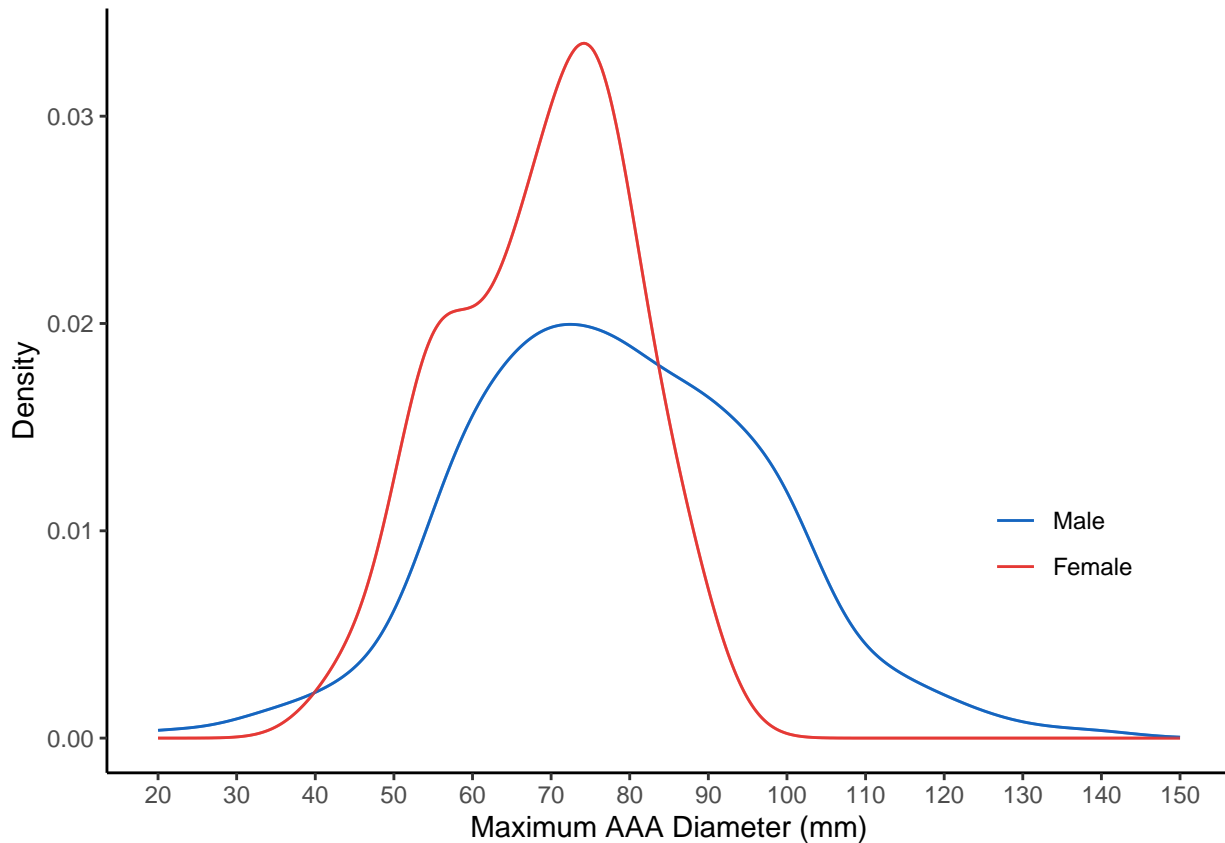
To increase comparability, the cohort was defined as follows: Open or endovascular procedures at the native suprarenal or infrarenal aorto-iliac segment for true aneurysms; only sterile procedures for patients with rupture (=bleeding), and no previous intervention at the same location. Further, only patients where the vascular intervention was either a “vascular graft” or a “bifurcated graft” were included. Thus, complex open or endovascular abdominal aortic aneurysm repairs are excluded.

4.1 Diameter Analysis 2020 - 2023

Table 10: AAA Diameter (ruptured)

	2020 (N=79)	2021 (N=67)	2022 (N=72)	2023 (N=66)	P value
Aneurysm Diameter (mm)					0.457
N-Miss	0	0	3	0	
Mean (SD)	71.4 (26.7)	77.2 (21.6)	74.7 (18.1)	75.3 (21.3)	
Median (Q1, Q3)	75.0 (59.0, 90.0)	78.0 (60.0, 90.0)	74.0 (66.0, 83.0)	76.5 (63.5, 90.0)	

4.1.1 Density Plot rAAA Diameter



4.2 Baseline Characteristics

Table 11: Patients treated for ruptured AAA

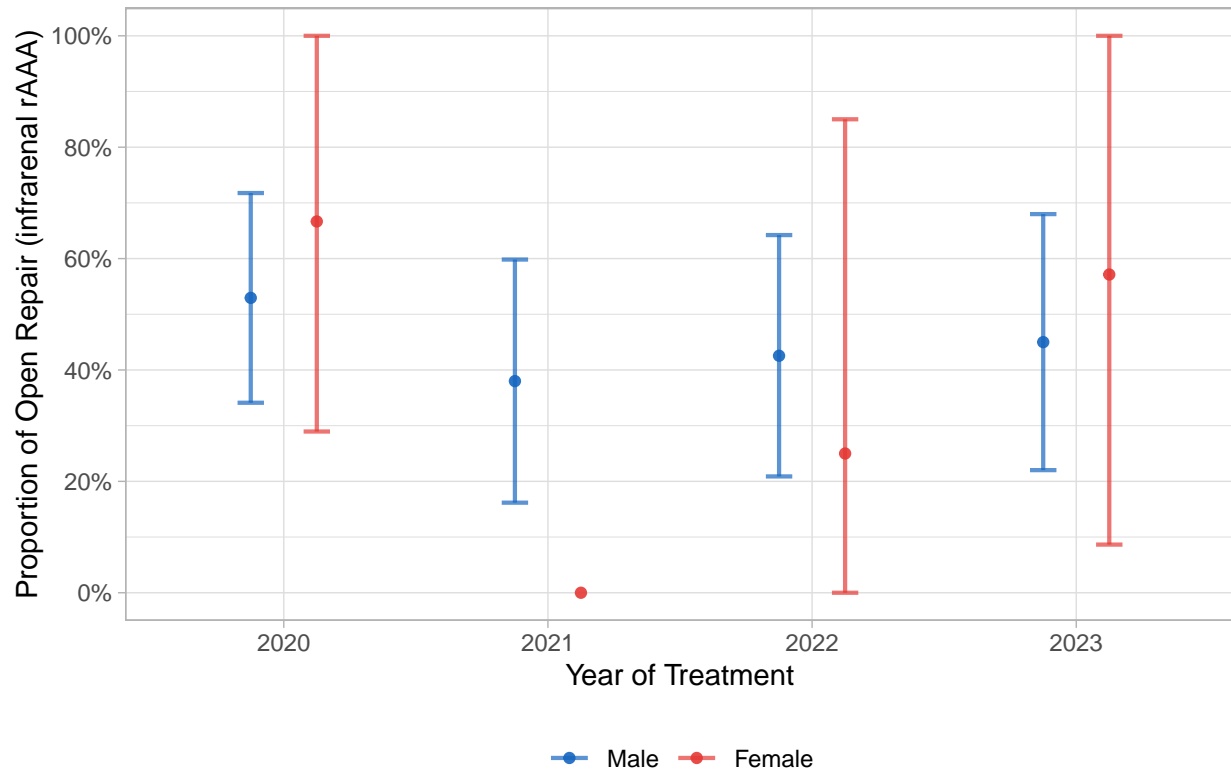
	2020 (N=79)	2021 (N=67)	2022 (N=72)	2023 (N=66)	p value
Segment					0.837
Aorto-iliac, suprarenal	19 (24.1%)	15 (22.4%)	17 (23.6%)	19 (28.8%)	
Aorto-iliac, infrarenal	60 (75.9%)	52 (77.6%)	55 (76.4%)	47 (71.2%)	
Sex					0.058
Male	67 (84.8%)	65 (97.0%)	64 (88.9%)	55 (83.3%)	
Female	12 (15.2%)	2 (3.0%)	8 (11.1%)	11 (16.7%)	
Age (years)					0.133
Mean (SD)	74.5 (8.5)	73.0 (9.5)	76.3 (8.8)	73.2 (10.1)	
N-Miss	0	0	1	0	
Renal Failure					0.334
G1 eGFR > 90	4 (5.1%)	3 (4.5%)	9 (12.5%)	9 (13.6%)	
G2 eGFR 60-89	21 (26.6%)	16 (23.9%)	17 (23.6%)	18 (27.3%)	
G3a eGFR 45-59	10 (12.7%)	14 (20.9%)	15 (20.8%)	12 (18.2%)	
G3b eGFR 30-44	7 (8.9%)	7 (10.4%)	3 (4.2%)	10 (15.2%)	
G4 eGFR 15-29	8 (10.1%)	5 (7.5%)	3 (4.2%)	1 (1.5%)	
G5 eGFR <15 or dialysis	2 (2.5%)	1 (1.5%)	2 (2.8%)	2 (3.0%)	
Unknown	27 (34.2%)	21 (31.3%)	23 (31.9%)	14 (21.2%)	
COPD					0.003
N-Miss	14	13	8	7	
No COPD	33 (50.8%)	33 (61.1%)	31 (48.4%)	38 (64.4%)	
COPD w/o medication	2 (3.1%)	6 (11.1%)	4 (6.2%)	4 (6.8%)	
COPD with medication	8 (12.3%)	2 (3.7%)	0 (0.0%)	1 (1.7%)	
COPD with O2 therapy	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (3.4%)	
Unknown	22 (33.8%)	13 (24.1%)	29 (45.3%)	14 (23.7%)	
Heart Failure					0.496
N-Miss	14	13	8	7	
No heart failure	28 (43.1%)	23 (42.6%)	29 (45.3%)	32 (54.2%)	
NYHA I	4 (6.2%)	4 (7.4%)	4 (6.2%)	9 (15.3%)	
NYHA II	2 (3.1%)	1 (1.9%)	3 (4.7%)	2 (3.4%)	
NYHA III	3 (4.6%)	1 (1.9%)	1 (1.6%)	1 (1.7%)	
Unknown	28 (43.1%)	25 (46.3%)	27 (42.2%)	15 (25.4%)	

4.3 Treatment Details

Table 12: Patients treated for ruptured AAA

	2020 (N=79)	2021 (N=67)	2022 (N=72)	2023 (N=66)	p value
Technical Approach					0.229
Open surgery	52 (65.8%)	34 (50.7%)	39 (54.2%)	41 (62.1%)	
Endovascular intervention	27 (34.2%)	33 (49.3%)	33 (45.8%)	25 (37.9%)	
Segment					0.837
Aorto-iliac, suprarenal	19 (24.1%)	15 (22.4%)	17 (23.6%)	19 (28.8%)	
Aorto-iliac, infrarenal	60 (75.9%)	52 (77.6%)	55 (76.4%)	47 (71.2%)	
Sex					0.058
Male	67 (84.8%)	65 (97.0%)	64 (88.9%)	55 (83.3%)	
Female	12 (15.2%)	2 (3.0%)	8 (11.1%)	11 (16.7%)	
Age (years)					0.133
N-Miss	0	0	1	0	
Mean (SD)	74.5 (8.5)	73.0 (9.5)	76.3 (8.8)	73.2 (10.1)	
Renal Failure					0.334
G1 eGFR > 90	4 (5.1%)	3 (4.5%)	9 (12.5%)	9 (13.6%)	
G2 eGFR 60-89	21 (26.6%)	16 (23.9%)	17 (23.6%)	18 (27.3%)	
G3a eGFR 45-59	10 (12.7%)	14 (20.9%)	15 (20.8%)	12 (18.2%)	
G3b eGFR 30-44	7 (8.9%)	7 (10.4%)	3 (4.2%)	10 (15.2%)	
G4 eGFR 15-29	8 (10.1%)	5 (7.5%)	3 (4.2%)	1 (1.5%)	
G5 eGFR <15 or dialysis	2 (2.5%)	1 (1.5%)	2 (2.8%)	2 (3.0%)	
Unknown	27 (34.2%)	21 (31.3%)	23 (31.9%)	14 (21.2%)	
COPD					0.003
N-Miss	14	13	8	7	
No COPD	33 (50.8%)	33 (61.1%)	31 (48.4%)	38 (64.4%)	
COPD w/o medication	2 (3.1%)	6 (11.1%)	4 (6.2%)	4 (6.8%)	
COPD with medication	8 (12.3%)	2 (3.7%)	0 (0.0%)	1 (1.7%)	
COPD with O2 therapy	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (3.4%)	
Unknown	22 (33.8%)	13 (24.1%)	29 (45.3%)	14 (23.7%)	
Heart Failure					0.496
N-Miss	14	13	8	7	
No heart failure	28 (43.1%)	23 (42.6%)	29 (45.3%)	32 (54.2%)	
NYHA I	4 (6.2%)	4 (7.4%)	4 (6.2%)	9 (15.3%)	
NYHA II	2 (3.1%)	1 (1.9%)	3 (4.7%)	2 (3.4%)	
NYHA III	3 (4.6%)	1 (1.9%)	1 (1.6%)	1 (1.7%)	
Unknown	28 (43.1%)	25 (46.3%)	27 (42.2%)	15 (25.4%)	

4.3.1 Treatment Approach

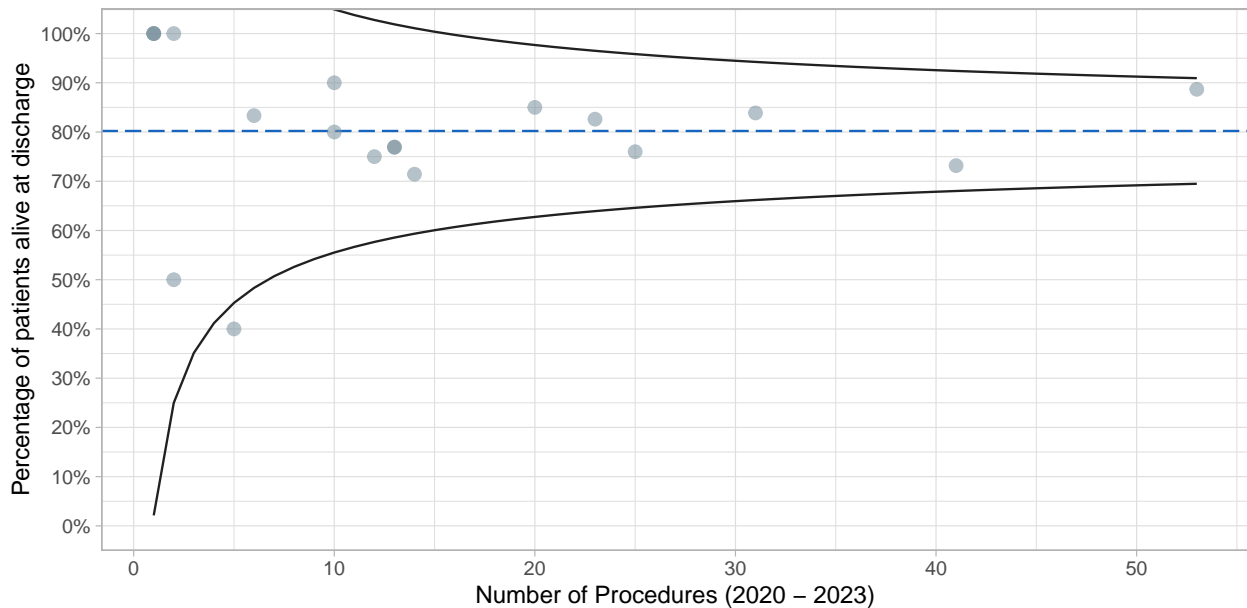


4.4 Inhospital Outcomes

Table 13: Inhospital outcomes for emergent repair of ruptured AAA

	2020 (N=79)	2021 (N=67)	2022 (N=72)	2023 (N=66)	p value
Inhospital Mortality					0.677
Dead	17 (21.5%)	12 (17.9%)	16 (22.2%)	11 (16.7%)	
Alive	62 (78.5%)	55 (82.1%)	55 (76.4%)	55 (83.3%)	
Missing	0 (0.0%)	0 (0.0%)	1 (1.4%)	0 (0.0%)	
Clavien Dindo at Discharge					0.232
Grade 0 - No Complication	25 (31.6%)	23 (34.3%)	23 (31.9%)	20 (30.3%)	
Grade I	4 (5.1%)	1 (1.5%)	2 (2.8%)	1 (1.5%)	
Grade I disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	
Grade II	8 (10.1%)	12 (17.9%)	8 (11.1%)	15 (22.7%)	
Grade II disability	2 (2.5%)	1 (1.5%)	2 (2.8%)	4 (6.1%)	
Grade IIIa	5 (6.3%)	2 (3.0%)	2 (2.8%)	1 (1.5%)	
Grade IIIa disability	1 (1.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Grade IIIb	6 (7.6%)	5 (7.5%)	6 (8.3%)	4 (6.1%)	
Grade IIIb disability	1 (1.3%)	2 (3.0%)	1 (1.4%)	0 (0.0%)	
Grade IVa	1 (1.3%)	2 (3.0%)	9 (12.5%)	7 (10.6%)	
Grade IVa disability	3 (3.8%)	1 (1.5%)	1 (1.4%)	0 (0.0%)	
Grade IVb	0 (0.0%)	1 (1.5%)	1 (1.4%)	2 (3.0%)	
Grade IVb disability	1 (1.3%)	0 (0.0%)	1 (1.4%)	0 (0.0%)	
Grade V - Death	17 (21.5%)	12 (17.9%)	16 (22.2%)	11 (16.7%)	
Missing	5 (6.3%)	5 (7.5%)	0 (0.0%)	0 (0.0%)	

4.4.1 Survival at Discharge



Note: This plot does NOT show mortality at discharge! For Inhospital Mortality, see Table above.

4.5 Outcomes during follow-up

	2020 (N=79)	2021 (N=67)	2022 (N=72)	2023 (N=66)	p value
30d Mortality					0.824
Alive	44 (55.7%)	38 (56.7%)	40 (55.6%)	33 (50.0%)	
Dead	16 (20.3%)	12 (17.9%)	16 (22.2%)	11 (16.7%)	
Missing	19 (24.1%)	17 (25.4%)	16 (22.2%)	22 (33.3%)	
30d Stroke					0.751
Yes	1 (1.3%)	1 (1.5%)	2 (2.8%)	0 (0.0%)	
No	45 (57.0%)	37 (55.2%)	42 (58.3%)	33 (50.0%)	
Missing	33 (41.8%)	29 (43.3%)	28 (38.9%)	33 (50.0%)	
30d Myocardial infraction					0.684
Yes	2 (2.5%)	2 (3.0%)	3 (4.2%)	0 (0.0%)	
No	44 (55.7%)	36 (53.7%)	41 (56.9%)	33 (50.0%)	
Missing	33 (41.8%)	29 (43.3%)	28 (38.9%)	33 (50.0%)	

5 Carotid Artery Stenosis

To increase comparability, the cohort was defined as follows: Open or endovascular procedure at the native carotid bifurcation or the carotid artery (CCA, ICA, ECA) for obstructing wall pathology or intraluminal obstruction. Only sterile procedures, only procedures with no previous intervention at the same location, and only symptomatic patients (including “acute ischemia”) or patients with no clinical problem.

5.1 Overview

	2020 (N=855)	2021 (N=930)	2022 (N=951)	2023 (N=1028)	p value
Technical Approach					0.014
Open surgery	692 (80.9%)	742 (79.8%)	803 (84.4%)	813 (79.1%)	
Endovascular intervention	163 (19.1%)	188 (20.2%)	148 (15.6%)	215 (20.9%)	
Clinical Problem					0.008
No problem	244 (28.5%)	276 (29.7%)	294 (30.9%)	328 (31.9%)	
Symptomatic	529 (61.9%)	575 (61.8%)	595 (62.6%)	586 (57.0%)	
Acute Ischemia	82 (9.6%)	79 (8.5%)	62 (6.5%)	114 (11.1%)	

Note: Endovascular procedures are presumably not covered as thoroughly as open surgical procedures.

5.2 Proportion of symptomatic patients



5.3 Indication for Carotid Interventions (ESVS 2023 Guidelines)

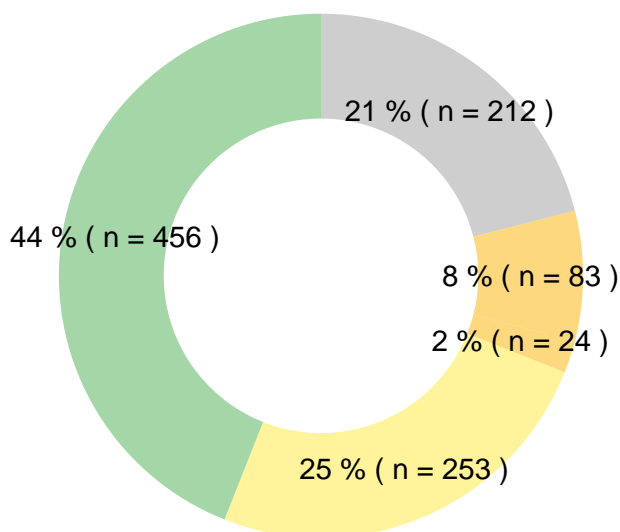
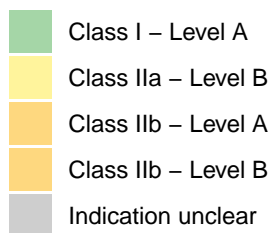
Since 1 January 2023, it has been possible to document carotid stenosis according to the NASCET classification and to document a progression of the stenosis. This information makes it possible to analyse adherence to the current treatment recommendations. However, not all criteria mentioned in the current ESVS guidelines are reflected in Swissvasc, so that other criteria that lead to a treatment indication may be present but are not taken into account here.

Treatment indications were classified according to Figure 2, page 23, and recommendation no. 42 & 43 of the European Society for Vascular Surgery (ESVS) 2023 Clinical Practice Guidelines on the Management of Atherosclerotic Carotid and Vertebral Artery Disease. DOI: 10.1016/ejects.ejvs.2022.04.011.

Treatment indications that were outside these recommendations were classified as “Indication unclear”.

Table 16: Overall Indication

	2023 (N=1028)
Indication	
Class I - Level A	456 (44.4%)
Class IIa - Level B	253 (24.6%)
Class IIb - Level A	24 (2.3%)
Class IIb - Level B	83 (8.1%)
Indication unclear	212 (20.6%)



5.4 Symptomatic Patients

5.4.1 Baseline Characteristics (CEA and CAS)

	2020 (N=611)	2021 (N=654)	2022 (N=657)	2023 (N=700)	p value
Technical Approach					0.040
Open surgery	458 (75.0%)	477 (72.9%)	521 (79.3%)	518 (74.0%)	
Endovascular intervention	153 (25.0%)	177 (27.1%)	136 (20.7%)	182 (26.0%)	
Sex					0.543
N-Miss	0	0	0	1	
Male	428 (70.0%)	441 (67.4%)	464 (70.6%)	476 (68.1%)	
Female	183 (30.0%)	213 (32.6%)	193 (29.4%)	223 (31.9%)	
Age (years)					0.294
N-Miss	0	0	0	0	
Mean (SD)	74.4 (9.6)	74.9 (9.2)	74.7 (9.3)	73.9 (10.4)	
Renal Failure					< 0.001
G1 eGFR > 90	45 (7.4%)	56 (8.6%)	84 (12.8%)	61 (8.7%)	
G2 eGFR 60-89	170 (27.8%)	225 (34.4%)	231 (35.2%)	238 (34.0%)	
G3a eGFR 45-59	47 (7.7%)	75 (11.5%)	67 (10.2%)	88 (12.6%)	
G3b eGFR 30-44	19 (3.1%)	29 (4.4%)	48 (7.3%)	35 (5.0%)	
G4 eGFR 15-29	11 (1.8%)	12 (1.8%)	7 (1.1%)	13 (1.9%)	
G5 eGFR <15 or dialysis	3 (0.5%)	1 (0.2%)	1 (0.2%)	1 (0.1%)	
Unknown	316 (51.7%)	256 (39.1%)	219 (33.3%)	264 (37.7%)	
COPD					0.037
N-Miss	196	216	159	218	
No COPD	293 (70.6%)	315 (71.9%)	374 (75.1%)	372 (77.2%)	
COPD w/o medication	14 (3.4%)	26 (5.9%)	30 (6.0%)	24 (5.0%)	
COPD with medication	14 (3.4%)	24 (5.5%)	17 (3.4%)	16 (3.3%)	
COPD with O2 therapy	0 (0.0%)	1 (0.2%)	2 (0.4%)	1 (0.2%)	
Unknown	94 (22.7%)	72 (16.4%)	75 (15.1%)	69 (14.3%)	
Heart Failure					0.001
N-Miss	196	216	160	218	
No heart failure	260 (62.7%)	321 (73.3%)	331 (66.6%)	309 (64.1%)	
NYHA I	31 (7.5%)	26 (5.9%)	40 (8.0%)	61 (12.7%)	
NYHA II	26 (6.3%)	13 (3.0%)	25 (5.0%)	27 (5.6%)	
NYHA III	11 (2.7%)	9 (2.1%)	21 (4.2%)	13 (2.7%)	
NYHA IV	0 (0.0%)	2 (0.5%)	1 (0.2%)	0 (0.0%)	
Unknown	87 (21.0%)	67 (15.3%)	79 (15.9%)	72 (14.9%)	

5.4.2 Stenosis Analysis 2023 - 2023

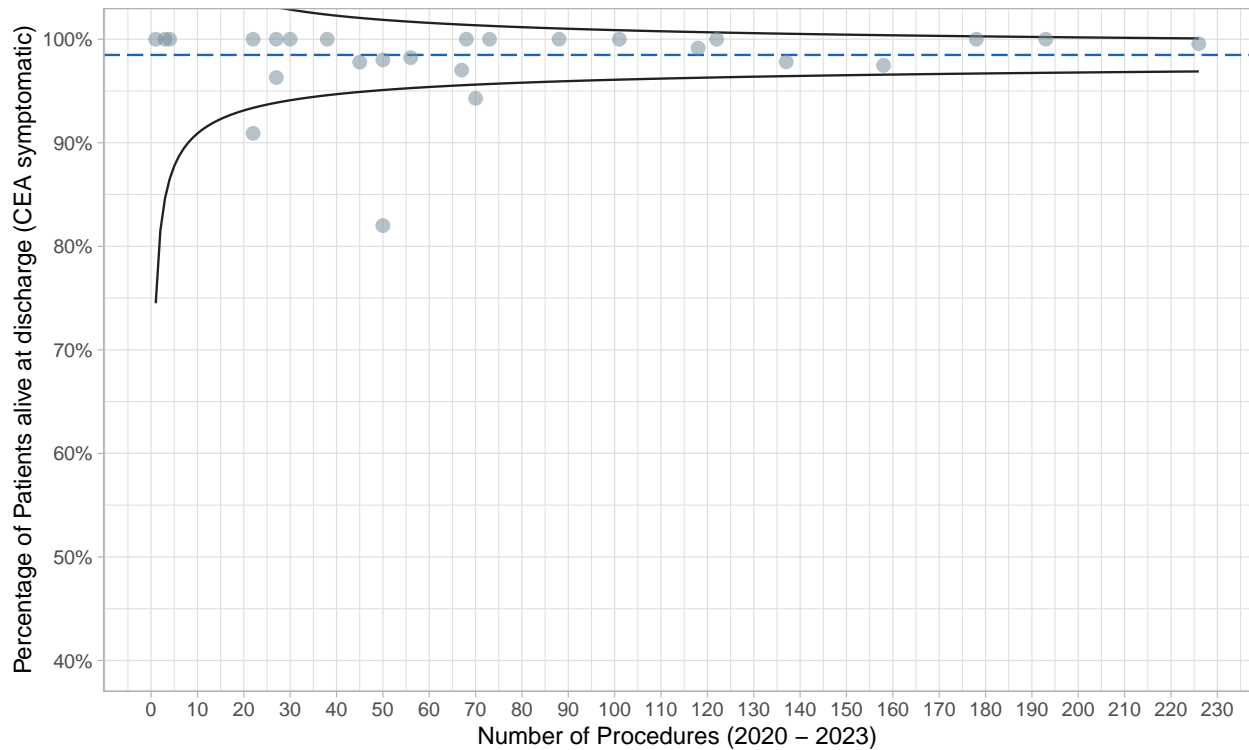
Stenosis information is only available since 1st of January 2023. This analysis excludes patients treated prior to this this date.

Table 18: Stenosis grading (symptomatic)

	2023 (N=700)
NASCET grading	
N-Miss	20
<50%	33 (4.9%)
50-59%	40 (5.9%)
60-69%	76 (11.2%)
70-79%	124 (18.2%)
80-89%	171 (25.1%)
>90%	128 (18.8%)
Near occlusion	19 (2.8%)
Occlusion	37 (5.4%)
No duplex available	43 (6.3%)
No stenosis	9 (1.3%)
Progression of stenosis	
N-Miss	23
Yes	346 (51.1%)
No	331 (48.9%)
Sex	
N-Miss	1
Male	476 (68.1%)
Female	223 (31.9%)
Age (years)	
N-Miss	0
Mean (SD)	73.9 (10.4)
Median (Q1, Q3)	75.0 (68.0, 81.0)

5.4.3 Outcomes at Discharge (CEA symptomatic)

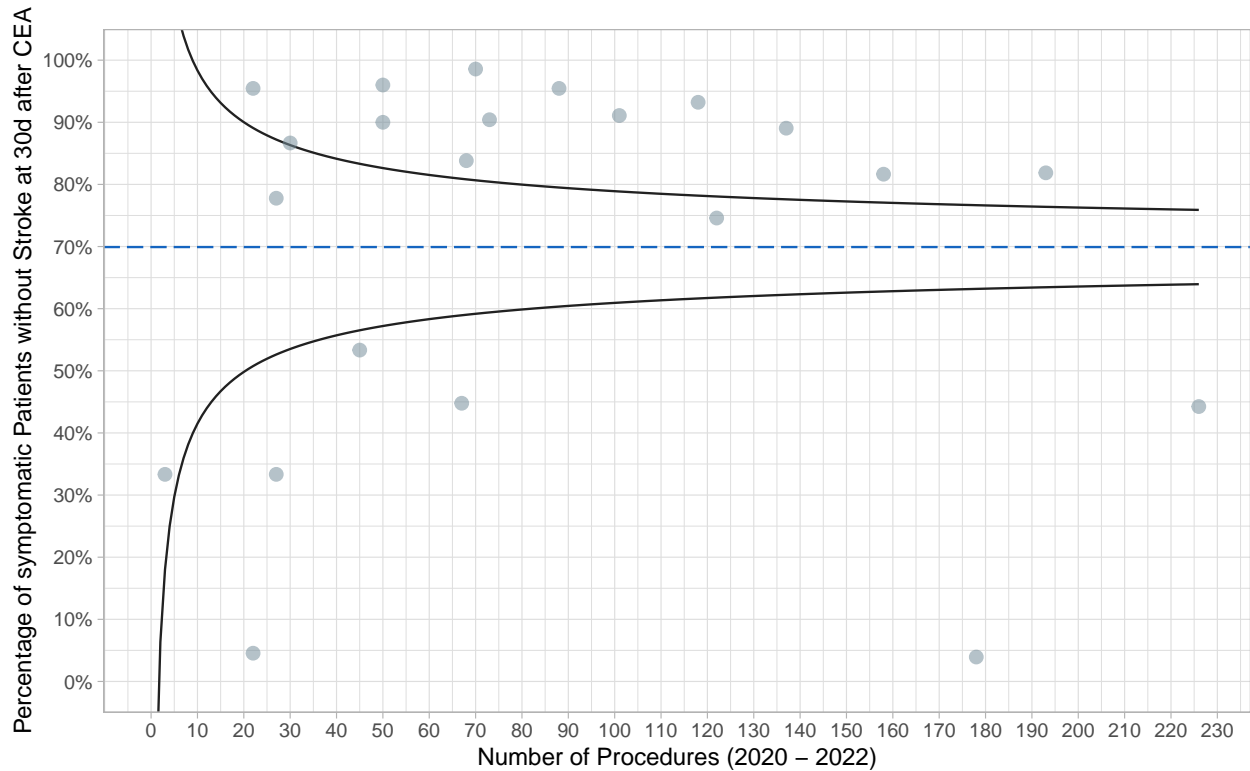
	2020 (N=458)	2021 (N=477)	2022 (N=521)	2023 (N=518)	p value
Inhospital Mortality					< 0.001
Dead	9 (2.0%)	2 (0.4%)	3 (0.6%)	1 (0.2%)	
Alive	436 (95.2%)	474 (99.4%)	517 (99.2%)	517 (99.8%)	
Missing	13 (2.8%)	1 (0.2%)	1 (0.2%)	0 (0.0%)	
Clavien Dindo at Discharge					< 0.001
Grade 0 - No Complication	271 (59.2%)	362 (75.9%)	390 (74.9%)	357 (68.9%)	
Grade I	13 (2.8%)	9 (1.9%)	15 (2.9%)	14 (2.7%)	
Grade I disability	5 (1.1%)	6 (1.3%)	9 (1.7%)	10 (1.9%)	
Grade II	10 (2.2%)	15 (3.1%)	27 (5.2%)	28 (5.4%)	
Grade II disability	3 (0.7%)	3 (0.6%)	4 (0.8%)	5 (1.0%)	
Grade IIIa	7 (1.5%)	4 (0.8%)	3 (0.6%)	3 (0.6%)	
Grade IIIa disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	
Grade IIIb	10 (2.2%)	8 (1.7%)	9 (1.7%)	21 (4.1%)	
Grade IIIb disability	2 (0.4%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	
Grade IVa	4 (0.9%)	1 (0.2%)	2 (0.4%)	4 (0.8%)	
Grade IVa disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	
Grade IVb disability	0 (0.0%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	
Grade V - Death	9 (2.0%)	2 (0.4%)	3 (0.6%)	1 (0.2%)	
Missing	124 (27.1%)	65 (13.6%)	59 (11.3%)	73 (14.1%)	



Note: This plot does NOT show the stroke rate! For stroke rate, see Table above.

5.4.4 Outcomes during Follow-up (CEA symptomatic)

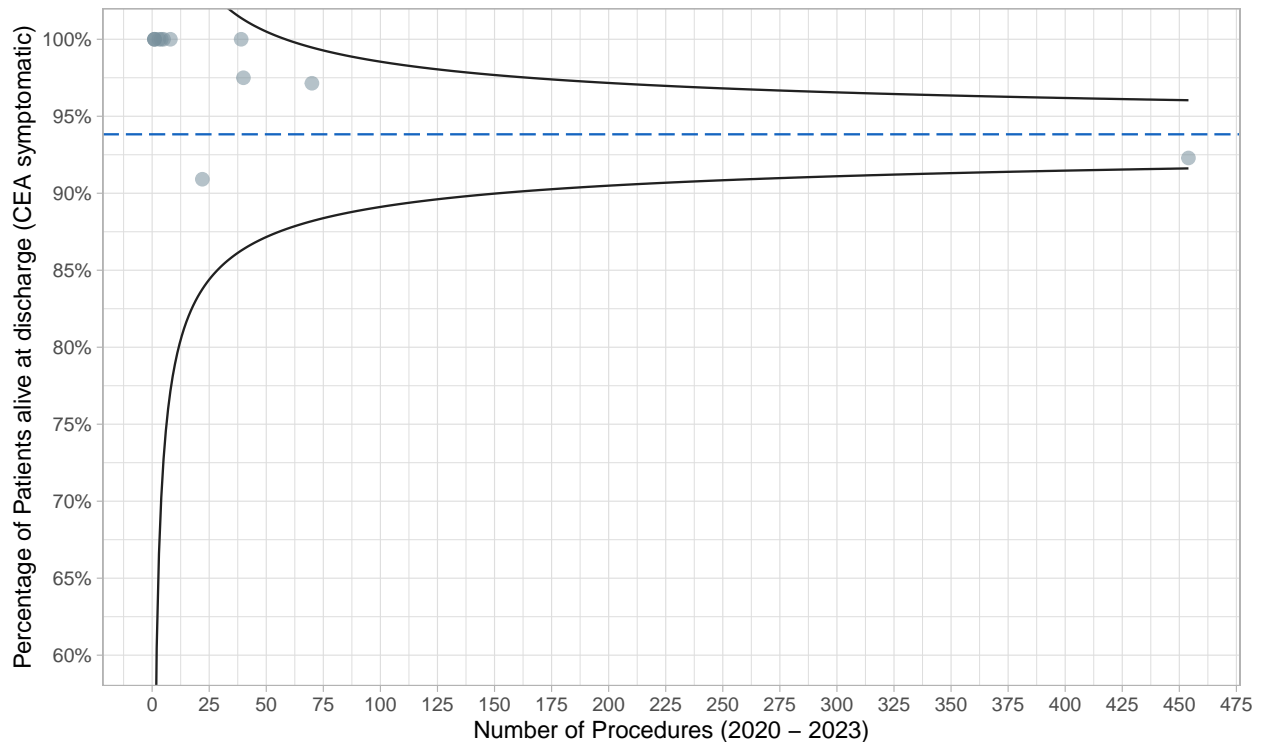
	2020 (N=458)	2021 (N=477)	2022 (N=521)	2023 (N=518)	p value
30d Mortality					0.002
Alive	261 (57.0%)	305 (63.9%)	345 (66.2%)	305 (58.9%)	
Dead	8 (1.7%)	2 (0.4%)	3 (0.6%)	1 (0.2%)	
Missing	189 (41.3%)	170 (35.6%)	173 (33.2%)	212 (40.9%)	
30d Stroke					0.018
Yes	9 (2.0%)	11 (2.3%)	7 (1.3%)	9 (1.7%)	
No	304 (66.4%)	312 (65.4%)	377 (72.4%)	318 (61.4%)	
Missing	145 (31.7%)	154 (32.3%)	137 (26.3%)	191 (36.9%)	



Note: This plot does NOT show the stroke rate! For stroke rate, see Table above.

5.4.5 Outcomes at Discharge (CAS symptomatic)

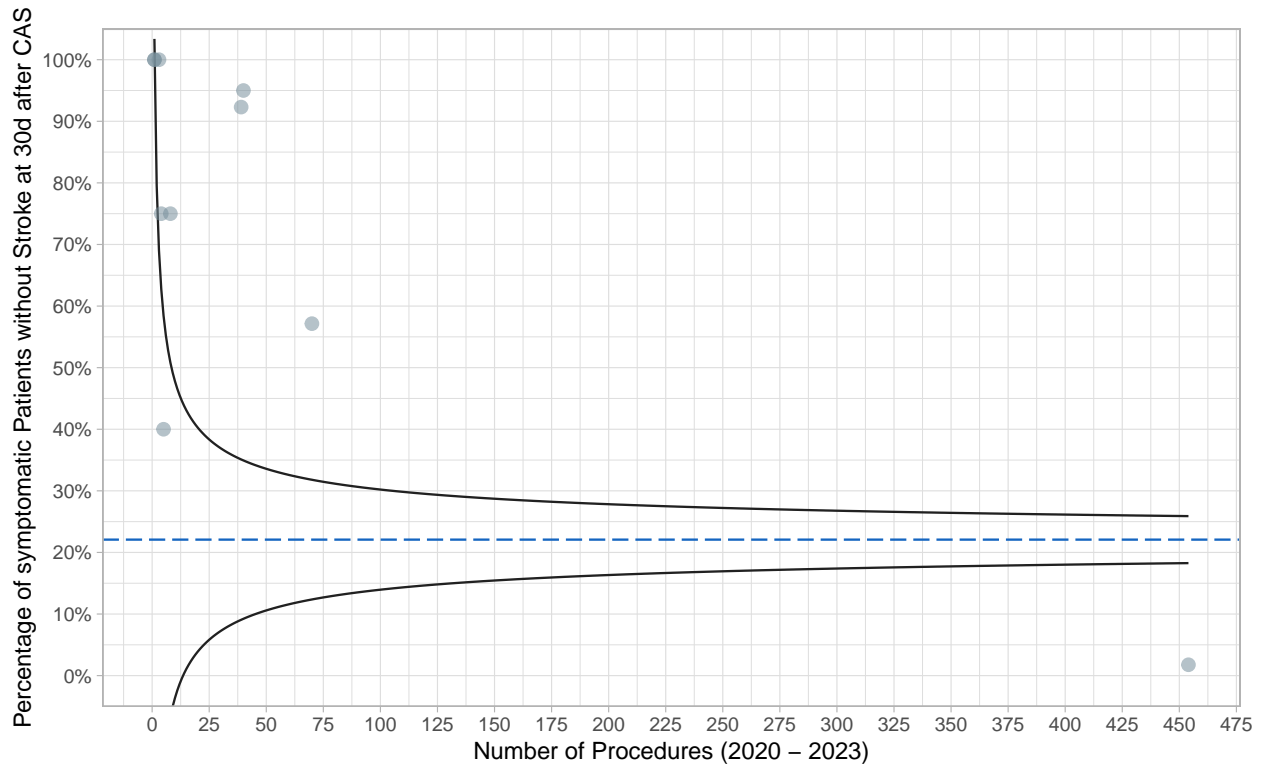
	2020 (N=153)	2021 (N=177)	2022 (N=136)	2023 (N=182)	p value
Inhospital Mortality					0.003
Dead	19 (12.4%)	9 (5.1%)	5 (3.7%)	7 (3.8%)	
Alive	134 (87.6%)	168 (94.9%)	131 (96.3%)	175 (96.2%)	
Clavien Dindo at Discharge					< 0.001
Grade 0 - No Complication	125 (81.7%)	120 (67.8%)	31 (22.8%)	40 (22.0%)	
Grade I	1 (0.7%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	
Grade I disability	1 (0.7%)	1 (0.6%)	1 (0.7%)	0 (0.0%)	
Grade II	3 (2.0%)	0 (0.0%)	1 (0.7%)	4 (2.2%)	
Grade II disability	2 (1.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Grade IIIa	0 (0.0%)	2 (1.1%)	0 (0.0%)	2 (1.1%)	
Grade IIIa disability	0 (0.0%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	
Grade IIIb	1 (0.7%)	1 (0.6%)	0 (0.0%)	1 (0.5%)	
Grade IIIb disability	1 (0.7%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	
Grade IVa	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	
Grade IVb disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	
Grade V - Death	19 (12.4%)	9 (5.1%)	5 (3.7%)	7 (3.8%)	
Missing	0 (0.0%)	44 (24.9%)	96 (70.6%)	125 (68.7%)	



Note: This plot does NOT show the mortality rate! For mortality rate, see Table above.

5.4.6 Outcomes during Follow-up (CAS symptomatic)

	2020 (N=153)	2021 (N=177)	2022 (N=136)	2023 (N=182)	p value
30d Mortality					< 0.001
Alive	32 (20.9%)	59 (33.3%)	35 (25.7%)	28 (15.4%)	
Dead	19 (12.4%)	9 (5.1%)	5 (3.7%)	7 (3.8%)	
Missing	102 (66.7%)	109 (61.6%)	96 (70.6%)	147 (80.8%)	
30d Stroke					0.067
Yes	3 (2.0%)	2 (1.1%)	1 (0.7%)	3 (1.6%)	
No	37 (24.2%)	47 (26.6%)	30 (22.1%)	24 (13.2%)	
Missing	113 (73.9%)	128 (72.3%)	105 (77.2%)	155 (85.2%)	



Note: This plot does NOT show the stroke rate! For stroke rate, see Table above.

5.5 Asymptomatic Patients

5.5.1 Baseline Characteristics (CEA and CAS)

	2020 (N=244)	2021 (N=276)	2022 (N=294)	2023 (N=328)	p value
Technical Approach					0.001
Open surgery	234 (95.9%)	265 (96.0%)	282 (95.9%)	295 (89.9%)	
Endovascular intervention	10 (4.1%)	11 (4.0%)	12 (4.1%)	33 (10.1%)	
Sex					0.366
Male	163 (66.8%)	188 (68.1%)	205 (69.7%)	240 (73.2%)	
Female	81 (33.2%)	88 (31.9%)	89 (30.3%)	88 (26.8%)	
Age (years)					0.167
N-Miss	0	0	0	0	
Mean (SD)	71.3 (8.5)	72.3 (8.0)	72.8 (7.6)	72.5 (7.9)	
Renal Failure					< 0.001
G1 eGFR > 90	23 (9.4%)	34 (12.3%)	43 (14.6%)	41 (12.5%)	
G2 eGFR 60-89	79 (32.4%)	114 (41.3%)	128 (43.5%)	141 (43.0%)	
G3a eGFR 45-59	30 (12.3%)	30 (10.9%)	38 (12.9%)	36 (11.0%)	
G3b eGFR 30-44	12 (4.9%)	16 (5.8%)	24 (8.2%)	18 (5.5%)	
G4 eGFR 15-29	0 (0.0%)	3 (1.1%)	5 (1.7%)	7 (2.1%)	
G5 eGFR <15 or dialysis	2 (0.8%)	4 (1.4%)	1 (0.3%)	2 (0.6%)	
Unknown	98 (40.2%)	75 (27.2%)	55 (18.7%)	83 (25.3%)	
COPD					0.316
N-Miss	62	47	30	58	
No COPD	133 (73.1%)	176 (76.9%)	186 (70.5%)	201 (74.4%)	
COPD w/o medication	8 (4.4%)	11 (4.8%)	16 (6.1%)	15 (5.6%)	
COPD with medication	11 (6.0%)	3 (1.3%)	13 (4.9%)	14 (5.2%)	
COPD with O2 therapy	1 (0.5%)	3 (1.3%)	0 (0.0%)	1 (0.4%)	
Unknown	29 (15.9%)	36 (15.7%)	49 (18.6%)	39 (14.4%)	
Heart Failure					0.772
N-Miss	62	47	30	59	
No heart failure	119 (65.4%)	143 (62.4%)	175 (66.3%)	164 (61.0%)	
NYHA I	20 (11.0%)	27 (11.8%)	27 (10.2%)	36 (13.4%)	
NYHA II	11 (6.0%)	20 (8.7%)	26 (9.8%)	25 (9.3%)	
NYHA III	3 (1.6%)	6 (2.6%)	6 (2.3%)	3 (1.1%)	
NYHA IV	1 (0.5%)	0 (0.0%)	0 (0.0%)	2 (0.7%)	
Unknown	28 (15.4%)	33 (14.4%)	30 (11.4%)	39 (14.5%)	

5.5.2 Stenosis Analysis 2023 - 2023

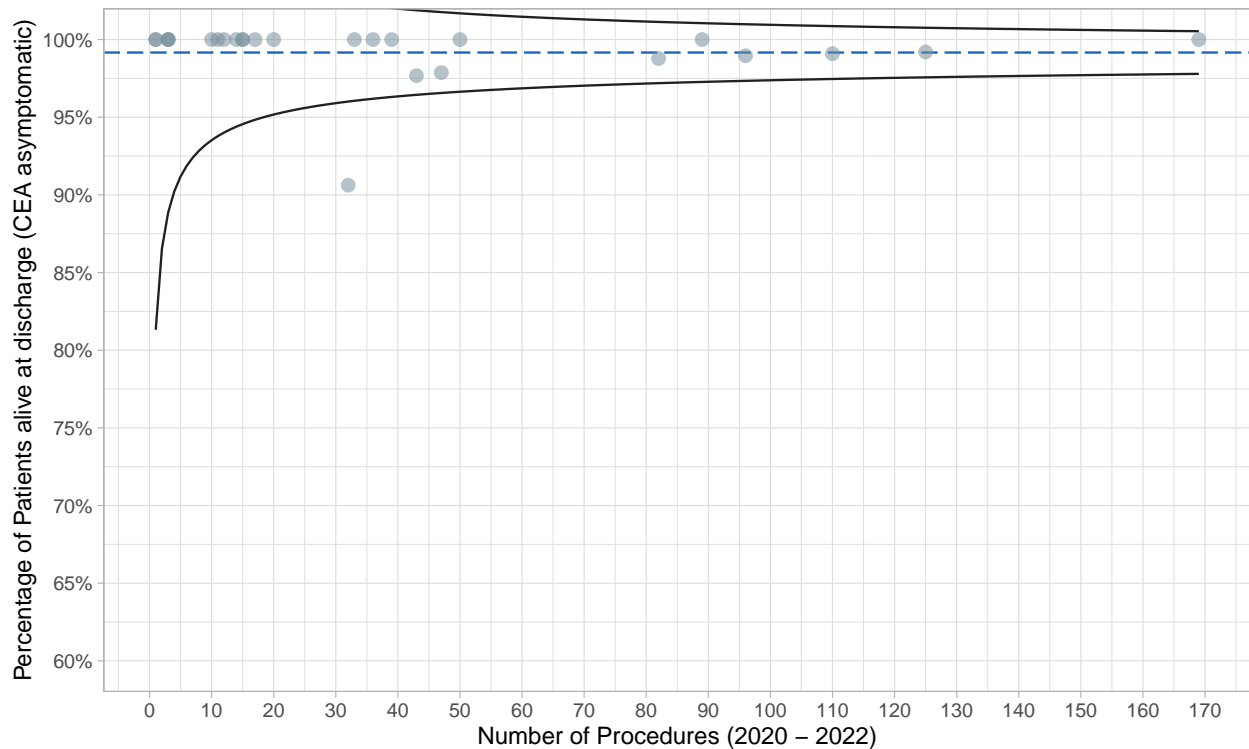
Stenosis information is only available since 1st of January 2023. This analysis excludes patients treated prior to this this date.

Table 24: Stenosis grading (asymptomatic)

	2023 (N=328)
NASCET grading	
N-Miss	4
50-59%	3 (0.9%)
60-69%	8 (2.5%)
70-79%	94 (29.0%)
80-89%	150 (46.3%)
>90%	60 (18.5%)
Near occlusion	7 (2.2%)
Occlusion	1 (0.3%)
No stenosis	1 (0.3%)
Progression of stenosis	
N-Miss	4
Yes	234 (72.2%)
No	90 (27.8%)
Sex	
Male	240 (73.2%)
Female	88 (26.8%)
Age (years)	
Mean (SD)	72.5 (7.9)
Median (Q1, Q3)	73.5 (67.0, 79.0)
N-Miss	0

5.5.3 Outcomes at Discharge (CEA asymptomatic)

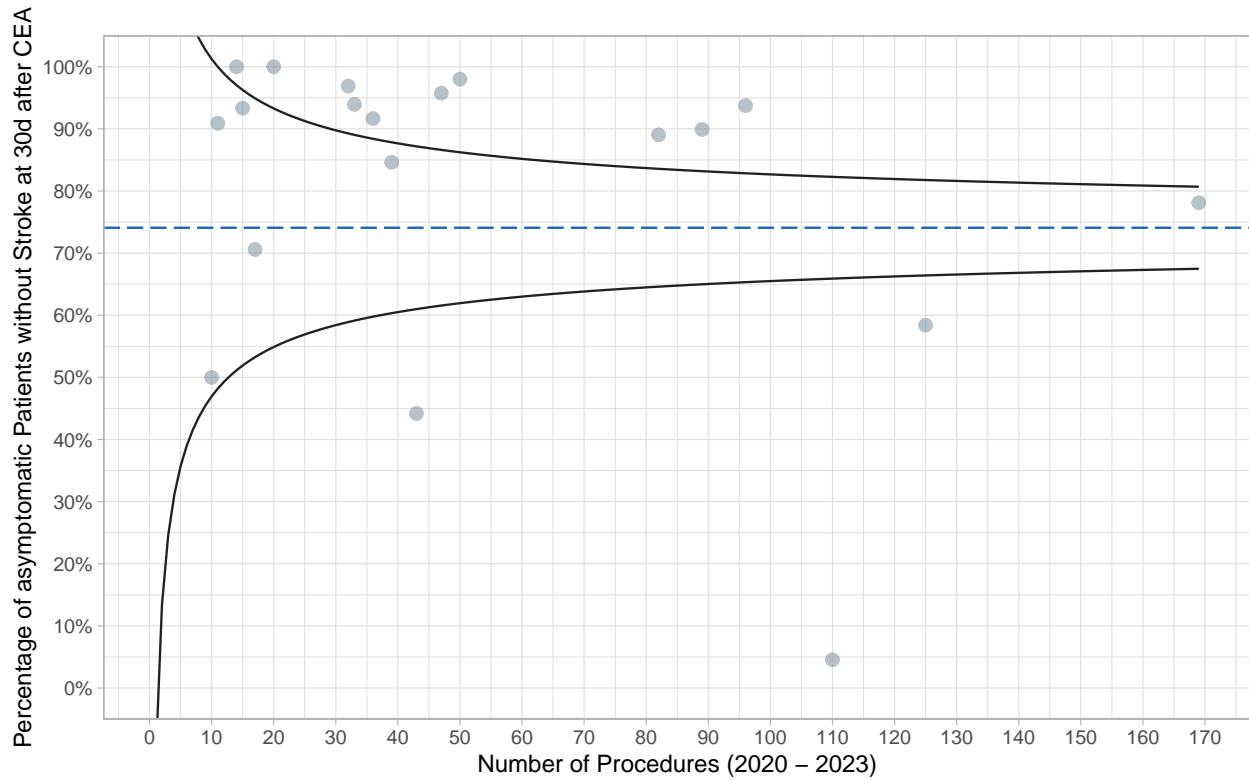
	2020 (N=234)	2021 (N=265)	2022 (N=282)	2023 (N=295)	p value
Inhospital Mortality					0.049
Dead	1 (0.4%)	2 (0.8%)	0 (0.0%)	1 (0.3%)	
Alive	229 (97.9%)	263 (99.2%)	282 (100.0%)	293 (99.3%)	
Missing	4 (1.7%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	
Clavien Dindo at Discharge					0.007
Grade 0 - No Complication	166 (70.9%)	191 (72.1%)	214 (75.9%)	236 (80.0%)	
Grade I	2 (0.9%)	10 (3.8%)	7 (2.5%)	11 (3.7%)	
Grade I disability	3 (1.3%)	5 (1.9%)	4 (1.4%)	3 (1.0%)	
Grade II	3 (1.3%)	8 (3.0%)	15 (5.3%)	7 (2.4%)	
Grade II disability	4 (1.7%)	2 (0.8%)	3 (1.1%)	4 (1.4%)	
Grade IIIa	0 (0.0%)	5 (1.9%)	1 (0.4%)	0 (0.0%)	
Grade IIIb	4 (1.7%)	3 (1.1%)	4 (1.4%)	5 (1.7%)	
Grade IIIb disability	0 (0.0%)	0 (0.0%)	1 (0.4%)	1 (0.3%)	
Grade IVa	0 (0.0%)	1 (0.4%)	0 (0.0%)	2 (0.7%)	
Grade IVa disability	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	
Grade V - Death	1 (0.4%)	2 (0.8%)	0 (0.0%)	1 (0.3%)	
Missing	51 (21.8%)	37 (14.0%)	33 (11.7%)	25 (8.5%)	



Note: This plot does NOT show the mortality rate! For mortality rate, see Table above.

5.5.4 Outcomes during Follow-up (CEA asymptomatic)

	2020 (N=234)	2021 (N=265)	2022 (N=282)	2023 (N=295)	p value
30d Mortality					0.136
Alive	147 (62.8%)	168 (63.4%)	185 (65.6%)	172 (58.3%)	
Dead	0 (0.0%)	2 (0.8%)	0 (0.0%)	0 (0.0%)	
Missing	87 (37.2%)	95 (35.8%)	97 (34.4%)	123 (41.7%)	
30d Stroke					0.194
Yes	5 (2.1%)	3 (1.1%)	2 (0.7%)	5 (1.7%)	
No	171 (73.1%)	193 (72.8%)	211 (74.8%)	194 (65.8%)	
Missing	58 (24.8%)	69 (26.0%)	69 (24.5%)	96 (32.5%)	



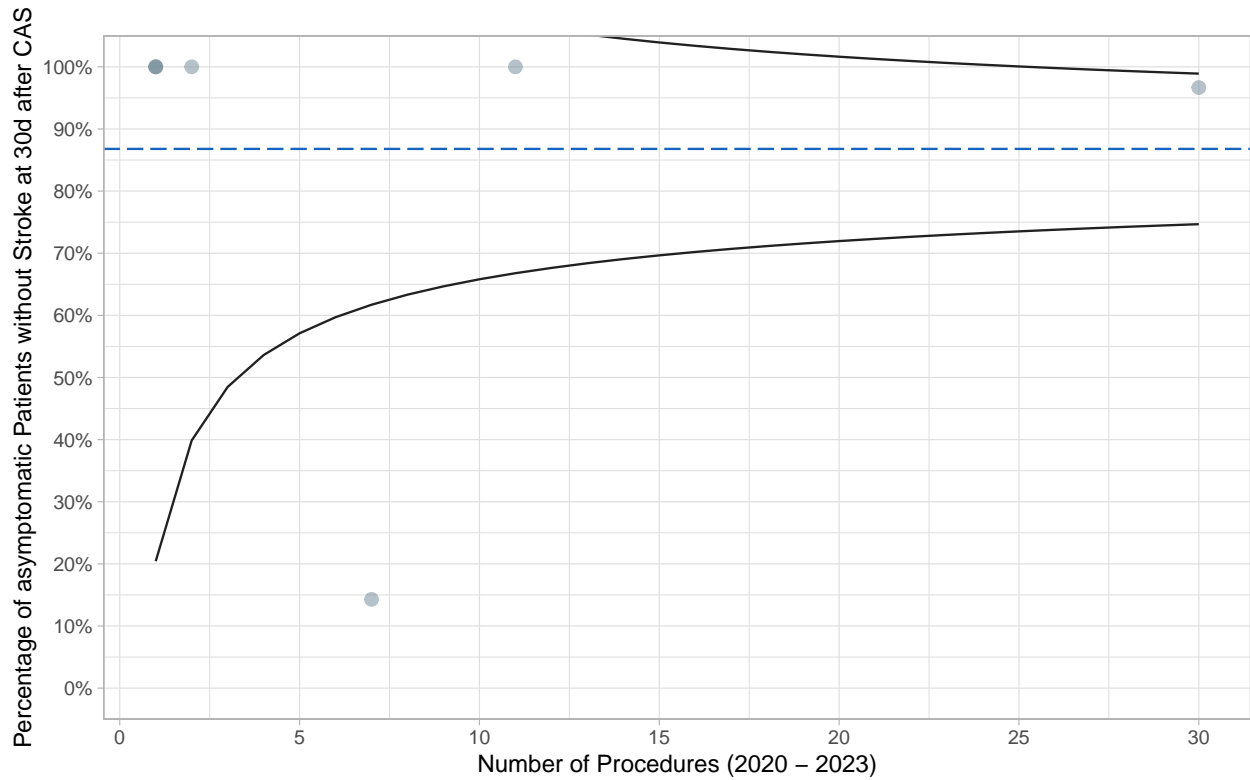
Note: This plot does NOT show the stroke rate! For stroke rate, see Table above.

5.5.5 Outcomes at Discharge (CAS asymptomatic)

	2020 (N=10)	2021 (N=11)	2022 (N=12)	2023 (N=33)	p value
Inhospital Mortality					< 0.001
Alive	10 (100.0%)	11 (100.0%)	12 (100.0%)	33 (100.0%)	
Clavien Dindo at Discharge					0.270
Grade 0 - No Complication	9 (90.0%)	9 (81.8%)	11 (91.7%)	30 (90.9%)	
Grade I	1 (10.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Grade II	0 (0.0%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	
Grade IIIb	0 (0.0%)	1 (9.1%)	0 (0.0%)	0 (0.0%)	
Grade IVa	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (3.0%)	
Missing	0 (0.0%)	1 (9.1%)	0 (0.0%)	2 (6.1%)	

5.5.6 Outcomes during Follow-up (CAS asymptomatic)

	2020 (N=10)	2021 (N=11)	2022 (N=12)	2023 (N=33)	p value
30d Mortality					0.495
Alive	7 (70.0%)	9 (81.8%)	10 (83.3%)	21 (63.6%)	
Missing	3 (30.0%)	2 (18.2%)	2 (16.7%)	12 (36.4%)	
30d Stroke					0.398
Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (3.0%)	
No	7 (70.0%)	9 (81.8%)	11 (91.7%)	19 (57.6%)	
Missing	3 (30.0%)	2 (18.2%)	1 (8.3%)	13 (39.4%)	



Note: This plot does NOT show the stroke rate! For stroke rate, see Table above.

6 Bypass Surgery for Femoro-Popliteal Occlusive Disease

This cohort includes patients with open procedure at the native femoro-popliteal (supragenicular, infragenicular, or isolated popliteal) segment for obstructing wall pathology or intraluminal obstruction. Only sterile procedures, only procedures with no previous intervention at the same location, and only patients with chronic ischemia (both critical and relative).

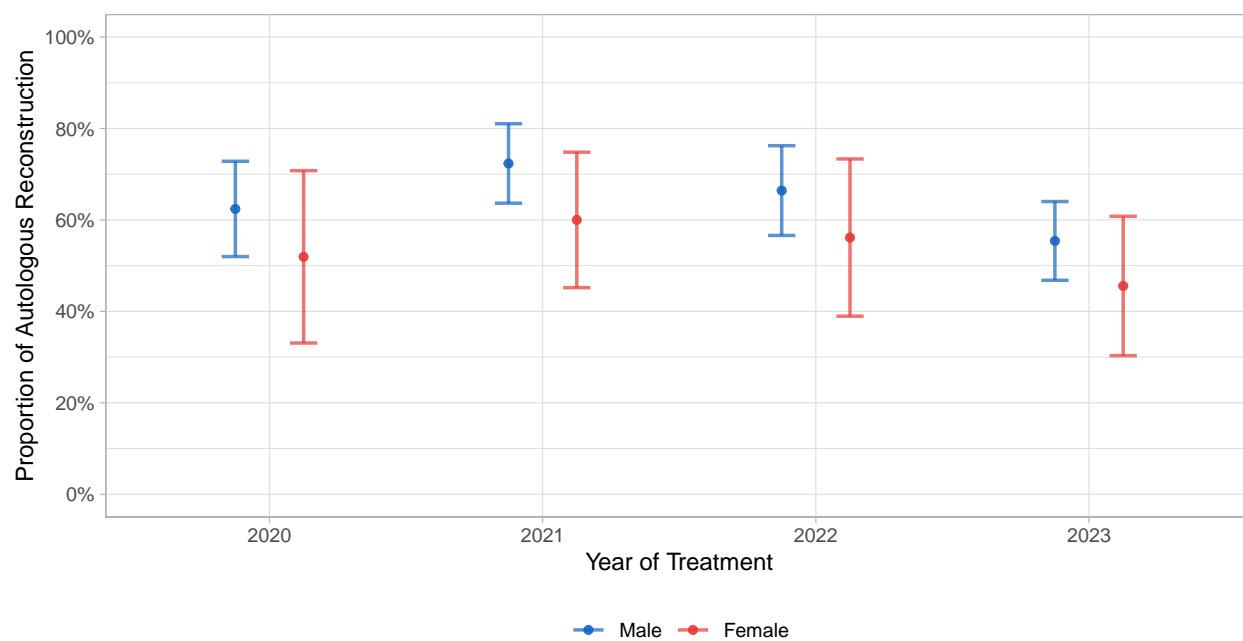
6.1 Baseline Characteristics

	2020 (N=185)	2021 (N=211)	2022 (N=191)	2023 (N=321)	p value
Sex					0.599
Male	133 (71.9%)	141 (66.8%)	134 (70.2%)	231 (72.0%)	
Female	52 (28.1%)	70 (33.2%)	57 (29.8%)	90 (28.0%)	
Age (years)					0.714
N-Miss	0	0	0	0	
Mean (SD)	71.5 (11.4)	71.5 (10.4)	72.0 (10.0)	72.4 (10.3)	
Renal Failure					0.004
G1 eGFR > 90	31 (16.8%)	38 (18.0%)	36 (18.8%)	61 (19.0%)	
G2 eGFR 60-89	38 (20.5%)	61 (28.9%)	61 (31.9%)	87 (27.1%)	
G3a eGFR 45-59	12 (6.5%)	24 (11.4%)	19 (9.9%)	37 (11.5%)	
G3b eGFR 30-44	9 (4.9%)	7 (3.3%)	8 (4.2%)	28 (8.7%)	
G4 eGFR 15-29	3 (1.6%)	4 (1.9%)	10 (5.2%)	8 (2.5%)	
G5 eGFR <15 or dialysis	1 (0.5%)	2 (0.9%)	2 (1.0%)	3 (0.9%)	
Unknown	91 (49.2%)	75 (35.5%)	55 (28.8%)	97 (30.2%)	
COPD					0.523
N-Miss	63	63	39	71	
No COPD	82 (67.2%)	87 (58.8%)	87 (57.2%)	158 (63.2%)	
COPD w/o medication	12 (9.8%)	12 (8.1%)	14 (9.2%)	23 (9.2%)	
COPD with medication	7 (5.7%)	13 (8.8%)	12 (7.9%)	25 (10.0%)	
COPD with O2 therapy	0 (0.0%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	
Unknown	21 (17.2%)	36 (24.3%)	38 (25.0%)	44 (17.6%)	
Heart Failure					0.325
N-Miss	63	63	39	71	
No heart failure	79 (64.8%)	80 (54.1%)	74 (48.7%)	156 (62.4%)	
NYHA I	9 (7.4%)	12 (8.1%)	15 (9.9%)	18 (7.2%)	
NYHA II	4 (3.3%)	9 (6.1%)	14 (9.2%)	20 (8.0%)	
NYHA III	5 (4.1%)	5 (3.4%)	9 (5.9%)	8 (3.2%)	
NYHA IV	2 (1.6%)	2 (1.4%)	1 (0.7%)	2 (0.8%)	
Unknown	23 (18.9%)	40 (27.0%)	39 (25.7%)	46 (18.4%)	

6.2 Treatment Details

	2020 (N=185)	2021 (N=211)	2022 (N=191)	2023 (N=321)	p value
Segment					0.354
Fem-pop, supragenicular	92 (49.7%)	96 (45.5%)	98 (51.3%)	180 (56.1%)	
Fem-pop, infragenicular	88 (47.6%)	110 (52.1%)	90 (47.1%)	136 (42.4%)	
Isolated popliteal	5 (2.7%)	5 (2.4%)	3 (1.6%)	5 (1.6%)	
Clinical Problem					0.013
Chronic relative ischemia	79 (42.7%)	95 (45.0%)	97 (50.8%)	180 (56.1%)	
Chronic critical ischemia	106 (57.3%)	116 (55.0%)	94 (49.2%)	141 (43.9%)	
Material					0.002
Autologous	110 (59.5%)	144 (68.2%)	121 (63.4%)	169 (52.6%)	
Biological	7 (3.8%)	15 (7.1%)	8 (4.2%)	15 (4.7%)	
Synthetic	68 (36.8%)	52 (24.6%)	62 (32.5%)	137 (42.7%)	

6.2.1 Proportion of autologous reconstructions



6.3 Critical Limb Ischemia

To increase comparability, the cohort was defined as follows: Open or endovascular procedure at the native femoro-popliteal (supragenicular or infragenicular) segment for obstructing wall pathology or intraluminal obstruction. Only sterile procedures, only procedures with no previous intervention at the same location, and only patients with chronic critical ischemia.

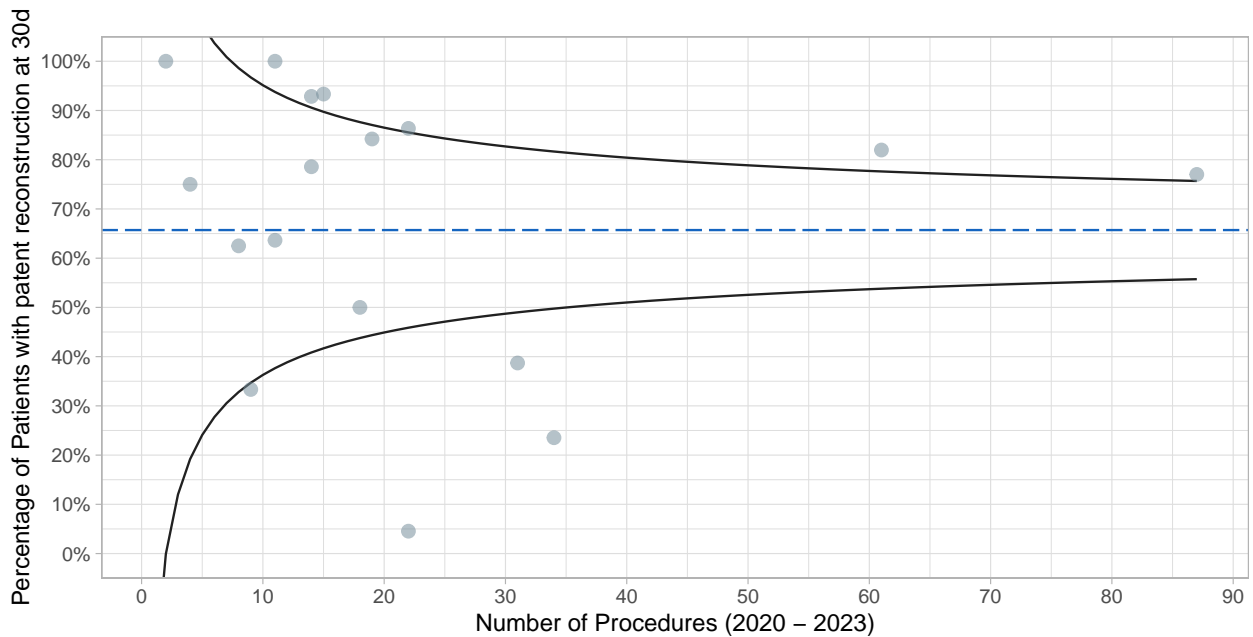
6.3.1 Characteristics and Hospital Outcomes

Table 31: Revascularisation for Critical Limb Ischemia

	2020 (N=106)	2021 (N=116)	2022 (N=94)	2023 (N=141)	p value
Segment					0.305
Fem-pop, supragenicular	45 (42.5%)	36 (31.0%)	40 (42.6%)	55 (39.0%)	
Fem-pop, infragenicular	59 (55.7%)	80 (69.0%)	53 (56.4%)	83 (58.9%)	
Isolated popliteal	2 (1.9%)	0 (0.0%)	1 (1.1%)	3 (2.1%)	
Material					0.253
Autologous	58 (54.7%)	81 (69.8%)	64 (68.1%)	86 (61.0%)	
Biological	6 (5.7%)	7 (6.0%)	5 (5.3%)	10 (7.1%)	
Synthetic	42 (39.6%)	28 (24.1%)	25 (26.6%)	45 (31.9%)	
Inhospital Mortality					0.664
Dead	3 (2.8%)	6 (5.2%)	3 (3.2%)	8 (5.7%)	
Alive	100 (94.3%)	109 (94.0%)	90 (95.7%)	132 (93.6%)	
Missing	3 (2.8%)	1 (0.9%)	1 (1.1%)	1 (0.7%)	
Clavien Dindo at Discharge					0.042
Grade 0 - No Complication	55 (51.9%)	64 (55.2%)	41 (43.6%)	69 (48.9%)	
Grade I	8 (7.5%)	0 (0.0%)	2 (2.1%)	3 (2.1%)	
Grade II	5 (4.7%)	6 (5.2%)	12 (12.8%)	17 (12.1%)	
Grade II disability	1 (0.9%)	1 (0.9%)	0 (0.0%)	2 (1.4%)	
Grade IIIa	1 (0.9%)	2 (1.7%)	1 (1.1%)	6 (4.3%)	
Grade IIIa disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)	
Grade IIIb	8 (7.5%)	12 (10.3%)	14 (14.9%)	11 (7.8%)	
Grade IIIb disability	1 (0.9%)	1 (0.9%)	4 (4.3%)	0 (0.0%)	
Grade IVa	1 (0.9%)	2 (1.7%)	3 (3.2%)	2 (1.4%)	
Grade IVa disability	1 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Grade V - Death	3 (2.8%)	6 (5.2%)	3 (3.2%)	8 (5.7%)	
Missing	22 (20.8%)	22 (19.0%)	14 (14.9%)	22 (15.6%)	

6.3.2 Outcomes during Follow-up

	2020 (N=106)	2021 (N=116)	2022 (N=94)	2023 (N=141)	p value
30d Mortality					0.223
Alive	74 (69.8%)	76 (65.5%)	69 (73.4%)	82 (58.2%)	
Dead	3 (2.8%)	6 (5.2%)	2 (2.1%)	5 (3.5%)	
Missing	29 (27.4%)	34 (29.3%)	23 (24.5%)	54 (38.3%)	
30d Reconstruction patency					0.071
Yes	54 (50.9%)	64 (55.2%)	62 (66.0%)	71 (50.4%)	
No	6 (5.7%)	1 (0.9%)	1 (1.1%)	4 (2.8%)	
Missing	46 (43.4%)	51 (44.0%)	31 (33.0%)	66 (46.8%)	



Note: This plot does NOT show the occlusion rate! For occlusion rate, see Table above.

6.4 Chronic Relative Ischemia (Claudication)

To increase comparability, the cohort was defined as follows: Open or endovascular procedure at the native femoro-popliteal (supragenicular or infragenicular) segment for obstructing wall pathology or intraluminal obstruction. Only sterile procedures, only procedures with no previous intervention at the same location, and only patients with chronic relative ischemia.

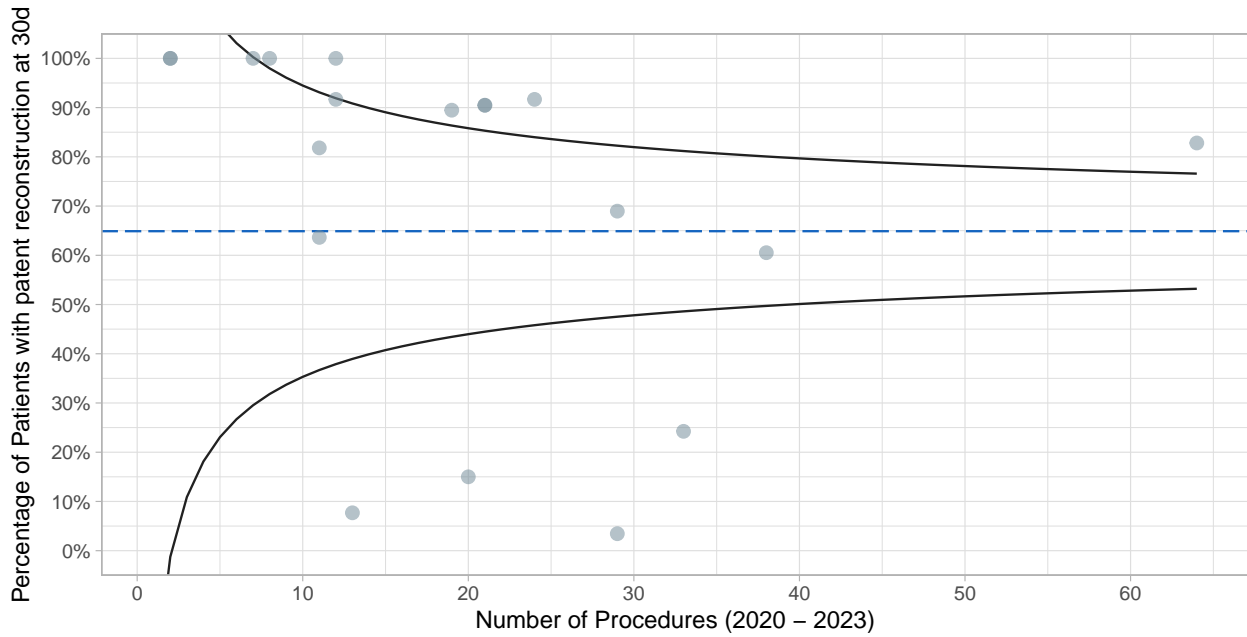
6.4.1 Characteristics and Hospital Outcomes

Table 33: Revascularisation for Claudication

	2020 (N=79)	2021 (N=95)	2022 (N=97)	2023 (N=180)	p value
Segment					0.256
Fem-pop, supragenicular	47 (59.5%)	60 (63.2%)	58 (59.8%)	125 (69.4%)	
Fem-pop, infragenicular	29 (36.7%)	30 (31.6%)	37 (38.1%)	53 (29.4%)	
Isolated popliteal	3 (3.8%)	5 (5.3%)	2 (2.1%)	2 (1.1%)	
Material					< 0.001
Autologous	52 (65.8%)	63 (66.3%)	57 (58.8%)	83 (46.1%)	
Biological	1 (1.3%)	8 (8.4%)	3 (3.1%)	5 (2.8%)	
Synthetic	26 (32.9%)	24 (25.3%)	37 (38.1%)	92 (51.1%)	
Inhospital Mortality					0.377
Dead	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Alive	76 (96.2%)	93 (97.9%)	97 (100.0%)	171 (95.0%)	
Missing	3 (3.8%)	2 (2.1%)	0 (0.0%)	8 (4.4%)	
Clavien Dindo at Discharge					0.195
Grade 0 - No Complication	45 (57.0%)	58 (61.1%)	48 (49.5%)	114 (63.3%)	
Grade I	3 (3.8%)	2 (2.1%)	4 (4.1%)	3 (1.7%)	
Grade I disability	0 (0.0%)	0 (0.0%)	1 (1.0%)	0 (0.0%)	
Grade II	1 (1.3%)	8 (8.4%)	5 (5.2%)	4 (2.2%)	
Grade II disability	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Grade IIIa	2 (2.5%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	
Grade IIIb	3 (3.8%)	4 (4.2%)	7 (7.2%)	5 (2.8%)	
Grade V - Death	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Missing	25 (31.6%)	22 (23.2%)	32 (33.0%)	52 (28.9%)	

6.4.2 Outcomes during Follow-up

	2020 (N=79)	2021 (N=95)	2022 (N=97)	2023 (N=180)	p value
30d Mortality					0.166
Alive	45 (57.0%)	62 (65.3%)	59 (60.8%)	88 (48.9%)	
Dead	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Missing	34 (43.0%)	33 (34.7%)	38 (39.2%)	91 (50.6%)	
30d Reconstruction patency					0.037
Yes	36 (45.6%)	61 (64.2%)	58 (59.8%)	89 (49.4%)	
No	2 (2.5%)	3 (3.2%)	1 (1.0%)	1 (0.6%)	
Missing	41 (51.9%)	31 (32.6%)	38 (39.2%)	90 (50.0%)	

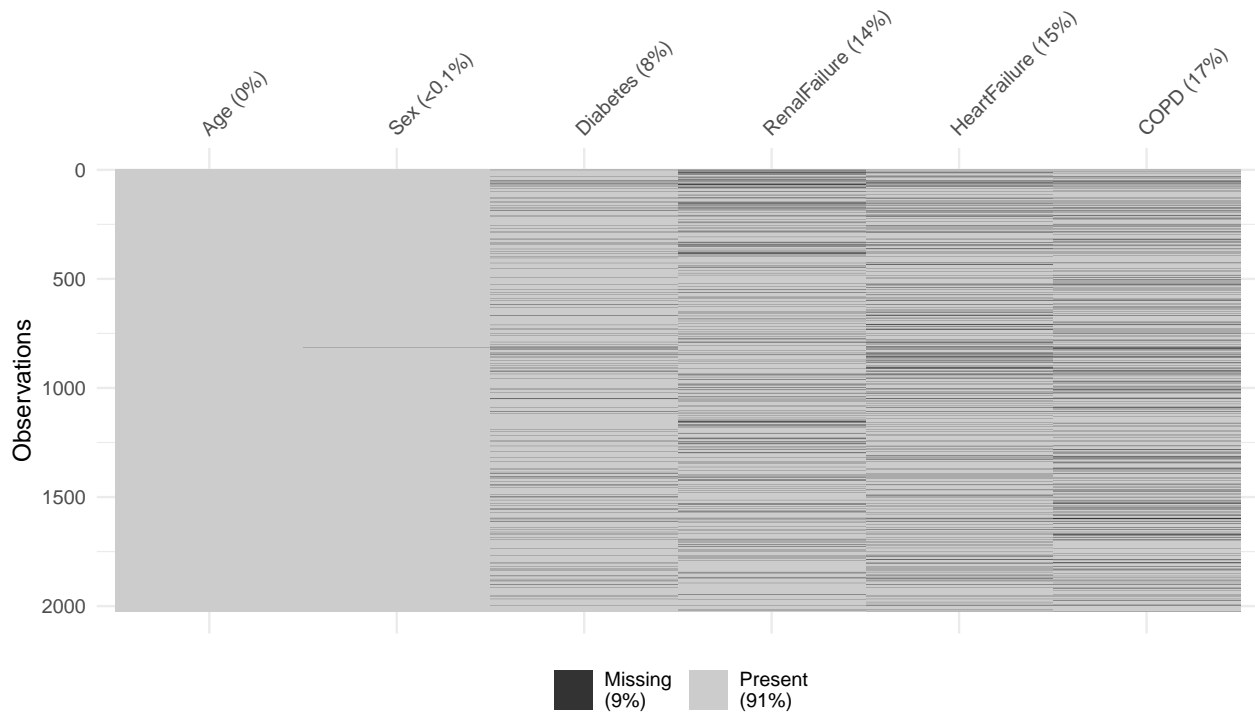


Note: This plot does NOT show the occlusion rate! For occlusion rate, see Table above.

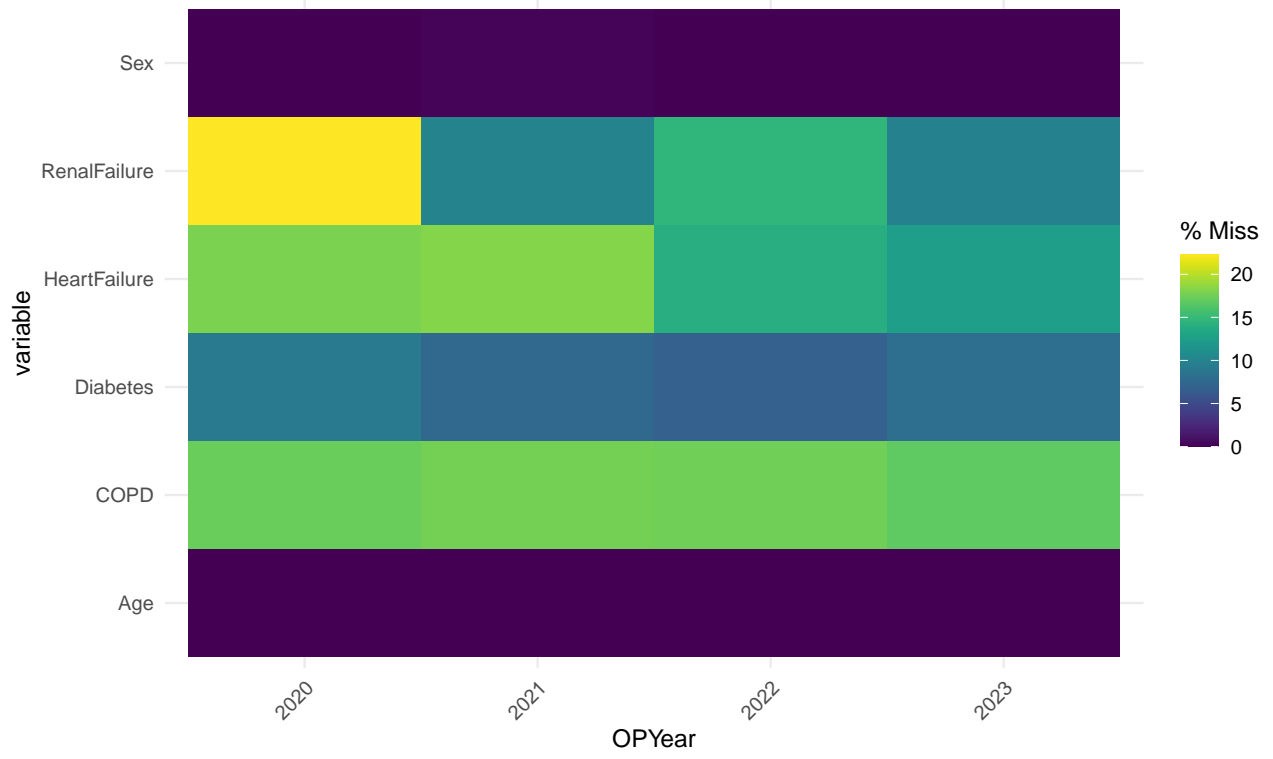
7 Appendix I

7.1 Missing Data in the AAA Cohort

Missing in AAA Cohort – Overall



Missing in AAA Cohort Your Clinic over time



8 R Session Info

R version 4.2.3 (2023-03-15) on macOS Monterey 12.5.1

Table 35: Package Names and Versions

Package	Version
naniar	1.0.0
forestmodel	0.6.2
mice	3.15.0
Hmisc	5.0-1
reshape2	1.4.4
gridExtra	2.3
funnelR	0.1.0
RColorBrewer	1.1-3
ggrepel	0.9.3
markdown	1.5
arsenal	3.6.3
kableExtra	1.3.4
survival	3.5-7
survminer	0.4.9
cowplot	1.1.1
jtools	2.2.1
ggpubr	0.6.0
lubridate	1.9.2
forcats	1.0.0
stringr	1.5.0
dplyr	1.1.4
purrr	1.0.1
readr	2.1.4
tidyr	1.3.0
tibble	3.2.1
ggplot2	3.5.0
tidyverse	2.0.0