

BACKGROUND

- Bloodstream infection (BSI) following arterial aneurysm repair may signify arterial graft infection (AGI) [1].
- The incidence of BSI and its outcome in patients with arterial grafts have received scant attention with limited contemporary study.

OBJECTIVE

- To determine the incidence, epidemiology, and outcome of BSI following arterial aneurysm repair in a southern Minnesotan population.
- To compare the incidence of BSI following open surgical repair (OSR) and that following endovascular repair (EVAR)

METHODS

- The expanded Rochester Epidemiology Project (e-REP) was queried for all adults (≥18 years) who underwent arterial aneurysm repairs between January 1, 2010 and December 31, 2020.
- Only 8 counties in southern Minnesota which had approximately 90% or more of their residents captured in e-REP were included.
- Billing codes were used to identify patients.
- Records were manually screened for first BSI episode following arterial aneurysm repair.

COHORT CHARACTERISTICS

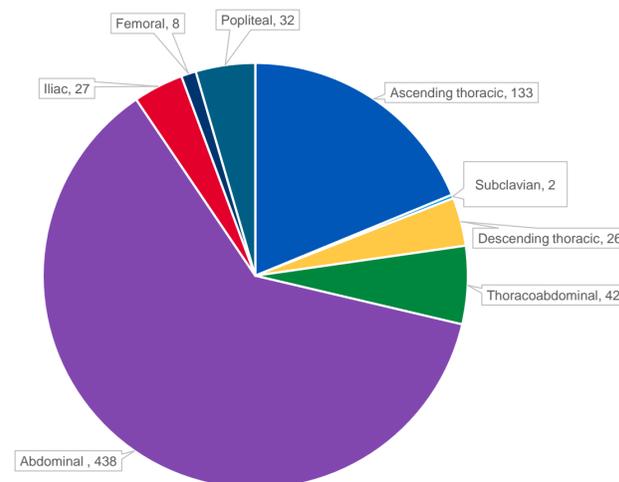
- Overall, 643 patients underwent 708 aneurysm repairs: 417 EVAR and 291 OSR.

Table 1. Characteristic of Study Cohort Based on Repair Type (N=708).

Repair type	EVAR (N=417)	OSR (N=291)	P-value
Age at repair, years	77.8 (71.5, 83.1)	68.3 (60.3, 75.3)	<0.001
Gender, Male	329 (78.9%)	233 (80.1%)	0.715
BMI (kg/m ²)	28.7 (25.5, 33.0)	29.1 (25.9, 33.1)	0.335
Valve prosthesis	19 (4.6%)	45 (15.5%)	<0.001
CIED	30 (7.2%)	11 (3.8%)	0.063
Comorbidities			
• Coronary artery disease	301 (72.2%)	207 (71.1%)	0.768
• Coronary artery intervention	146 (35.0%)	65 (22.3%)	<0.001
• Congestive heart failure	118 (28.3%)	92 (31.6%)	0.358
• Diabetes mellitus	130 (31.2%)	73 (25.1%)	0.094
• Moderate to severe CKD	36 (8.6%)	14 (4.8%)	0.049
• Valve Disease	231 (55.4%)	206 (70.8%)	<0.001
• Cancer (solid tumor and hematologic)	53 (12.7%)	20 (6.9%)	0.014
• Transplant (solid organ and bone marrow)	8 (1.9%)	1 (0.3%)	0.103
• Charlson comorbidity index	7 (5, 8)	5 (4, 7)	<0.001
Operative length, hours (N=687)	2.1 (1.4, 3.3)	5.7 (4.8, 7.5)	<0.001
Repair setting, emergent	40 (9.6%)	45 (15.5%)	0.022
Aneurysm site			
• Intra-cavitary	409 (98.1%)	259 (89.0%)	<0.001
• Extra-cavitary	8 (1.9%)	32 (11.0%)	

Values represent frequency (percentage) for categorical variables and median (quartile 1, quartile 3) for continuous variables. CIED: cardiovascular implantable electronic device; CKD: chronic kidney disease.

Figure 1. Location of Repaired Aneurysms.



RESULTS

INCIDENCE OF BSI

- BSI occurred in 42 cases, 39 of which were monomicrobial (92.9%).
- Median time to BSI was 3.1 (0.6-6.4) years.
- Median follow-up time from BSI was 2.7 (1.3-6.0) years.

Table 2. Incidence of Bloodstream Infection

	Overall	EVAR	OSR
Incident BSI	42	17	25
Procedure-years (PY)	3093.7	1568.0	1525.6
Incidence rate/1000 PY (95% CI)	13.6 (9.8-18.4)	10.8 (6.3-17.4)	16.4 (10.6-24.2)
Hazard ratio (95% CI)	--	1.0 (ref)	1.37 (0.72-2.62)

P=0.338

HR estimated by Cox regression + Huber-White cluster sandwich estimator to correct model estimates for correlated responses from the same patient.

Table 3. Microbiology of Monomicrobial BSI (N=39)

	Gram-positive (N=18)	Gram-negative (N=21)
Community onset	17 (94.4%)	19 (90.5%)
Source of BSI		
• Unknown	13 (72.2%)	2 (9.5%)
• Central line	1 (5.6%)	1 (4.8%)
• Odontogenic	1 (5.6%)	-
• Pulmonary	2 (11.1%)	1 (4.8%)
• Skin and soft tissue	1 (5.6%)	-
• Gastrointestinal/biliary	-	3 (14.3%)
• Peritonitis	-	1 (4.8%)
• Urinary tract	-	13 (61.9%)
Duration of BSI, days	2.0 (1.0-6.5)	1 (1.0-2.0)
Number of positive blood culture sets	4.0 (1.3-6.5)	2.0 (1.0-2.0)
Number of positive blood culture bottles	9.0 (2.8-12.3)	3.0 (2.0-5.0)

Gram-positive	N=18	Gram-negative	N=21
<i>Staphylococcus aureus</i>	6	<i>Escherichia coli</i>	8
<i>Streptococcus spp.</i>	8	<i>Pseudomonas aeruginosa</i>	4
• <i>Streptococcus dysgalactiae</i>	2	<i>Klebsiella spp.</i>	4
• <i>Streptococcus mitis</i> Group	2	• <i>Klebsiella pneumoniae</i>	3
• <i>Streptococcus pyogenes</i>	2	• <i>Klebsiella aerogenes</i>	1
• <i>Streptococcus agalactiae</i>	1	<i>Bacteroides spp.</i>	2
• <i>Streptococcus pneumoniae</i>	1	• <i>Bacteroides uniformis</i>	1
<i>Finnegoldia magna</i>	1	• <i>Bacteroides fragilis</i>	1
<i>Listeria monocytogenes</i>	1	<i>Enterobacter cloacae</i>	1
<i>Enterococcus faecalis</i>	2	<i>Yersinia enterocolitica</i>	1
		<i>Proteus mirabilis</i>	1

AGI FOLLOWING BSI

Table 4. AGI following Monomicrobial BSI (N=39)

	Gram-positive (N=18)	Gram-negative (N=21)	P-value
AGI at time of BSI			
• No	10 (55.6%)	19 (90.5%)	0.013*
• Yes	8 (44.4%)	2 (9.5%)	

P value by * Pearson χ^2 test.

MORTALITY FOLLOWING BSI

Table 5. Mortality Following BSI in Patients with Arterial Aneurysm Repair (N=42).

Year	Cumulative all-cause mortality, (%) [95% confidence interval]
• 1-year	9 (22.2%) [8.3-34.0%]
• 3-year	18 (55.8%) [32.1-71.2%]
• 5-year	21 (76.8%) [44.3-90.3%]

Cumulative frequency (Kaplan-Meier percentage) was used for all-cause mortality.

CONCLUSIONS

- The overall incidence of BSI following arterial aneurysm repair was 13.6 cases per 1,000 PY.
- Incidence of BSI following EVAR versus that for OSR was not statistically different.
- Higher rates of AGI were seen following monomicrobial Gram-positive BSI compared to monomicrobial Gram-negative BSI.
- All-cause mortality following BSI was high and likely due to the older age and multiple comorbid conditions among patients.

REFERENCES

- [1] Vogel TR et al. The incidence and factors associated with graft infection after aortic aneurysm repair. *J Vasc Surg* 2008; 47(2): 264-9