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BOOK OF ABSTRACT

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Program Chair: Dr. Fadi Elias
Assistant Program Chair: Ivica Vucemilo

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SESSION I - PERIPHERAL ARTERY DISEASE 1 (PAD)

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UTILITY OF ANGIOGRAPHIC METRICS OF PERFUSION AS A PREDICTOR OF SUCCESSFUL ENDOVASCULAR REVASCULARIZATION OF ATHEROSCLEROTIC PERIPHERAL VASCULAR DISEASE

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OBJECTIVE

Angiogram for peripheral vascular disease (PVD) can provide physiologic perfusion data in addition to the more common use as an anatomic assessment of arterial stenosis. The primary objective of this study was to investigate the feasibility of angiographic metrics of perfusion as a predictor of successful endovascular revascularization (ER) of PVD.

METHODS

This was a post-hoc analysis of a prospective, operator-blinded, and blinded endpoint-adjudicated observational cohort study. To calculate the angiographic metrics of perfusion, contrast density at consistent regions of interest proximal and distal to a treated atherosclerotic lesion was serially recorded at multiple time points in pre- and post-ER angiographic videos. Static perfusion metrics (i.e., density ratio, static gradient) and dynamic perfusion metrics (i.e., peak density, wash-in and wash-out rates) were derived using contrast density from static angiogram images and corresponding Time Attenuation Curves, respectively (Figure 1). The significance of perioperative changes in the perfusion metrics was determined using a paired t-test.

RESULTS

A total of 253 angiogram frames from 26 unique endovascular procedures were analyzed. 3 (12%) procedures involved an iliac artery, 18 (69%) involved a femoropopliteal artery, and 5 (19%) involved a tibial artery. Technical success was 100% with all patients experiencing complete resolution of symptoms and Ankle-Brachial Index increase greater than 0.15. The composite rates of distal wash-in (Mean Percentage Difference [MPD] 125%; 95% CI [32,219]; p=0.011) and wash-out (MPD -121%; 95% CI [-202,-40]; p=0.005) showed significant improvement following successful ER (Figure 2). Conversely, the proximal wash-in and wash-out rates, density ratio, static gradient, and peak density did not significantly improve (p>0.05).

CONCLUSION

Dynamic angiographic metrics of perfusion can provide objective and reliable feedback of perfusion to guide ER. The authors propose that the wash-out rate distal to a threatened lesion is the most robust angiographic metric of perfusion when predicting the success of ER.

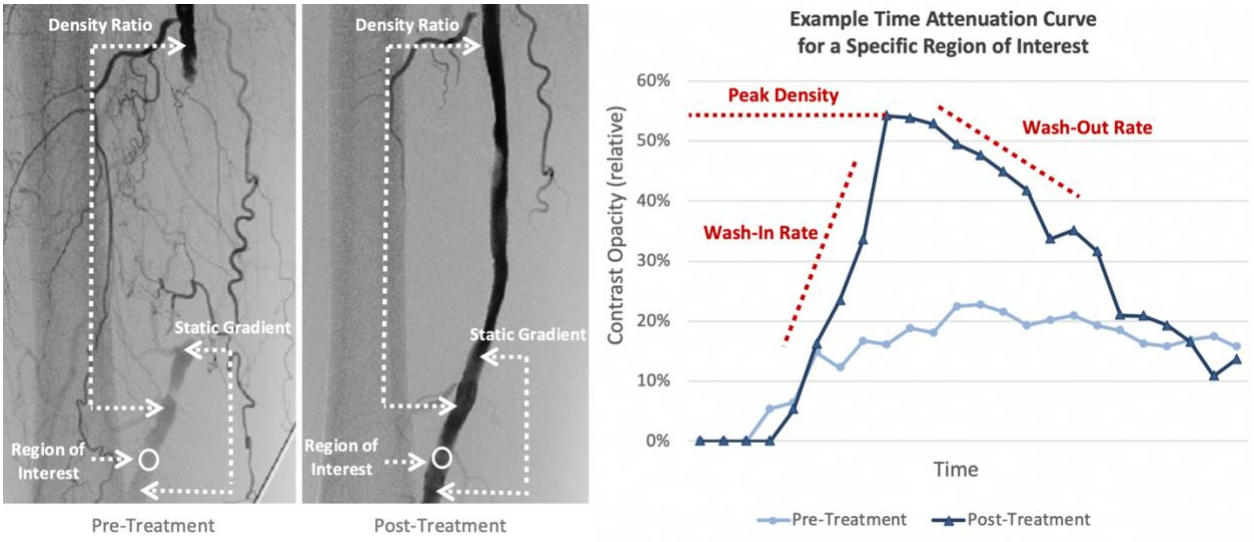

Figure 1. Depiction of various perfusion metrics obtainable from a static (left; Density Ratio and Static Gradient) or dynamic (right; Peak Density, Wash-In and Wash-Out Rates) angiogram.

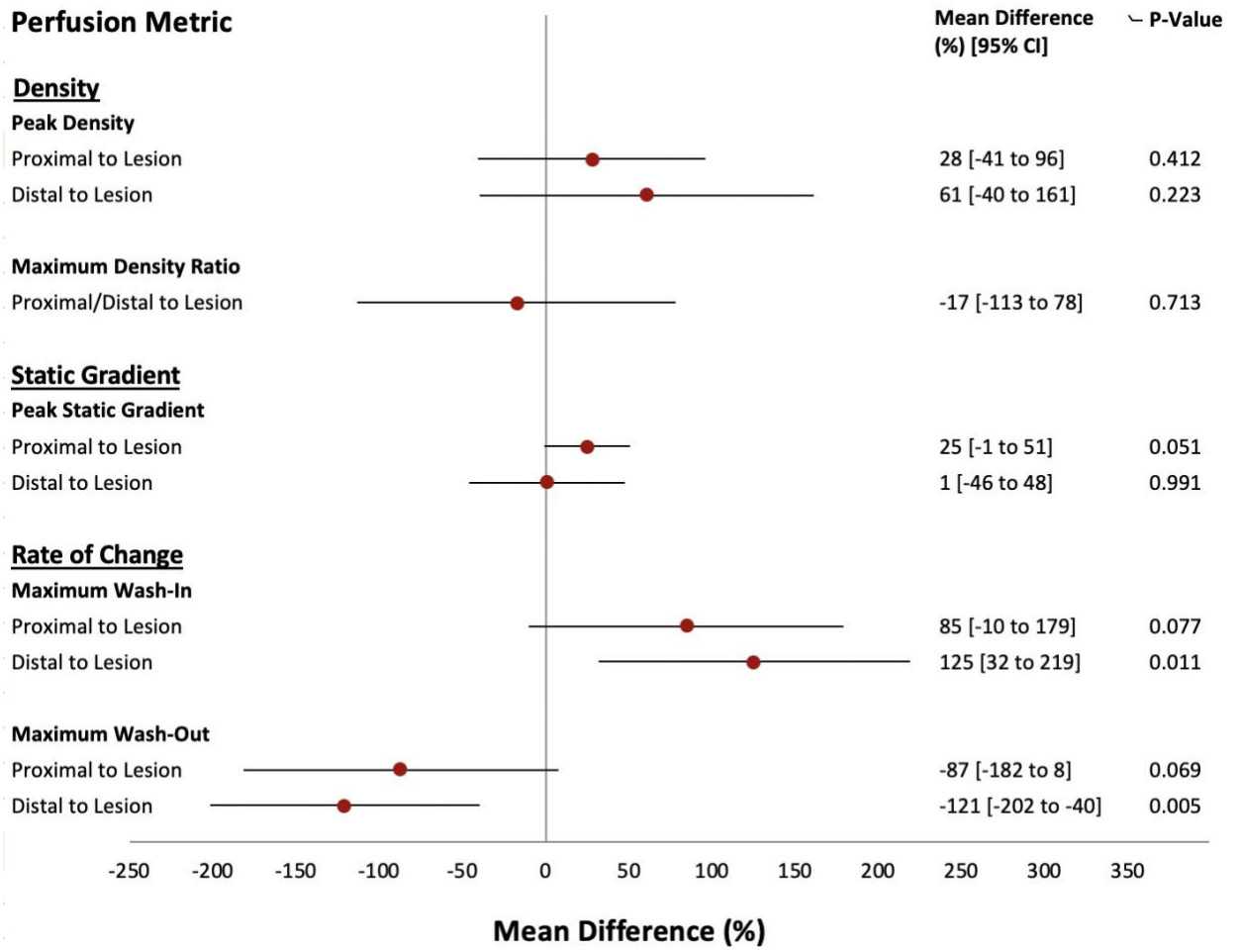

Figure 2. Mean change in angiographic metrics of perfusion from baseline following successful endovascular revascularization.

02_CSVS_2021

MULTIMODAL PREHABILITATION FOR PERIPHERAL ARTERIAL DISEASE: RESULTS OF AN IN-TRIAL PILOT RANDOMIZED CONTROLLED TRIAL

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OBJECTIVE

The goal of this in-trial pilot is to assess the feasibility and treatment effect of multimodal prehabilitation (MP) in PAD patients.

METHODS

Patients with the diagnosis of PAD were recruited at the vascular outpatient clinic and randomized 1:1 to either 12 weeks of MP or walking advice (standard of care). MP consisted of 1) 1 time/week structured supervised aerobic and resistance exercise session tailored to their capabilities 2) 2-3 times/week Home-based structured aerobic and resistance exercise 3) Nutritional counseling 4) Smoking cessation and 5) Psychosocial intervention. Baseline assessment included demographics, disease specific quality of life and functional capacity. After the 12-week program patients were reassessed.

RESULTS

A total of 27 patients were randomized to either standard of care or MP. Analysis was performed in 24 patients who completed the program. Two from the standard of care and one from the prehabilitation group dropped out leaving 12 patients in each group. Baseline characteristics were similar in the two groups (table 1). Median [IQR] adherence to each prehabilitation component was 83% [21] for supervised, 90% [13] for home-based and 69% [48] for nutrition. 50% of patients underwent psychosocial intervention and 40% of the active smokers enrolled in the smoking cessation program. No adverse events were observed. A statistically significant mean change (SD) was seen in the prehabilitation group vs standard of care for both functional capacity and quality of life (table 2). One patient (8.3%) in the MP eventually underwent further treatment via endovascular revascularization vs two patients (16.7%) in the standard of care group (p=0.5) after 12 weeks.

CONCLUSIONS

This in-trial pilot demonstrates that Multimodal Prehabilitation is not only safe but feasible in patients with PAD and claudication. MP significantly improves QOL and functional capacity to a greater extent than standard of care. Promising results on the role of Prehabilitation in reducing the need for revascularization might be evidenced in the ongoing RCT.

Table 1: Baseline patient characteristics and measurements

	Multimodal Prehabilitation (n=12)	Unsupervised walking advice (n=12)
Age, yr	71.7 (7.4)	69.5 (8.1)
Sex, male	6 (50%)	4 (33.3%)
BMI, kg/m^2	25.9 (2.1)	26.6 (4.0)
Charlson Comorbidity Index (CCI)	5.5 (2.2)	5.6 (2.5)
Smoking		
Active smoker	5 (41.7%)	2 (16.7%)
Ex-smoker	5 (41.7%)	4 (33.3%)
Packs/year	30.8 (19.7)	19.6 (22.7)
Comorbidities		
Ischemic heart disease	5 (41.7%)	5 (41.7%)
Hypertension	10 (83.3%)	11 (91.7%)
Diabetes	7 (58.3%)	4 (33.3%)
COPD	2 (16.7%)	2 (16.7%)
Chronic kidney disease	2 (16.7%)	2 (16.7%)
Obesity	4 (33.3%)	7 (70%)
6-MWT (meters)	374 (97)	425 (78)
Onset of pain (seconds)	143 (79)	147 (67)
Gardner's test (seconds)	442 (274)	558 (349)
Timed Up and Go (seconds)	7.46 [3.24]	7.33 [2.32]
VascuQol total score (points 1-7)	4.34 (1.14)	5.07 (0.91)
WIQ total score (0-100%)	35.87 (23.46)	47.99 (18.89)
HADS (points)		
Anxiety	5 [10]	5 [8]
Depression	3 [10]	4 [5]
DASI (points)	31.5 (18.8)	36.5 (11.6)

Data is presented as mean (SD), median [IQR], or n (%). 6-MWT: 6 Minute Walk Test; VascuQol: Vascular Quality of Life Questionnaire; WIQ: Walking Impairment Questionnaire; HADS Hospital Anxiety and Depression Scale.

Table 2: Mean change in functional capacity and quality of life from baseline to 12-weeks

Change from baseline to 12 weeks	Multimodal Prehabilitation	Unsupervised walking advice	p value
Functional capacity	n=12	n= 12	
6MWT Δ (m)	**60 (74)**	**-11 (40)**	**p<0.05**
Onset of pain Δ (s)	48 (79)	-26 (65)	p= 0.64
Gardner's test Δ (s)	156 (184)	20 (140)	p=0.13
Timed Up and Go Δ (s)	-1.43 [1.25]	-0.81 [1.88]	p= 0.07
Quality of life & emotional status			
VascuQol change			
Pain domain Δ	0.81 (0.81)	0 (1.05)	p=0.06
Social domain Δ	1.05 (1.02)	-0.55 (1.42)	p<0.05
Activity domain Δ	1.31 (0.65)	-0.2 (1.29)	p<0.05
Symptoms Δ	0.73 (0.74)	-0.86 (1.86)	p<0.05
Emotional Δ	1.46 (0.98)	-0.44 (1.54)	p<0.05
Total ranged Δ	**1.15 (0.54)**	**-0.3 (1.09)**	**p<0.05**
Change in %	**31.5 (21)**	**-7 (23)**	**p<0.05**
WIQ			
Distance Δ	19.7 (22.7)	3.9 (26.4)	p=0.14
Speed Δ	16.3 (24.2))	7.7 (33.0)	p=0.48
Stairs Δ	10.8 (20.1)	-16.7 (34.4)	p<0.05
Total Δ	**15.6 (13.0)**	**-1.7 (21.7)**	**p<0.05**
Change in %	**81 (96)**	**-2 (53)**	**p<0.05**
HADS			
Anxiety Δ	-2 [6.0]	0 [6.0]	p=0.07
Depression Δ	-1 [5]	2 [5.5]	p=0.13

Data is presented as mean (SD), median [IQR], or n (%). 6-MWT: 6 Minute Walk Test; VascuQol: Vascular Quality of Life Questionnaire; WIQ: Walking Impairment Questionnaire; HADS Hospital Anxiety and Depression Scale.

03_CSVS_2021

UPDATED META-ANALYSIS FOR PACLITAXEL IN PERIPHERAL ARTERIAL DISEASE

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OBJECTIVE

To assess the effect of paclitaxel eluting technologies versus non-drug coated devices in the setting of infrainguinal revascularization.

METHODS

We extracted trial data from SWEDE-PAD independently and in duplicate. We meta-analyzed this data in conjunction with previously extracted data from the Katsanos review using a fixed effects model. RevMan 5 was used for all analyses. Subgroup assessment was carried out to assess differences between original data and the newly introduced trial. We assessed risk of bias using the Cochrane risk of bias tool 2.0.

RESULTS

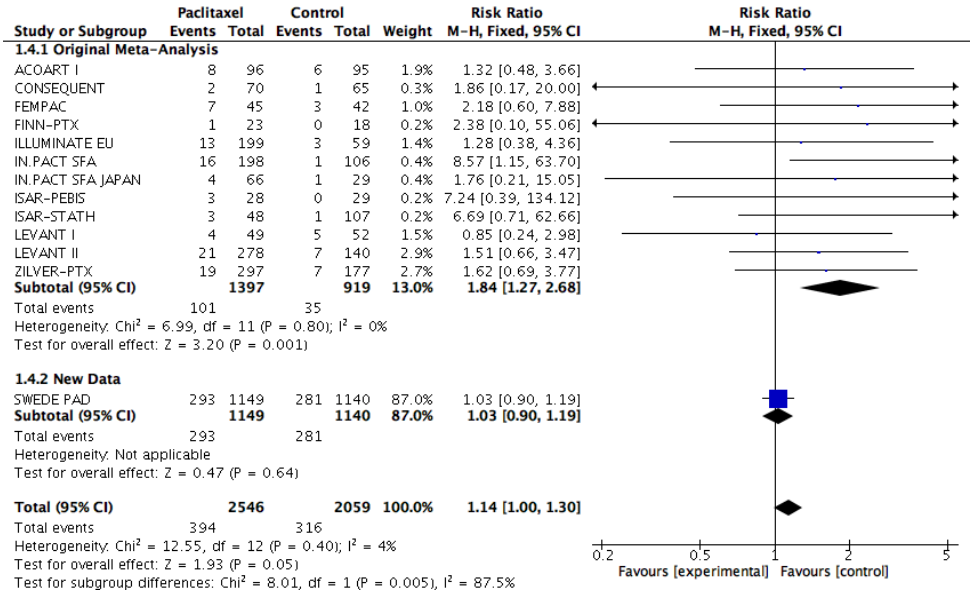
Updated meta-analysis of mortality demonstrated an overall risk ratio of 1.14 (95% CI 1.00-1.30; p=0.05; I^2=4%). There was a significant difference between SWEDE-PAD data and trials included in the original meta-analysis ($p_{interaction}$=0.005 I^2=87.5%) When meta-analyzing only SWEDE-PAD patients with claudication (n=809) the significant risk for increased mortality with paclitaxel was observed (RR=1.52 95%CI 1.15-2.00 p=0.003) while differences between SWEDEPAD and the original meta-analysis trials became non-significant($p_{interaction}$=0.1).

DISCUSSION

Meta-analysis of paclitaxel eluting technologies in the periphery including SWEDE-PAD data did not demonstrate increased risk for mortality, however systematic differences between SWEDEPAD versus the preceding body of literature were observed. When including only patients with claudication from SWEDE-PAD this signal for between group difference was not seen and significant risk for increased mortality returned. We wonder whether the enrolment of critical limb ischemia patients in SWEDE-PAD (n=1480) with a higher competing risk of death, unrelated to revascularization, masked the previously described signal for harm. SWEDE-PAD demonstrated a significantly higher 2 year mortality rate (25%) vs Katsanos (5.9%) patients. By comparison, the subgroup of patients with claudication in SWEDE-PAD experienced a more comparable 10% 2-year mortality.

Competing risk of death may mask underlying effects of paclitaxel on mortality. In patients with claudication alone, best evidence continues to suggest a significant increase in mortality at two years with paclitaxel eluting devices.

A



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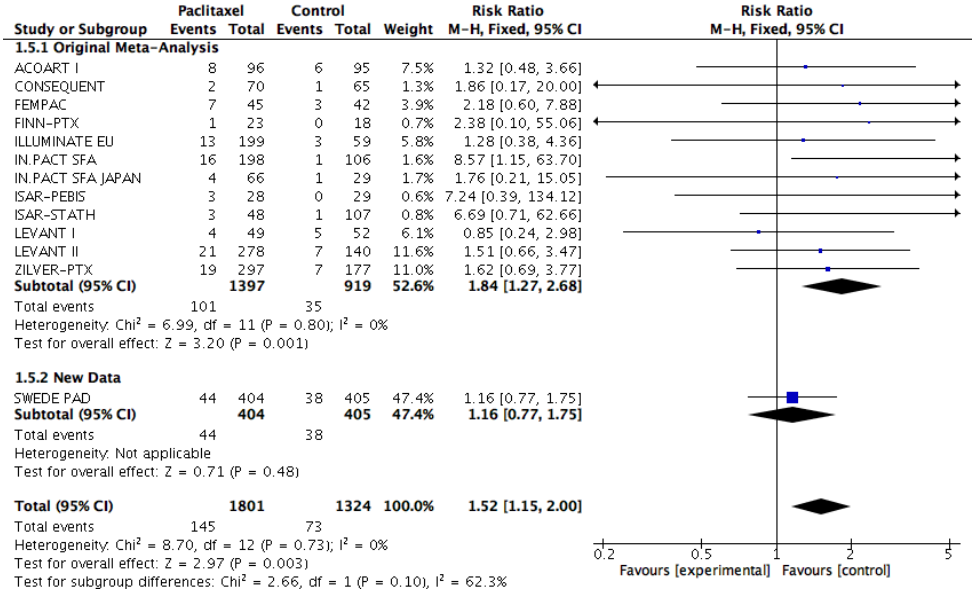

Figure 1 All cause mortality at 2 year follow-up after peripheral revascularization; paclitaxel coated devices vs non-paclitaxel coated devices – A - All SWEDEPAD participants included, **B** – SWEDEPAD patients with claudication only – *Subgroups*: Original meta-analyzed trials and New data. Square markers represent the point estimate of RR for each primary study, with size of each square proportional to the weight of the given study in meta-analysis. Horizontal lines indicate 95% CIs. The solid diamond represents the estimated 95% confidence interval for effect size of all meta-analyzed data

04_CSVS_2021

EVALUATION OF FACTORS ASSOCIATED WITH LIMB THROMBUS FORMATION POST-ENDOVASCULAR AORTIC ANEURYSM REPAIR

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OBJECTIVE

Our objective was to determine the incidence of limb thrombus and to evaluate if any demographic, anatomic, or graft variables were associated with higher rates of limb thrombus.

METHODS

Retrospective review of patients that underwent EVAR at Vancouver General Hospital between Jan 2010-Dec 2018 was carried out. The frequency of limb thrombus was recorded, and multiple variables were analyzed for associations with limb thrombus.

RESULTS

A total of 301 patients were included with average follow-up of 27.6±4.9 months. The mean age was 76.5±0.5 years and 84% were male. Twenty-two (7.3%) patients had limb thrombus and of these, 11 (50%) had occlusive limb thrombus, 14 (63.6%) were symptomatic, and 17 (77.3%) required interventions. Patients with limb thrombus were younger (69.8±1.3 years vs. 77.1±0.5 years, $p<0.0001$) and more likely to be smokers (10.2% vs. 5.2%, $p=0.10$). Cook Alpha grafts had higher rates of limb thrombus (10.7%) compared to non-Cook grafts (4.0%), with a trend towards significance ($p=0.07$). Right-sided limb thrombus was more likely in smaller right iliac arteries (14.7±0.9cm vs. 17.0±0.6cm, $p<0.05$), with a similar finding on the left (13.6±0.9cm vs. 15.2±0.4cm, $p=0.13$). Unilateral limb thrombus was almost twice as likely on the main body side compared to the contralateral side (11 vs. 6). Aortoiliac disease, limb extension into external iliac artery or non-matching heights of the limbs were not associated with higher rates of limb thrombus ($p>0.05$). Limb thrombus was not associated with increased 30-day mortality ($p>0.05$).

CONCLUSION

Limb thrombus formation is a prevalent complication post-EVAR (7.3%) and was seen more frequently in younger patients and in smokers. Cook Alpha grafts were associated with higher rates of limb thrombus. Limb thrombus was more likely in smaller iliac arteries and on the main body side.

05_CSVS_2021

STANDARDIZED APPROACH TO MEDIAN ARCUATE SYNDROME AND LAPAROSCOPIC RELEASE: AN INSTITUTIONAL EXPERIENCE

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BACKGROUND
Median arcuate ligament syndrome (MALS) is a rare disorder characterized by compression of the celiac axis and plexus that is both challenging to diagnose and treat. Recently, laparoscopic approaches to median arcuate ligament release (MALR) have been described with promising outcomes, emphasizing the importance of ligament release in conjunction with celiac plexus ganglionectomy for post-operative symptom relief. The purpose of this study is to evaluate our institutional experience and outcomes with laparoscopic MALR using a standardized approach for patients with suspected MALS in terms of diagnostic work-up, surgical technique and perioperative management.

METHOD
Retrospective analysis of all patients who underwent laparoscopic MALR between January 2018 and April 2020 at a single institution in Ontario, Canada was performed. Patients were pre-operatively assessed by a general and vascular surgeon, who determined suitability for laparoscopic MALR based on symptomology, imaging, and results of celiac plexus block. All patients participated in a telephone survey to assess post-operative satisfaction and outcomes.

RESULTS
In total, 9 patients underwent successful laparoscopic MALR. Five patients were discharged home on postoperative day one and average length of stay was 2.1 days (SD 1.96). There were no reported intra-operative complications and no conversions to open. Average procedure time was 92.4 minutes (SD 31.4), and surgical time significantly decreased with following the second procedure (p=0.046, table 1 and figure 1). Average survey follow-up time was 71.4 weeks (SD 36.5). All patients experienced improvement after surgery, overall satisfaction with surgery was 68.9% (SD 29.3), and seven patients stated they would still have undergone surgery knowing what they know now.

CONCLUSION
This study describes a standardized approach to laparoscopic MALR that is safe, and effective with early relief of symptoms. Moreover, it provides insight into selecting patients most likely to benefit from operative intervention.

	Case Number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	***P* value**
OR Time [mins]	133	157	78	85	81	70	66	91	71	0.046*

*Non-parametric test for trend across ordered groups

Table 1. Operating times per case (OR, operating room; mins, minutes)

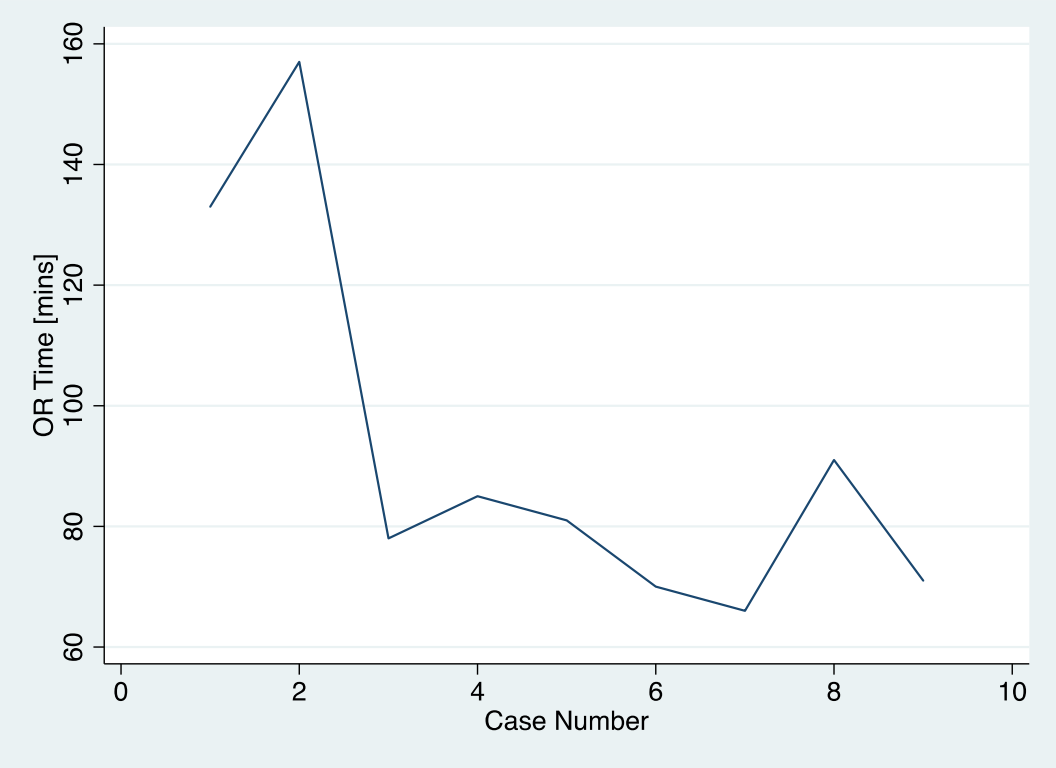

Figure 1. Operating times per case (OR, operating room; mins, minutes)

SESSION II - THORACOABDOMINAL AORTA

06_CSVS_2021

INCREASING AORTIC COVERAGE IMPROVES BRANCH STABILITY IN FENESTRATED ENDOVASCULAR ANEURYSM REPAIR

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OBJECTIVE
During FEVAR for complex visceral segment aneurysms, mesenteric vessels may be incorporated with a scallop or fenestration, reinforced with a bridging stent. The outcome of differences in visceral incorporation, specifically at the celiac axis, has not been previously contextualized to assess the cost/benefit of additional procedural complexity on patient outcomes perioperatively and at follow-up.

METHODS
A retrospective review of prospectively collected data on all patients undergoing FEVAR for degenerative juxtarenal/pararenal aneurysm between January 2015-December 2019 at a single centre (n= 159) was assessed for the primary outcomes of celiac instability during 5 years of follow-up, against the type of celiac bridging strategy utilized. Secondarily, the "cost" of celiac stenting was measured, interrogating procedural and perioperative complications and radiation exposure between treatment groups.

RESULTS
The celiac axis of most patients was treated with a stented fenestration (n=74), followed by an unstented fenestration (n=59), and the minority with an unstented scallop (n=26). There were no differences between groups in procedural indication, anatomic aneurysm/celiac features, including no between group differences in preoperative celiac stenosis. Fenestrated stented patients had a higher level of graft coverage above the celiac, more often had a spinal drain, and with fenestrated unstented patients, had improved primary technical success, versus scallop-only patients. During follow-up, scallop patients were more likely to have an endoleak, although celiac instability was highest in the fenestrated unstented group. Celiac instability in the fenestrated unstented group was not associated with celiac reintervention, worse reintervention-free survival, or a difference in all-cause mortality. Regression analysis for any branch instability revealed significant predictors related to celiac scallop or non-stenting of the celiac, and diminished length of graft coverage above the celiac.

CONCLUSION
Perioperatively, non-stenting of the celiac does not change radiation exposure or perioperative complication rates. At follow-up, non-stenting of the celiac is associated with clinically-silent celiac instability. Increasing length of graft coverage, regardless of celiac bridging strategy, reduces any branch instability.

07_CSVS_2021

OUTCOMES JUSTIFY THE USE OF BRANCHED AND FENESTRATED ENDOVASCULAR DEVICES FOR AORTIC ANEURYSM REPAIR IN OCTOGENARIANS

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OBJECTIVE

To compare outcomes between those ≥80 to those <80 undergoing thoracoabdominal (TAAA) and juxtarenal (JRAA) aortic aneurysm repair using branched and/or fenestrated endovascular devices (B/FEVAR).

METHODS

Patients that underwent B/FEVAR at a single institution between 2007 and 2020 were reviewed. Clinical follow-up was 100% complete and median follow-up was 3.3 years [interquartile range 1.6-5.3].

RESULTS

In total, 68 (25.8%) octogenarians and 196 (74.2%) <80 year-old patients were included (mean age, 83.5 $\pm$ 3.0 vs 71.9 $\pm$ 5.8 years, *P*=<0.001). Maximum aneurysm size was significantly larger in ≥80 years-old versus <80 patients (68.9 $\pm$ 11.4 vs 65.4 $\pm$ 10.0 mm, *P*=0.017), while number of TAAA repairs were similar in both groups (29.4% vs 38.3%, *P*=0.19). There were no differences in target vessel revascularization (97.8% vs 96.2%, *P*=0.268) or technical success (92.6% vs 86.7%, *P*=0.274). Octogenarians, compared to those <80, had similar rates of in-hospital mortality (7.4% vs 5.1%, *P*=0.49), stroke (1.5% vs 3.6%, *P*=0.384), and spinal cord ischemia (2.9% vs 9.2%, *P*=0.094; Table I). Six-year survival was 58.9% for all patients (95% confidence interval [CI], 51.9-66.8) and it was lower for octogenarians (44.5%; 95% CI, 31.4-63.1), compared to younger patients (64.1%, 95% CI 56.4-72.9) (Hazard Ratio [HR] 1.96; *P*=0.02, Figure 1). Cumulative rate of reintervention at 6-years was similar between the two groups (42.0%, 95% CI 36.1-48.0; HR 0.96, *P*=0.84). The rate of endoleaks on follow-up did not differ between ≥80 versus <80-year-old patients (38.2% vs 34.2%, *P*=0.558), however, progression of aneurysmal disease leading to rupture on follow-up was significantly higher in octogenarians (5.9% vs 0.5%, *P*=0.005).

CONCLUSION

B/FEVAR in octogenarians is associated with equivalent rates of technical success and postoperative adverse outcomes when compared to their younger counterpart. Long-term mortality is higher in octogenarians. Nonetheless, it justifies this therapy in patients ≥80 years-old deemed fit for intervention.

Table I: Comparison of in-hospital postoperative outcomes by age after B/FEVAR in 264 patients

Parameters	<80 Years Old (n = 196)	≥80 Years Old (n = 68)	Total (n = 264)	*p*-value*
Age, mean ± SD	83.5 ± 3.0	71.9 ± 5.8	74.8 ± 7.3	<0.001**
Hospital LOS, mean ± SD	9.7 ± 11.4	9.6 ± 10.3	9.6 ± 11.1	0.977
ICU LOS, mean ± SD	3.7 ± 5.7	2.8 ± 3.1	3.5 ± 5.1	0.202
In-hospital mortality, n (%)	10 (5.1)	5 (7.4)	15 (5.7)	0.49
SCI, n (%)	18 (9.2)	2 (2.9)	20 (7.6)	0.094
Early, n (%)	10 (5.1)	1 (1.5)	11 (4.2)	0.197
Delayed, n (%)	8 (4.1)	1 (1.5)	9 (3.4)	0.307
Temporary Paraparesis, n (%)	6 (3.1)	2 (2.9)	8 (3.0)	0.96
Temporary Paraplegia, n (%)	3 (1.5)	0 (0)	3 (1.1)	0.305
Permanent Paraparesis, n (%)	4 (2.0)	0 (0)	4 (1.5)	0.235
Permanent Paraplegia, n (%)	5 (2.5)	0 (0)	5 (1.9)	0.184
Stroke, n (%)	7 (3.6)	1 (1.5)	8 (3.0)	0.384
TIA, n (%)	2 (1.0)	0 (0)	2 (0.8)	0.403
AKI, n (%)	22 (11.2)	9 (13.2)	31 (11.7)	0.657
Transient dialysis, n (%)	7 (4.6)	1 (1.5)	8 (3.0)	0.384
Permanent dialysis, n (%)	1 (0.5)	1 (1.5)	2 (0.8)	0.431
Major Adverse Outcomes#, n (%)	28 (14.3)	7 (10.3)	35 (13.3)	0.403
Acute MI, n (%)	11 (5.6)	6 (8.8)	17 (6.4)	0.353
Leg ischemia, n (%)	5 (2.5)	5 (7.4)	10 (3.8)	0.074
DVT/PE, n (%)	4 (2.0)	1 (1.5)	5 (1.9)	0.766
UTI, n (%)	15 (7.6)	5 (7.4)	20 (7.6)	0.936
Sepsis, n (%)	7 (3.6)	2 (2.9)	9 (3.4)	0.805
Re-intubation, n (%)	13 (6.6)	4 (5.9)	17 (6.4)	0.828
Bowel ischemia, n (%)	11 (5.6)	1 (1.5)	12 (4.5)	0.158
In-hospital re-intervention, n (%)	32 (16.3)	16 (23.5)	48 (18.2)	0.203

AKI = Acute Kidney Injury; AMI = Acute Myocardial Infarction; DVT/PE = Deep Venous Thrombosis/Pulmonary Embolism; ICU = Intensive Care Unit; SCI = Spinal Cord Ischemia; TIA = Transient Ischemic Attack; UTI = Urinary Tract Infection. * Comparison

between <80 years old vs. ≥80 years old. ** Statistically significant *(P* < .05). [#]A composite of mortality, paraplegia , stroke, and permanent dialysis.

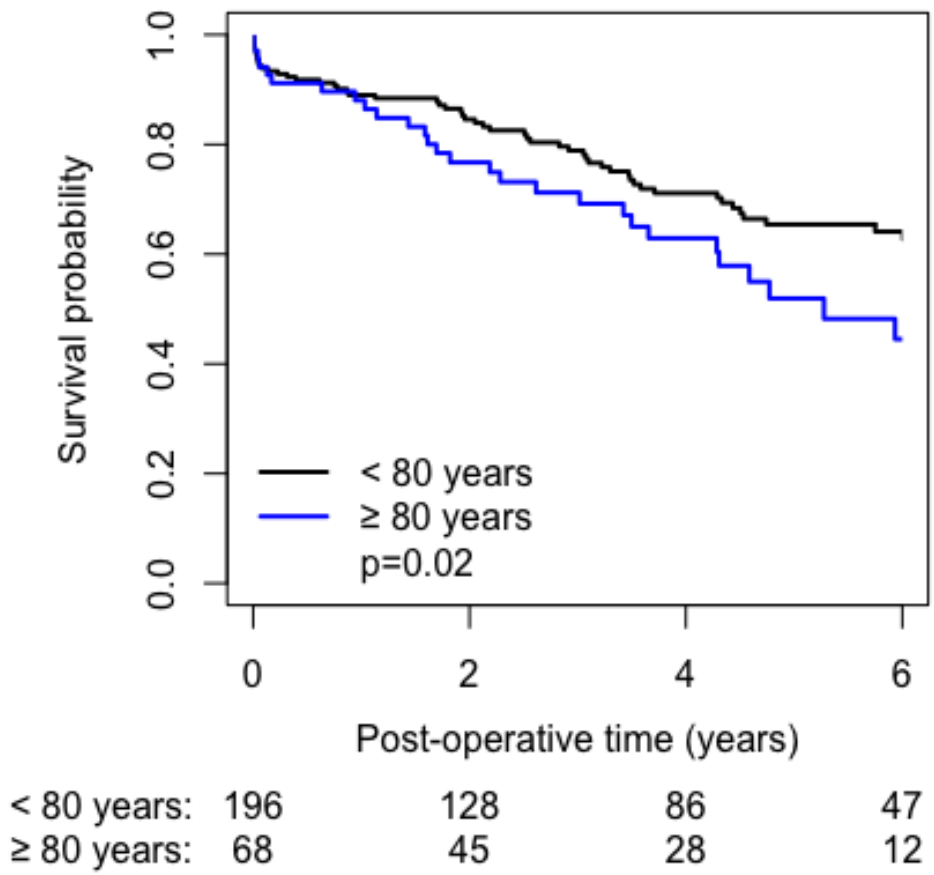

Figure 1: Kaplan-Meier survival curve for 264 patients receiving B/FEVAR for TAAA/JRAA, stratified by age cohort (HR 1.96, 95% CI, 1.30-2.96*; P* = 0.02).
CI = Confidence Interval; HR = Hazard Ratio.

08_CSVS_2021

FEMALE SEX IS ASSOCIATED WITH ELEVATED EARLY MORBIDITY AND MORTALITY BUT SIMILAR MID-TERM SURVIVAL IN BRANCHED/FENESTRATED ENDOVASCULAR AORTIC ANEURYSM REPAIR

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OBJECTIVE

To identify sex-related differences in outcomes in patients undergoing branched and/or fenestrated endovascular aortic repair (B/FEVAR) for thoracoabodominal (TAAA) and juxtarenal (JRAA) aortic aneurysms.

METHODS

Chart review was completed on 264 patients (65 [24.6%] female) that underwent B/FEVAR between 2007 and 2020 at a single centre. Median follow-up time was 3.3 years [interquartile range: 1.6-5.3].

RESULTS

Mean age (74.8 ± 7.3 years) was similar between males and females although males had a higher percentage of JRAAs (70.3% vs 44.6%, *P*<0.001). Aneurysm size was similar (males 66.8 ± 11.3mm vs 65.0 ± 7.6mm, *P*=0.237). Successful target vessel revascularization and technical success were similar (males 96.7% vs 96.5%, *P*=0.902; males 87.4% vs 90.8%, *P*=0.657, respectively). Women had longer fluoroscopy times (108.8 ± 47.5 vs 125.0 ± 48.6, *P*=0.021), more contrast usage (189.2 ± 81.1 vs 230.4 ± 103.2, *P*=0.001), and 4 women underwent open assisted target vessel revascularization, compared to 2 males (*P*=0.016). Postoperatively, females experienced significantly higher rates adverse outcomes including: in-hospital mortality (2.5% vs 15.4%, *P*<0.001), spinal cord ischemia (4.5% vs 16.9%, *P*=0.001), stroke (1.5% vs 7.7%, *P*=0.012), urinary tract infections (4.5% vs 16.9%. *P*=0.001), sepsis (2.0% vs 7.7%, *P*=0.028), and bowel ischemia (2.5% vs 10.8%, *P*=0.005; Table I). Nevertheless, the 6-year survival was 58.9% for all patients (95% confidence interval [CI], 51.9-66.8), and was similar between male and females (Hazard Ratio [HR] 1.06; *P*=0.79, Figure 1). Cumulative reinterventions at 6-years was 42.0% (95% CI, 36.1-48.0) with no sex differences observed (HR 0.89; *P*=0.55). Endoleaks (34.2% vs 38.5%, *P*=0.552) and progression of aneurysmal disease leading to rupture on follow-up (1.5% vs 3.1%, *P*=0.42) were not different between the groups.

CONCLUSION

Females experienced significantly higher rates of in-hospital morbidity and mortality following B/FEVAR than their male counterparts, however, overall mid-term survival was similar. Other investigators have not identified these differences.

Table I: In-hospital postoperative outcomes after B/FEVAR in 264 patients

Parameters	Males (n = 199)	Females (n = 65)	Total (n = 264)	*p-value**
In-hospital mortality, n (%)	5 (2.5)	10 (15.4)	15 (5.7)	$p <$ 0.001**
ICU LOS, mean ± SD	3.3 ± 5.6	4.1 ± 3.5	3.5 ± 5.1	0.243
Hospital LOS, mean ± SD	9.1 ± 11.4	11.4 ± 10.0	9.6 ± 11.1	0.137
SCI, n (%)	9 (4.5)	11 (16.9)	20 (7.6)	0.001**
Early, n (%)	5 (2.5)	6 (9.2)	11 (4.2)	0.019**
Delayed, n (%)	4 (2.0)	5 (7.7)	9 (3.4)	0.028**
Temporary Paraparesis, n (%)	5 (2.5)	3 (4.6)	8 (3.0)	0.39
Temporary Paraplegia, n (%)	0 (0)	3 (4.6)	3 (1.1)	0.002**
Permanent Paraparesis, n (%)	2 (1.0)	2 (3.1)	4 (1.5)	0.235
Permanent Paraplegia, n (%)	2 (1.0)	3 (4.6)	5 (1.9)	0.064
Stroke, n (%)	3 (1.5)	5 (7.7)	8 (3.0)	0.012**
TIA, n (%)	1 (0.5)	1 (1.5)	2 (0.8)	0.403
AKI, n (%)	23 (11.6)	8 (12.3)	31 (11.7)	0.87
Transient dialysis, n (%)	5 (2.5)	3 (4.6)	8 (3.0)	0.39
Permanent dialysis, n (%)	1 (0.5)	1 (1.5)	2 (0.8)	0.403
Major Adverse Outcomes[#], n (%)	15 (7.5)	20 (30.8)	35 (13.3)	$p <$ 0.001**

AMI, n (%)	13 (6.5)	4 (6.1)	17 (6.4)	0.914
Leg ischemia, n (%)	9 (4.5)	1 (1.5)	10 (3.8)	0.274
DVT/PE, n (%)	3 (1.5)	2 (3.1)	5 (1.9)	0.42
UTI, n (%)	9 (4.5)	11 (16.9)	20 (7.6)	0.001**
Sepsis, n (%)	4 (2.0)	5 (7.7)	9 (3.4)	0.028**
Re-intubation, n (%)	10 (5.0)	7 (10.8)	17 (6.4)	0.101
Bowel ischemia, n (%)	5 (2.5)	7 (10.8)	12 (4.5)	0.005**
In-hospital re-intervention, n (%)	32 (16.1)	16 (24.6)	48 (18.2)	0.139

AKI = Acute Kidney Injury; AMI = Acute Myocardial Infarction; DVT/PE = Deep Venous Thrombosis/Pulmonary Embolism; ICU = Intensive Care Unit; SCI = Spinal Cord Ischemia; TIA = Transient Ischemic Attack; UTI = Urinary Tract Infection. * Comparison between males and females. ** Statistically significant (P < .05).# A composite of mortality, paraplegia , stroke, and permanent dialysis.

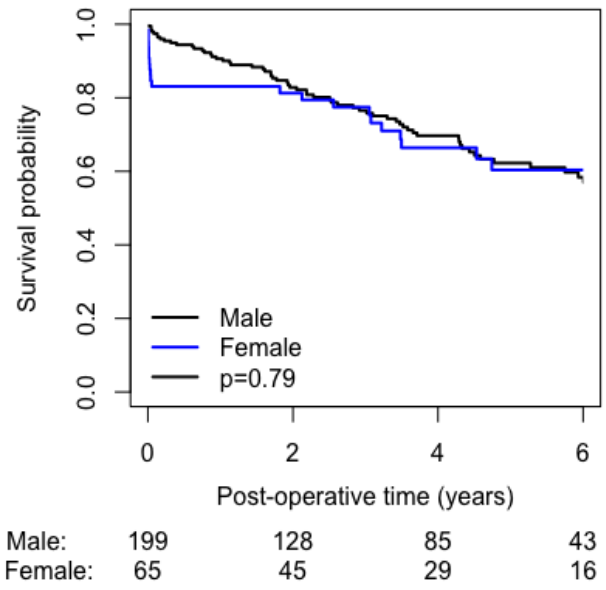

Figure 1: Kaplan-Meier survival curve for 264 patients receiving B/FEVAR for TAAA/JRAA, stratified by sex (HR 1.06, 95% CI 0.68-1.68; *P* = 0.79).

CI = Confidence Interval; HR = Hazard Ratio.

09_CSVS_2021

INTRODUCING A NEW CONCEPT OF FIXED-VOLUME AORTIC OCCLUSION FOR FLUOROSCOPY-FREE RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA)

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OBJECTIVES

Our aim was to investigate a new concept of Fixed-Volume Aortic Occlusion (FVAO) in fluoroscopy-free REBOA using a novel 4 French REBOA device, the COBRA-OS, with its unique safety shoulder reservoir. FVAO simplifies REBOA by enabling safe inflation to a set volume instead of relying on blood pressure to guide aortic occlusion.

METHODS

COBRA-OS devices were incrementally inflated in segments of cadaveric swine thoracic aorta until either rupture of the balloon or the aorta occurred. Devices were then deployed in the thoracic aorta of anesthetized swine with an intentionally exaggerated fixed volume of 20mL representing a compliant balloon diameter of 28mm.

RESULTS

Six cadaveric swine thoracic aorta segments were tested with a mean baseline aortic diameter of 21±0.098mm. The mean inflation volume for aortic occlusion was 5.85±0.42mL and for balloon rupture was 86.3±6.77mL. No aortic rupture or intimal tissue damage occurred despite >1000% increase in inflation volume above the aortic occlusion volume. The amount of balloon longitudinal deformation at the fixed volume of 20mL was 48±7.5mm and at balloon rupture was 127±1.4mm. Subsequently, 3 adult female swine were tested with a mean Zone 1 thoracic aortic occlusion diameter of 15±0.15 mm. The mean inflation volume for aortic occlusion was 7±2mL and at 20mL fixed inflation volume (186% increase), there were no ruptures of the aorta or balloon and no evidence of intimal tissue damage.

CONCLUSIONS

Our study is the first to introduce the concept of FVAO in order to simplify and improve the safety of REBOA procedures. Activation of the unique safety shoulder reservoir of the COBRA-OS allows for significant over-inflation without the risk of balloon or aortic rupture and has acceptable longitudinal deformation values.

10_CSVS_2021

OUTCOMES OF OFF-THE-SHELF T-BRANCH STENT GRAFTS IN ENDOVASCULAR REPAIR OF THORACOABDOMINAL AORTIC ANEURYSMS

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OBJECTIVE

To assess short-term patient outcomes of off-the-shelf T-branch stent grafts used for endovascular repair of thoracoabdominal aortic aneurysms (TAAAs).

METHODS

A retrospective single center review of all TAAA patients that underwent endovascular T-branch stent graft repair between November 2014 to December 2020. The outcomes included: technical success, mortality, stroke, dialysis and permanent paraplegia, branch instability measures, and target vessel patency.

RESULTS

Sixteen T-branch stent grafts were implanted (8 males, 8 females; mean age 72.7 $\pm$ 10.3 years) and followed for a median of 0.39 $\pm$ 1.7 years. Nine cases were emergent, two urgent and five elective repairs. Intraoperative primary target vessel revascularization was successful in 55 of 58 vessels (95%). One morbidly obese patient required three early branch revisions due to imaging limitations; two were successful, yielding an overall assisted primary patency of 98% (57/58). Technical success rate was 69% (11/16). In-hospital adverse outcomes are listed in Table 1. No patients required dialysis. Eleven patients completed clinical follow-up, 9/11 (82%) completed surveillance imaging. Follow-up branch stability based on imaging are in Table 2. Of the five patients with endoleaks, 3/5 (60%) required reintervention. Three patients had a branch occlusion (2 right renal, 1 left renal); one required reintervention, and one suffered acute infrarenal graft thrombosis, subsequent paraplegia and death. No aortic dissection, stent migration or perigraft fluid collection were noted on follow-up. On last follow-up, primary target vessel patency was 95% (54/57); secondary patency was 96% (55/57). Post discharge survival was 100% at 1-year.

CONCLUSION

Endovascular T-branch graft repair provides a viable treatment option for patients in emergent or urgent situations, with acceptable branch patency and technical success rates. Morbidity and mortality (5/9; 56%) was highest in emergent cases. Longer-term follow-up is required to assess clinical performance of these devices and compare them with elective case outcomes.

Table 1: In-hospital major adverse outcomes of endovascular TAAA repair using T-branch stent grafts

Adverse Outcomes	Emergent (n=9)	Urgent (n=2)	Elective (n=5)
Mortality	5	0	0
Permanent Paraplegia	3	0	0
Stroke	4	0	0
Myocardial Infarction	0	0	1

Table 2: Post discharge branch-related stability outcomes on follow-up imaging

Outcomes	Cases, n (%)	No. of cases requiring reintervention, n (%)
Endoleak (type I or III)	5 (55.5)	3 (60)
Aneurysm sac enlargement (>10mm)	1 (11.1)	0 (0)
Branch kink	1 (11.1)	1 (100)
Branch occlusion	3 (9.1)	1 (33.3)

SESSION III - CAROTID | VARIOUS

11_CSVS_2021

SAFETY OF SHUNTING STRATEGIES DURING CAROTID ENDARTERECTOMY

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OBJECTIVE

The goal of this study is to determine the safety of a non-shunting strategy during CEA, particularly in patients with contralateral carotid occlusion (CCO) or recent stroke.

METHODS

Data from all the CEAs registered in the Vascular Quality Initiative (VQI) database between October 2012 and June 2020 were analysed, excluding surgeons with less than 10 CEA registered, concomitant procedures, reintervention and incomplete information. Based on their rate of shunt use, participating surgeons were divided in three groups: non-shunters (<5%), selective-shunters (5-95%) and routine-shunters (>95%). Primary outcomes of in-hospital stroke, mortality and stroke-and-death rate were analysed for symptomatic and asymptomatic patients.

RESULTS

A total of 113 296 patients met the study criteria, of which 31 147 were symptomatic and 82 055 were asymptomatic. Of the 1 645 surgeons included, 12.1% were non-shunters, 63.4% were selective-shunters and 24.3% were routine-shunters, with 10 557, 71 160 and 31 579 procedures in each group respectively. On the univariable analysis, in-hospital stroke (2.0% vs 1.9% vs 1.6%; P=.17), mortality (0.5% vs 0.4% vs 0.4%; P=.71) and stroke-and-death rate (2.2% vs 2.1% vs 1.8%; P=.23) were similar among the three groups in the symptomatic cohort (Table 1). The asymptomatic cohort also did not show a significant difference for in-hospital stroke (0.9% vs 1.0% vs 0.9%; P=.55), mortality (0.2% vs 0.2% vs 0.2%; P=.64) and stroke-and-death rate (1.0% vs 1.1% vs 1.0%; P=.43). The multivariate models did not show any difference for the primary outcomes between the groups. On subgroup analysis, the stroke-and death rates were similar for patients with contralateral carotid occlusion (3.3% vs 2.5% vs 2.4 %; P=.64) and for patients presenting with a recent stroke (2.9% vs 3.4% vs 3.1%; P=.60).

CONCLUSION

This study supports routine non-shunting strategy as a safe cerebral protection strategy, even in patients with CCO or recent stroke.

Table I: Perioperative in-hospital outcomes

		Symptomatic patients				Asymptomatic patients			
	Overall	Non shunter	Selective shunter	Routine shunter	P value	Non shunter	Selective shunter	Routine shunter	P value
N	113 296	3 444	19 912	7 885		7 113	51 248	23 694	
Stroke and death **-Stroke** **-Mortality**	1.3 1.2 0.3	2.2 2.0 0.5	2.1 1.9 0.4	1.8 1.6 0.4	0.23 0.17 0.71	1.0 0.9 0.2	1.1 1.0 0.2	1.0 0.9 0.2	0.43 0.55 0.64

12_CSVS_2021

THE CONTEMPORARY NATURAL HISTORY OF MEDICALLY MANAGED ASYMPTOMATIC CAROTID ARTERY STENOSIS

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OBJECTIVE

To describe the contemporary natural history of a real-world cohort of patients with medically managed asymptomatic internal carotid artery stenosis.

METHODS

We designed a retrospective cohort study of adults with asymptomatic carotid stenosis (≥50%, no symptoms for at least 6 months, no prior carotid intervention) consecutively evaluated from April 1, 2013 to March 31, 2018 at two vascular centers with accredited vascular ultrasound laboratories. Data abstracted from ultrasound and clinic visit records were linked to population-based provincial administrative health data to provide follow-up up to 5 years from the index ultrasound date. The primary outcome was transient ischemic attack (TIA), ischemic stroke or urgent carotid intervention (endarterectomy or stenting), considering elective carotid intervention and death as competing risks. The influence of patient and disease characteristics (Table) on the incidence of the primary outcome was evaluated through multivariable Fine and Gray regression. Subgroup analysis was performed for patients with severe (70-99%) stenosis.

RESULTS

A total of 669 patients with asymptomatic carotid artery stenosis were identified (Table). The probability of the primary outcome was 4.0% at 1 year and 13.5% at 5 years. The probability of an ischemic stroke without prior AF or TIA was 2.6% at 1 year and 10.7% at 5 years. The probability of the primary outcome in patients with severe stenosis was 4.8% at 1 year and 13.4% at 5 years. An increased incidence of the primary outcome was observed with male sex, diabetes, congestive heart failure and chronic kidney disease.

CONCLUSION

These data provide real-world evidence of improvement in the 5-year risk of TIA or ischemic stroke in patients with asymptomatic carotid stenosis compared to historical randomized trials. However, the 1-year stroke risk remains in excess of 2%.

Table. Patient characteristics and disease severity at Index Visit Date

Patients demographics	
Age (mean ± SD)	72.2 ± 8.8
Male Sex - N (%)	416 (62.2%)
Comorbidities - N (%)	
Hypertension	599 (89.5%)
Coronary Artery Disease	526 (78.6%)
Diabetes	315 (47.1%)
Chronic Obstructive Pulmonary Disease	217 (32.4%)
Congestive Heart Failure	122 (18.2%)
Current Smoker	115 (17.2%)
Chronic Kidney Disease	45 (6.7%)
Carotid Disease Severity - N (%)	
Severe Stenosis	
ICA left or ICA right 70-99%	422 (63.1%)
Severe Stenosis or Occlusion	
ICA left or ICA right 50-69% but neither occluded AND neither 70-99%	227 (33.9%)
ICA left or ICA right 50-69% with 1 occluded AND neither 70-99%	20 (3.0%)
ICA left or ICA right 70-99% but neither occluded	386 (57.7%)
ICA left or ICA right 70-99% with 1 occluded	36 (5.4%)
Medications - N (%)	
Statin	468 (70.0%)
Other Antilipidemic	88 (13.2%)
Antihypertensive	474 (70.9%)
Antiplatelet	465 (69.5%)
Anticoagulant	69 (10.3%)

14_CSVS_2021

THE IMPACT OF HEPARIN ON MORTALITY FOLLOWING OPEN RUPTURED ABDOMINAL AORTIC ANEURYSM REPAIR: A PROPENSITY SCORE-MATCHED ANALYSIS

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OBJECTIVE

To investigate the impact of systemic heparin on mortality following open ruptured abdominal aortic aneurysm (rAAA) repair.

METHODS

The Vascular Quality Initiative Database was used to identify all patients who underwent open repair of rAAA between 2003-2020. Patients who received heparin were compared to those who did not using 1:1 propensity score-matched analysis. The primary outcome was 30-day all-cause mortality. The secondary outcome was long-term survival. Primary safety endpoints were the number of peri-operative blood transfusions and return to the operating room for bleeding. Logistic and linear regression were performed to analyze the impact of heparin on peri-operative mortality and bleeding risk. Kaplan-Meier analysis with log rank test was conducted to assess the impact of heparin on long-term survival.

RESULTS

During the study period, 2,477 patients underwent open rAAA repair. 386 patients who received heparin were matched to 386 patients who did not receive heparin. The mean age was 72.1 (SD 9.4), 73.8% were male, and 89.5% were white. Comorbidities included hypertension (78.1%), coronary artery disease (23.7%), and chronic obstructive pulmonary disease (29.9%). 55.2% of patients had a systolic blood pressure ≤ 80 prior to intubation. Mean follow-up was 22.7 (SD 35.0) months. Heparin administration was associated with significantly lower 30-day mortality (117/386 [30.3%] vs. 214/386 [55.4%], OR 0.35, 95% CI 0.26-0.47, $P < 0.0001$, Table 1). Patients who received heparin had fewer peri-operative blood transfusions (8.1 (SD 8.1) vs. 11.9 (SD 10.6) units, mean difference -3.80, 95% CI -5.23 to -2.53, $p < 0.0001$). There were no differences between groups for return to the operating room for bleeding. Long-term survival was similar between groups beyond the peri-operative period up to 10 years (Figure 1).

CONCLUSION

Systemic heparin administration is associated with a significant reduction in 30-day all-cause mortality with no increased risk of bleeding following open rAAA repair.

Table 1: Impact of systemic heparin on 30-day all-cause mortality and peri-operative bleeding risk in a propensity-score matched cohort of patients receiving open repair of ruptured abdominal aortic aneurysm

	Heparin (n = 386)	No heparin (n = 386)	Effect size	P value
30-day mortality; No. (proportion)	117 (30.3%)	214 (55.4%)	OR 0.35 (95% CI 0.26 to 0.47)	< 0.0001
Units of packed red blood cells transfused; Mean (SD)	8.1 (8.1)	11.9 (10.6)	MD -3.80 (95% CI -5.23 to -2.53)	< 0.0001
Return to operating room for bleeding; No. (proportion)	32 (8.3%)	42 (10.9%)	OR 0.64 (95% CI 0.37 to 1.10)	0.10

OR (odds ratio), CI (confidence interval), MD (mean difference), SD (standard deviation)

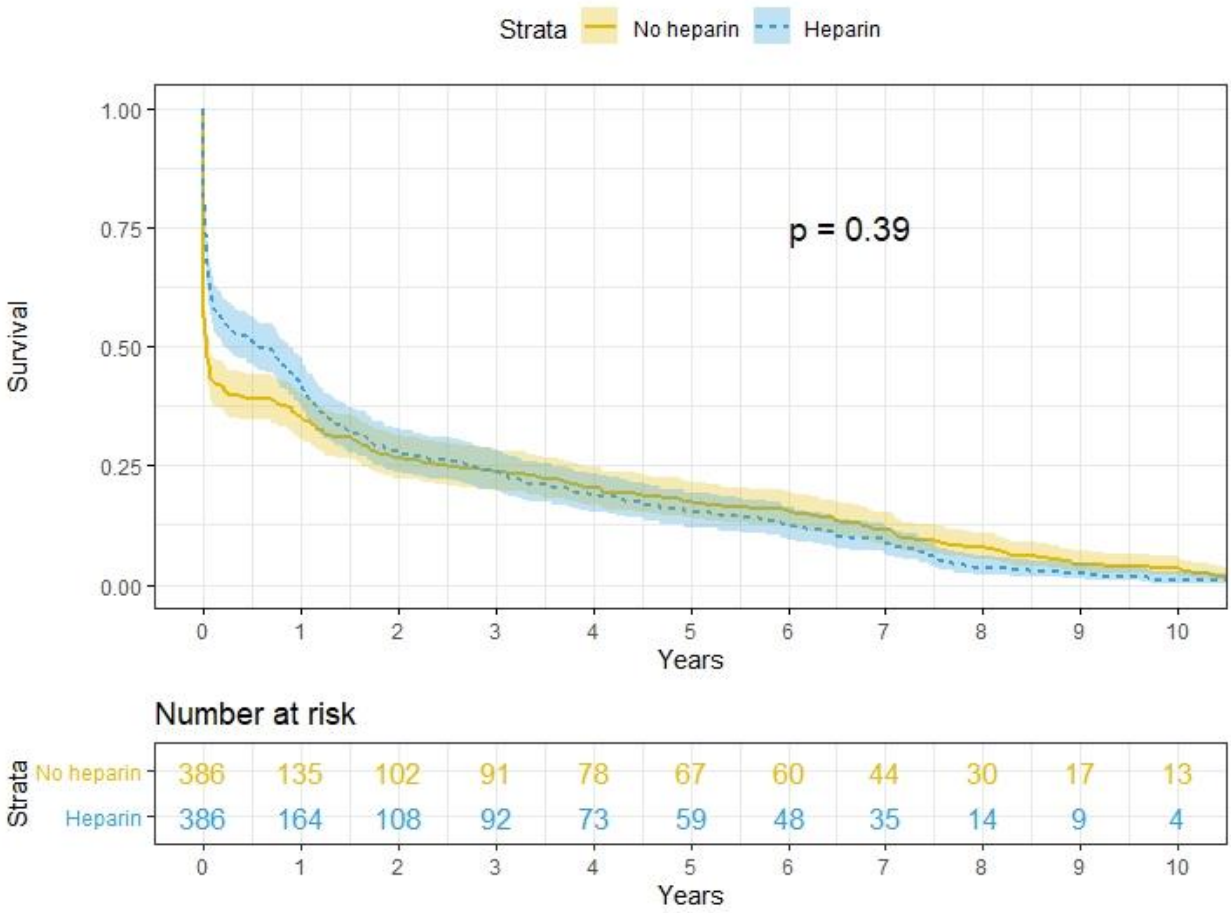

Figure 1. Impact of systemic heparin on long-term survival in a propensity-score matched cohort of patients receiving open repair of ruptured abdominal aortic aneurysm

14_CSVS_2021

EFFECT OF ANTICOAGULATION ON EVAR OUTCOMES AND DEVELOPMENT OF ENDOLEAKS

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OBJECTIVES

To investigate the impact of anticoagulation on EVAR outcomes including development of type II endoleaks and reintervention rates.

METHODS

Patient and aneurysm characteristics, procedure details, and postoperative outcomes were collected for consecutive patients undergoing EVAR between 2010-2019. Patient groups were separated based on anticoagulation use and presence or absence of type II endoleak. Groups were compared using chi-square, student t-test, univariate or multivariate logistic regression analyses as appropriate.

RESULTS

We included 581 patients (77.1±82 years, 82.6% male) with a mean follow-up of 3.99±2.4 years. During follow-up n=233 patients developed a type II endoleak. There were no significant differences in comorbidities and aneurysm size (mean 51.5±19.3 mm) between patients with and without type II endoleak. Anticoagulation was associated with type II endoleaks (P=0.06); 50% in patients on anticoagulation, compared to only 38.9% in patients not on anticoagulation.

There was no association between anticoagulation, type II endoleak and survival. In a logistic regression model including age, sex, AAA size, type II endoleak, and anticoagulation, only AAA size was associated with mortality (OR of 1.01 (95% CI 1.004-1.03), P=0.01). Logistic regression models confirmed the association of anticoagulation and type II endoleak (OR 1.57 (95% CI, 0.97-2.5) P=0.06). Age was also associated with type II endoleaks (OR 1.03, 1.009-1.05, P=0.005). Additional comorbidities and patient factors including sex, AAA size, and antiplatelet use were not associated with development of endoleak.

On logistic regression modelling, type II endoleak and anticoagulation were both independently associated with increased reintervention rates OR 3.2 (2.0-5.0, P<0.0001) and OR 2.5 (1.4-4.5, P=0.002) respectively.

CONCLUSIONS

There is an association between anticoagulation and type II endoleaks. Both the presence of a type II endoleak and anticoagulation are associated with a higher reintervention rate with no appreciable effect on long-term survival.

15_CSVS_2021

AN ANALYSIS OF SPIN IN VASCULAR SURGERY RANDOMIZED CONTROLLED TRIALS WITH STATISTICALLY NON-SIGNIFICANT PRIMARY OUTCOMES

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OBJECTIVES

Spin is the manipulation of language that distorts the interpretation of objective findings. The purpose of this study is to describe the characteristics of spin found in statistically nonsignificant RCTs comparing carotid endarterectomy (CEA) to carotid artery stenting (CAS) for carotid stenosis (CS), and endovascular repair (EVAR) to open repair (OR) for abdominal aortic aneurysms (AAA) as they represent a significant portion of vascular surgery literature.

METHODS

A search of MEDLINE, EMBASE, and the Cochrane Controlled Register of Trials was performed in June 2020 for studies published on AAA or CS. All phase three RCTs with nonsignificant primary outcomes comparing OR to EVAR or CEA to CAS were included. Studies were appraised for the characteristics and severity of spin using a validated tool (Table 1 and Table 2). Binary logistic regression was done to assess the association of spin grade to (1) funding source (commercial vs non-commercial) and (2) the impact factor of the articles publishing journal.

RESULTS

31 of 355 articles captured were included for analysis. Spin was identified in nine abstracts (9/18) and 13 main texts (13/18) of AAA articles and seven abstracts (7/13) and ten main texts (10/13) of CS articles. For both the AAA and CS articles, spin was most likely to be found in the manuscript discussion section and Strategy 2 was most prevalent (Table 2). Increasing journal impact factor was associated with a statistically significant lower likelihood of grade A spin (OR = 0.96, 95% CI: 0.94 - 0.99, p = 0.01) while no significant association could be found with funding source (OR = 1.33, 95% CI: 0.30-5.92, p = 0.71).

CONCLUSIONS

This study showed a large proportion of statistically nonsignificant RCTs with interpretations that were inconsistent with their results. These findings will stimulate authors and readers to appraise study findings and reduce the publication of distorted interpretations.

Table 1.

Grade of Spin	*AAA Studies*	*CS Studies*	*Total*
Grade A: Spin in the title or abstract conclusions	9	7	16
Grade B: Spin elsewhere in the abstract or spin in the conclusion	1	2	3
Grade C: Spin not in the abstract or conclusion	3	1	4

Table 2. Spin by Location and Strategy

	AAA						**CS**								
	Abstract			**Manuscript**			**Abstract**			**Manuscript**					
Strategy	Title	Results	Conclusion	Results	Discussion	Conclusion/ Summary	Title	Results	Conclusion	Results	Discussion	Conclusion/ Summary	**AAA total**	**CS total**	**Overall total**
1. Authors pivoted on statistically significant secondary results in the form of focus on within-group			1		5	1			1		1		7	2	9
2. Authors interpreted statistically nonsignificant results of the primary outcomes to show treatment equivalence or to rule out an adverse event			3		4	2		1	6	2	11	2	9	22	31
3. Authors emphasized the beneficial effect of the treatment with or without acknowledging the statistically nonsignificant primary outcome			2		3	1			1		2		6	3	9
4. Other/undefined/multiple strategies			3		1	1					2	2	5	4	9

SESSION IV - ABDOMINAL AORTA

16_CSVS_2021

COMPARATIVE COST ANALYSIS OF AMBULATORY VERSUS INPATIENT ENDOVASCULAR AORTIC REPAIR (EVAR)

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OBJECTIVE
We sought to compare the costs of ambulatory EVAR compared to inpatient EVAR.

METHODS
Consecutive patients undergoing elective EVAR between April 2016 and December 2018 at two academic centers were retrospectively reviewed. Patients' encounters were either planned ambulatory EVAR or inpatient EVAR. Index visit, 30-day and 1-year costs were compared based on intended type of admission. Costs included operating room (OR) use, ED visits, readmissions, and reinterventions. Factors associated with increased costs were identified. Independent sample t-test and Mann-Whitney U-test were used for comparison with a p value <0.05 taken as significant.

RESULTS
171 patients were identified. Most patients underwent percutaneous EVAR (94%) under regional anesthesia (80%). Ambulatory EVAR was planned in 101 patients and was successful in 84% (n=85). Ambulatory EVAR patients had smaller aneurysm diameters (56.5 mm versus 59.1 mm, p=0.011) and a shorter median length of stay (LOS) (0.48 vs 1.33 days, $p<0.001$). ED visits, readmission, reintervention rates were similar in the 2 groups up to 1 year. Ambulatory EVAR was cheaper than inpatient EVAR at the index visit (10,688 vs 12,397, p=0.016) and the perioperative period (11,340 vs 12,931, p=0.006). There was no difference in cost at 1 year (11,745 vs 12,952, p=0.065). Costs of supportive services including laboratory and pharmacy were cheaper in ambulatory EVAR. ED visits, readmissions and reinterventions were found to be associated with high 1 year EVAR costs irrespective of admission type.

CONCLUSION
In a Canadian multi-center experience, ambulatory EVAR costs were less than inpatient EVAR up to 30 days but not at 1 year. Ambulatory EVAR clinical pathway implementation reduced length of hospital stay and utilization of hospital resources involving the laboratory and pharmacy. It did not result in increased ED visits, readmission or reinterventions.

17_CSVS_2021

IMPACT OF AN EMERGENCY EVAR PROTOCOL ON RUPTURED ABDOMINAL AORTIC ANEURYSM MORTALITY: A SINGLE CENTRE RETROSPECTIVE REVIEW

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OBJECTIVE

To demonstrate an emergency EVAR protocol in a high-volume tertiary care center reduces mortality in ruptured infrarenal abdominal aortic aneurysms (rAAA).

METHODS

A retrospective review of all adult patients with rAAA who received surgical or endovascular intervention at the Peter Lougheed Centre between March 2001 and December 2018 were evaluated. An emergency EVAR protocol was introduced in January 2004. Risk-adjusted cumulative sum (CUSUM) analysis examined changes in 30-day mortality following protocol implementation.

RESULTS

364 patients were identified with rAAA between 2001 and 2018, with declining incidence of rAAA during the study period (Figure 1). Introduction of the protocol was associated with increased EVAR use (63.6% vs 6.7%, p<0.001). Patients managed according to the protocol were more frequently hypotensive (<=80mmHg, 51.3% vs 25.8%, p<0.001), with lower average SBP (88mmHg vs 106mmHg, p<0.001) and worse renal function (creatinine 121µmol/L vs 96µmol/L, p<0.001). The risk-adjusted 30-day mortality was 26% (95% CI, 15% to 42%) with the emergency EVAR protocol, versus 38% (95% CI, 22% to 58%) pre-protocol. Risk-adjusted marginal change in mortality based on a logistic regression model was -9.4% (p = 0.86, 95% CI = [-20.2%, 1.3%]) was not significant at P<0.05, but CUSUM analysis demonstrated “worse than expected” mortality outcomes in the pre-protocol period, and stability of the protocol over 15 years following introduction (Figure 2). In particular, hypotensive patients (SBP<=80) in the post-protocol period had improved 30-day mortality, with marginal change in mortality adjusted for age at -27.2% (p<0.01, 95% CI [-47.5%, -6.8%]).

CONCLUSIONS

An emergency EVAR protocol improved rAAA 30-day mortality, and this performance remained consistent despite an increase in unstable patients over the protocol use. Overall declining rates of rAAA may coincide with the introduction of the 2007 CSVS screening guidelines. EVAR should be offered as the first-line intervention to appropriate rAAA patients, especially when initial SBP<=80mmHg.

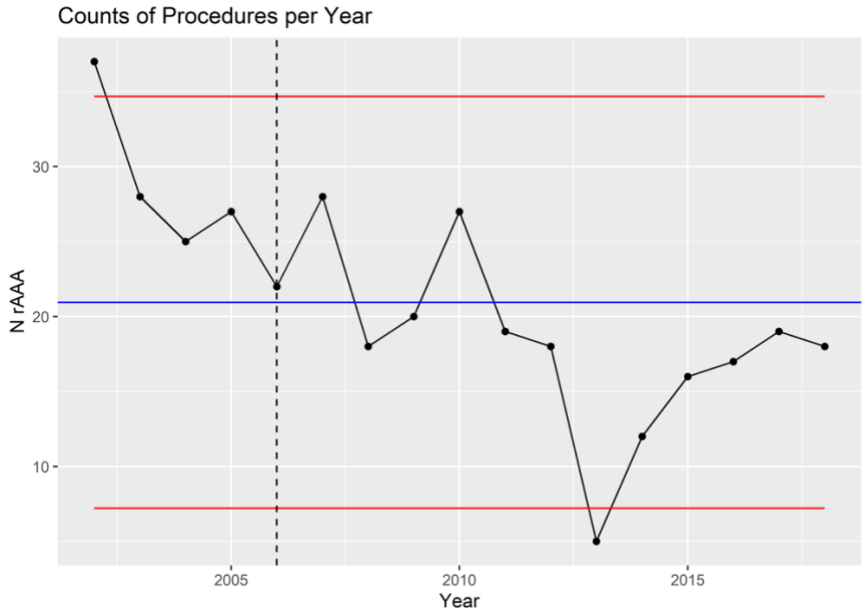

Figure 1: Number of patients with rAAA presenting to the Peter Lougheed Centre between March 2001 and December 2018. Blue horizontal line is the mean number of patients. Upper and lower red lines are +/- 3 standard deviations.

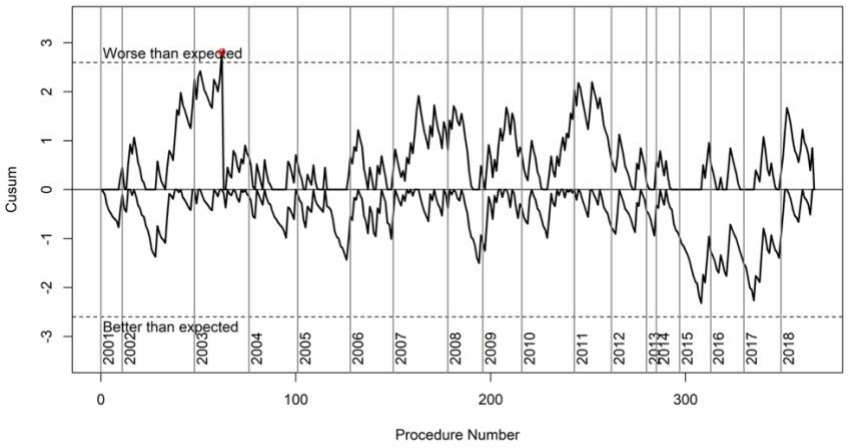

Figure 2: Risk-adjusted CUSUM analysis. The intent-to-treat EVAR protocol was introduced in January 2004. Upper and lower lines would be crossed on average every 500 surgeries if performance does not vary over time. Prior to the introduction of the protocol, the higher CUSUM line crossed the “worse than expected” line within 50 surgeries.

18_CSVS_2021

EXPLORING ESTIMATED SURGICAL DELAY BASED ON MAXIMUM ACCEPTABLE MORTALITY RISK FOR PATIENTS WITH ASYMPTOMATIC ABDOMINAL AORTIC ANEURYSMS

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OBJECTIVE

This study sought to determine the rupture risk of operable asymptomatic abdominal aortic aneurysms (AAA) as a function of time for maximal acceptable surgical delay.

METHODS

A literature review was performed from inception to March 2021 in the English and French languages. The analysis was limited to men with asymptomatic AAAs exclusively. The data on AAA rupture risk according to diameter and follow-up time were extracted from this review. The acceptable mortality risk for AAA patients as a function of surgical delay was further evaluated. This acceptable mortality risk was based on the acceptable risk of cardiovascular death associated with the delay of coronary revascularization in CAD populations. Data on estimated surgical delays were extracted using a free web-based software (WebPlotDigitizer), and plotted using Microsoft Excel.

RESULTS AND CONCLUSIONS

Our study identified minimal evidence as it pertains to AAA rupture risk as a function of surgical delay. The data on rupture risk of AAAs according to diameter and time were extracted from a single review (Fig. 1). The acceptable delays of semi-urgent and non-urgent invasive treatment for CAD is 6 and 12 weeks respectively. These acceptable delays are associated with an estimated acceptable cardiovascular mortality risk threshold of 0.46% and 0.48% at 6 and 12 weeks, for an average of 0.47%. Using this threshold of estimated maximum acceptable risk, we found that the delays would be estimated at 13 days for AAAs ≥ 7cm, 20 days for 6-6.9cm, and 32 days for 5.5-5.9cm (Fig. 2). In conclusion, this study identified estimated surgical delays for patients with AAAs based on the acceptable maximum risk. These estimations may be used cautiously to triage patients with asymptomatic AAAs, particularly in the setting of triaging patients during local and global crises.

Fig. 1 Risk of AAA rupture over time, raw data and best fit data

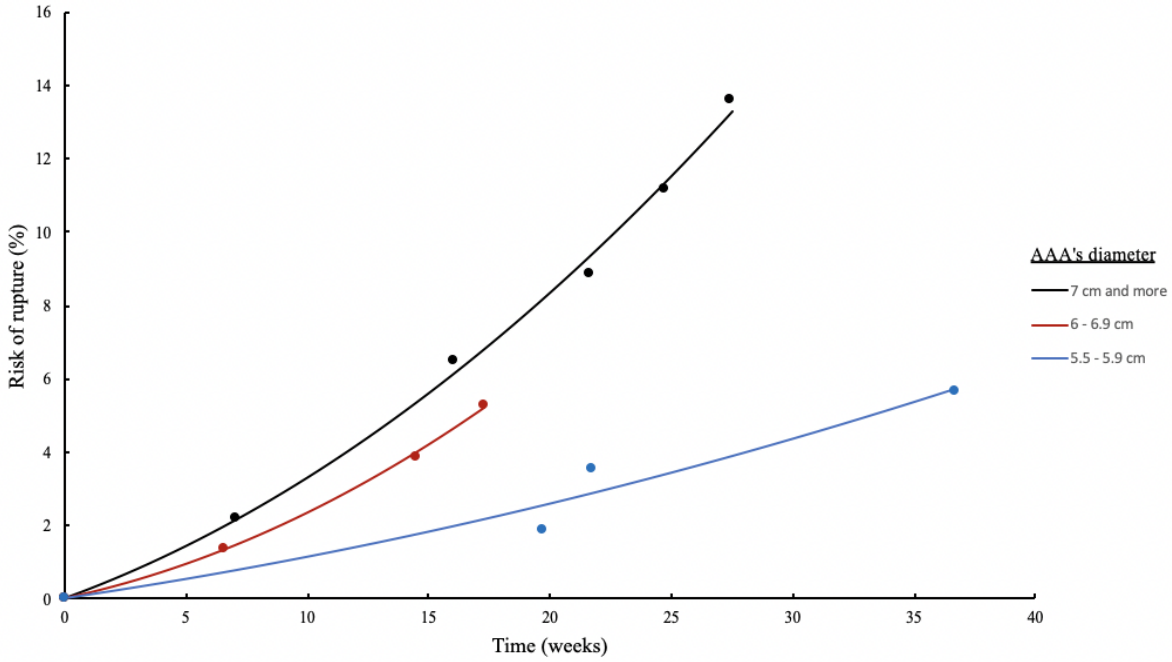
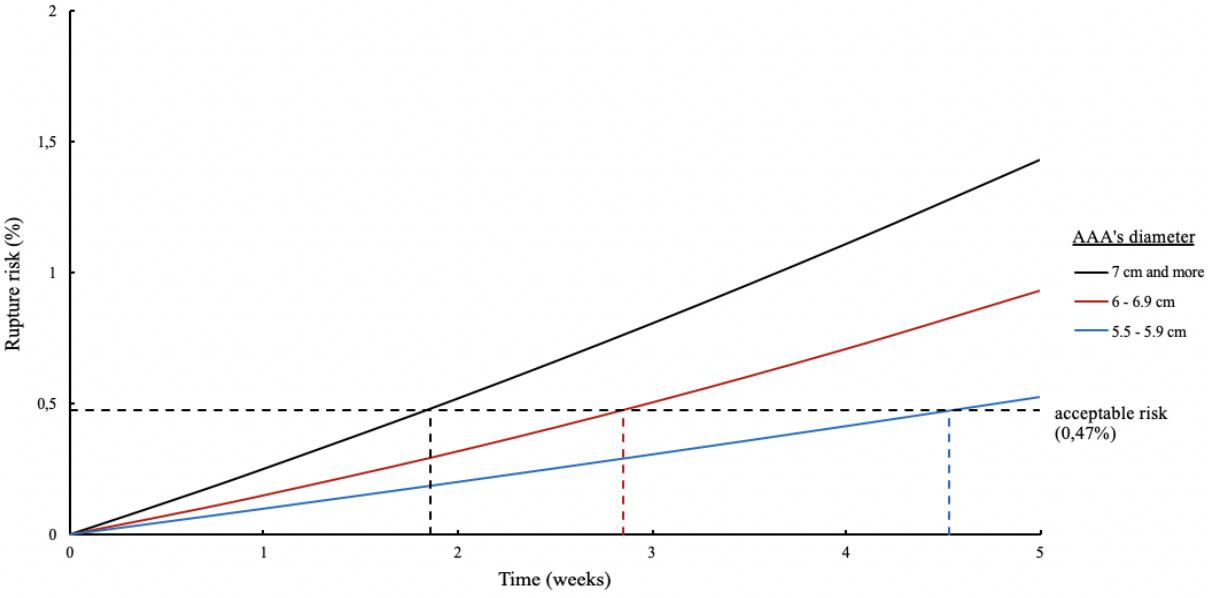


Fig. 2 Risk of AAA rupture over time associated with accpetable risk, best-fit data



19_CSVS_2021

EFFICACY OF COLD RENAL PERFUSION PROTECTION FOR OPEN COMPLEX AORTIC ANEURYSM REPAIR: A METANALYSIS

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INTRODUCTION

Open surgical repair of complex aortic aneurysms are associated with a risk of acute kidney injury (AKI) leading to significant morbidity and mortality. Cold renal perfusion (CRP) with 4˚C crystalloid fluids during open repair is a method to reduce renal injury during repair.

OBJECTIVE

A meta-analysis assessing CRP for open repair of complex aortic aneurysms was performed. Complex aneurysms were defined as those requiring at least a suprarenal clamp site and included juxtarenal, suprarenal and thoracoabdominal aortic aneurysms. Primary outcomes centered on presence of post-operative kidney injury, the need for dialysis and mortality related to kidney injury.

METHODS

A search strategy of keywords was searched for using Ovid Medline, Embase and Cochrane Databases. The study population included patients with any preoperative comorbidity who had undergone open aortic aneurysm repair with at least a supra-renal clamp. The concomitant use of any intraoperative renal perfusion protection strategy was compared to a control population without renal perfusion. A random-effects model was used to analyze derived odds-ratios and heterogeneity ($p<0.05$ deemed statistically significant).

RESULTS

A total of 688 studies were screened and 5 primary articles met the inclusion criteria. Cold renal perfusion as a technique of kidney protection significantly reduced post-operative AKI (OR=0.46; CI: 0.32-0.68; Z=3.98 p=0.001). Data were considered homogenous with Cochrane Q=0.23 and I2 of 0% although only few studies were incorporated into analysis.

CONCLUSIONS

This meta-analysis of patients undergoing open repair of complex aortic aneurysms demonstrated improved post-operative kidney function with the use of CRP. Randomized controlled trials (RCTs) are warranted as a future direction.

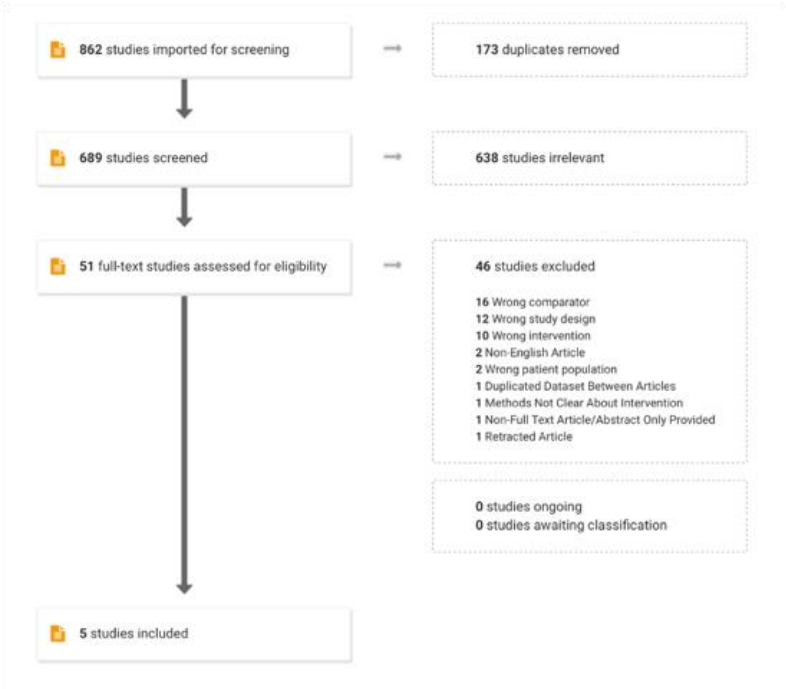

Figure 1: PRISMA flow diagram. A total of 688 studies were screened. Five studies met inclusion criteria for data extraction and analysis.

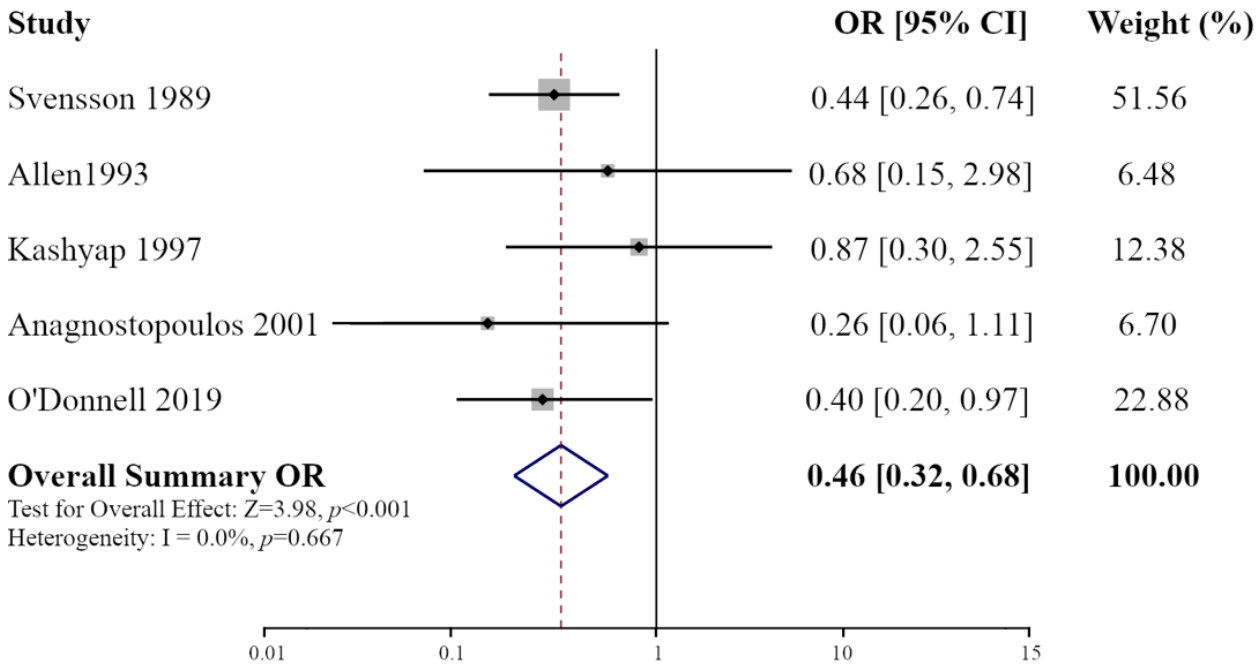

Figure 2: Forest plot of extracted data. Odds ratios were created from the number of acute kidney injury events in the cold renal perfusion (CRP) arm against the control arm. Tests for overall effect and heterogeneity were assessed.

20_CSVS_2021

DYING TO GET THERE: PATIENTS WHO LIVE AT INCREASED DISTANCE FROM THE TERTIARY CENTRE EXPERIENCE INCREASED MORTALITY FOLLOWING ABDOMINAL AORTIC ANEURYSM RUPTURE

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OBJECTIVE

To assess the relationship between distance from tertiary care center and mortality from Ruptured Abdominal Aortic Aneurysm (RAAA).

METHODS

We performed a retrospective analysis of all RAAA in Nova Scotia from 2005 to 2015. Patients were identified from the provincial administrative database, and verified with chart review. Patients' residential geographical coordinates were used to calculate estimated driving time to tertiary care using geographic information system software. The population was divided into two groups based on estimated driving time to tertiary care <1 hour and ≥1 hour. Baseline and operative characteristics, as well as mortality at home, mortality prior to operation, and 30-day mortality were compared across estimated travel time using t-test and chi-squared test, as appropriate. Multivariable logistic regression was used to calculate the independent effect of estimated travel time on mortality outcomes.

RESULTS

A total of 556 patients were identified with RAAA. 244 (44%) resided within 1 hour of travel time from a tertiary care center while 312 (56%) resided ≥1 hour (Figure 1). Individuals living ≥1 hour away were significantly older, but otherwise had similar sex distribution, co-morbidities and rates of endovascular repair (Table 1). On multivariable analysis (Table 1), residing ≥1 hour from tertiary care was associated with increased risk of dying at home (OR 1.68, 95% CI 1.07-2.63, p=0.024), risk of dying prior to operation (OR 2.64, 95% CI 1.81-3.83, p<0.0001), and overall 30-day mortality (OR 1.61, 95% CI 1.10-2.37, p=0.015). For the 272 (49%) of individuals who underwent an operation, residing ≥1 hour away from tertiary care did not increase post-operative mortality (OR 1.02, 95% CI 0.60-1.73, p=0.94).

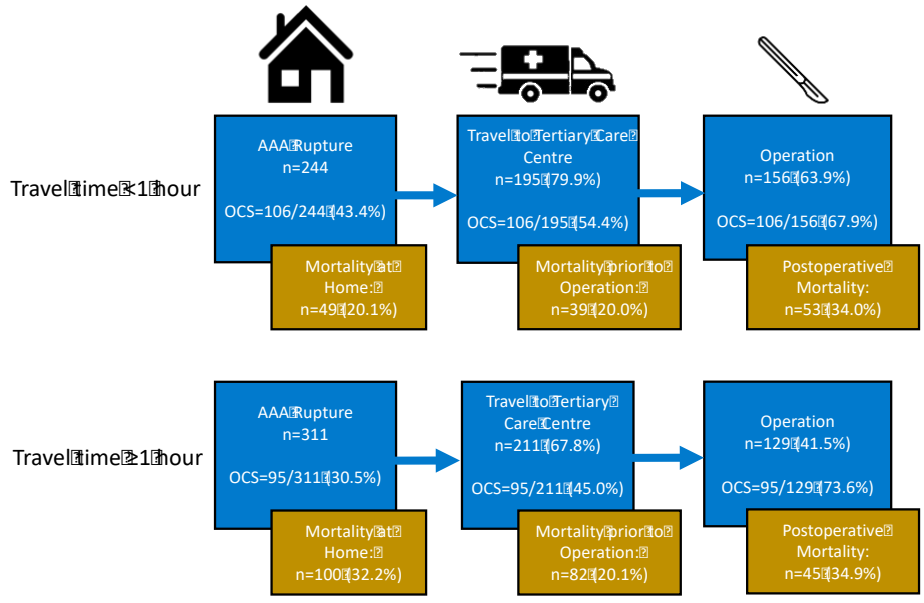
CONCLUSION

Residing ≥1 hour from a tertiary care center is associated with increased mortality after RAAA. For individuals who received an operation, increased travel time from tertiary care is not associated with mortality.

Table 1 Baseline and Operative Characteristics and Outcomes

Clinical Characteristics	Travel Time <1 Hour n=244 (44.0%)	Travel Time ≥1 Hour n=311 (56.0%)	p-value
Age, years (mean ±SD)	75.5 ±9.6	77.4 ±10.8	**0.03**
Female Sex	68 (27.9)	93 (29.9)	0.87
Hypertension	176 (72.1)	210 (67.5)	0.24
Diabetes	47 (19.3)	62 (19.9)	0.84
Coronary Artery Disease	46 (18.9)	61 (19.6)	0.82
Chronic Obstructive Pulmonary Disease	73 (29.9)	103 (33.1)	0.42
Peripheral Vascular Disease	41 (16.8)	54 (17.4)	0.86
Cerebrovascular Disease	31 (12.7)	31 (10.0)	0.31
Endovascular Repair	19 (12.5)	10 (8.3)	0.27
Outcomes			
Mortality at Home	49 (20.1%)	100 (32.2%)	**<0.0001**
Mortality Prior to Operation	88 (36.1%)	182 (58.5%)	**<0.0001**
30-day Mortality	138 (56.6%)	216 (69.5%)	**0.002**
Operative Mortality	53 (34.0%)	45 (37.5%)	0.65

Figure 1 Flow Chart of Mortality for Ruptured Abdominal Aortic Aneurysms (OCS = overall chance of survival)



SESSION V - PERIPHERAL ARTERY DISEASE 2 (PAD)

21_CSVS_2021

ANTITHROMBOTIC THERAPY IN FEMALES WITH PERIPHERAL ARTERY DISEASE: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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OBJECTIVES
To summarize female-specific cardiovascular (CV), limb, and bleeding event rates across randomized controlled trials (RCTs) comparing antithrombotic regimens in peripheral artery disease (PAD) patients, and to assess trial generalizability to females with PAD.

METHODS
We searched MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials for RCTs including females with PAD that compared anticoagulation (AC), dual pathway inhibition (DPI), or dual antiplatelet therapy (DAPT) to mono-antiplatelet therapy (MAPT). Cochrane risk of bias tool was employed. Meta-analyses of thromboembolic and bleeding events in females were performed for trials reporting sex-stratified outcomes using random-effects models. Trial generalizability was evaluated based on female enrollment, sex-based analyses, and participation-to-prevalence ratio (PPR; proportion of females enrolled relative to their PAD burden).

RESULTS
Among 6169 abstracts reviewed, we included 14 RCTs, of which eight provided sex-based analyses (Fig. 1). Trial characteristics are listed in Table 1. Meta-analyses of DAPT versus MAPT (n=2 trials) revealed increased bleeding (HR=1.42; 95% CI=1.08-1.86) with DAPT in females, but no difference in composite CV events (HR 0.84; 95% CI=0.68-1.04). Likewise, meta-analyses of DPI versus MAPT showed increased major bleeding (OR=2.11; 95% CI=1.42-3.13) with DPI in females, but no difference in composite CV and limb events (OR=0.85; 95% CI=0.65-1.10). The AC trials reported no effect of sex on graft occlusion, bleeding, or CV events: AC increased bleeding overall and did not affect composite CV outcomes. Among the 14 trials assessed for generalizability, five (35.6%) provided sex-based analyses *specific* to PAD participants. Females comprised 28.0%, 27.2%, and 26.8% of PAD participants in the DAPT, DPI, and AC versus MAPT trials, respectively. The PPR was 0.41, indicating underrepresentation of females with PAD across antithrombotic trials.

CONCLUSIONS
Antithrombic trials including PAD patients revealed increased bleeding but no difference in thromboembolic events in females on DAPT, DPI, or AC versus MAPT. Limited sex-stratified data and underrepresentation of females with PAD restricted RCT generalizability.

Figure 1. PRISMA Flow Diagram

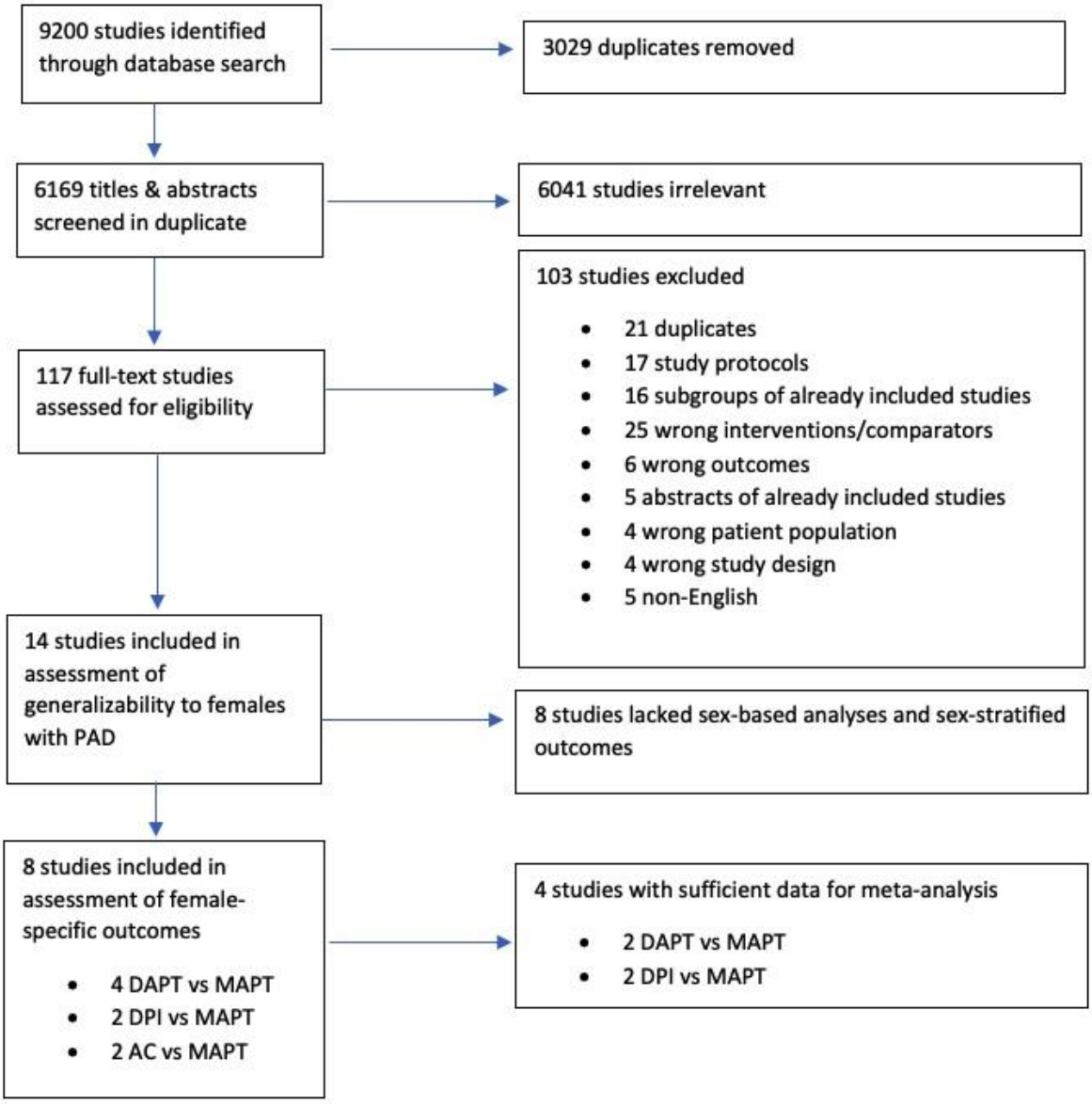

Table 1. Characteristics of the eight RCTs included in the analysis of female-specific outcomes.

Trials reported on a total of 20,027 females. For trials with PAD subgroups, main trial data was reported.

Trial, Author, Year	Population (brief description)	Females n (%)	Total PAD subjects n (%)	Intervention (daily unless specified)	Comparator	1º outcome
DAPT vs. MAPT						
CASPAR, Belch, 2010	Below-knee arterial bypass for PAD	207 (24)	851 (100)	Clopidogrel + ASA	ASA	Index bypass occlusion, endovascular revasc, above-ankle amputation, or death
PEGASUS-TIMI 54, Bonaca, 2015*	Recent MI + ≥1 of: age ≥65, DM requiring meds, 2nd prior spontaneous MI, multivessel CAD, CKD	3399 (24)	1143 (5)	Ticagrelor 90 mg BID + ASA	ASA	Composite CV death, MI, or stroke
TRA2P-TIMI 50, Morrow, 2012	Atherosclerosis hx (MI, ischemic stroke, or PAD [intermittent claducation + ABI <0.85 or prev revasc)	6326 (24)	6136 (23)	Vorapaxar + baseline MAPT	Placebo + Baseline MAPT	Composite CV death, MI, stroke, or recurrent ischemia leading to urgent coronary revasc
MATCH, Diener, 2004	Recent ischemic stroke/TIA + ≥1 of: prev ischemic stroke or MI, angina, DM, or symptomatic PAD within prev 3 yrs	2821 (37)	776 (10)	ASA + Clopidogrel	Placebo + Clopidogrel	Composite ischemic stroke, MI, vascular death, or rehospitalization for acute ischemic event
DPI vs MAPT						
COMPASS ᵞ, Eikelboom, 2017 & Liang, 2020	CAD (MI in last 20 yrs, mutivessel CAD with symptoms, multivessel PCI or CABG) or symptomatic PAD. Additional criteria for CAD patients <65	4048 (22)	4996 (27)	Rivaroxaban 2.5 mg BID + ASA	Placebo BID + ASA	Composite CV death, stroke, or MI
VOYAGER, Bonaca, 2020	Recent (≤10d) successful revasc for symptomatic PAD	1704 (26)	6564 (100)	Rivaroxaban 2.5 mg BID + ASA	Placebo BID + ASA	Composite ALI, major vascular amputation, MI, ischemic stroke, or CV death
AC +/- MAPT vs MAPT						
DUTCH BOA, Eikelboom, 2000	Infrainguinal bypass graft for obstructive PAD	952 (36)	2690 (100)	Vit. K antagonist (target INR 3-4.5)	ASAβ	Graft occlusion
WAVE, Anand, 2007	Symptomatic lower extremity PAD or carotid disease, asymptomatic carotid disease, or subclavian artery occlusive disease	570 (26)	2161 (100)	Vit. K antagonist (target INR 2-3) + baseline MAPT	Baseline MAPT	Composite CV death, MI, stroke, severe ischemia requiring urgent intervention of the coronary or peripheral artery circulation

* Only Ticagrelor 90 mg BID + ASA and ASA arms included ᵞ Only Rivaroxaban 2.5 mg BID + ASA and ASA arms included

β Carbasalate calcium 100 mg daily metabolized to aspirin 80 mg

MAPT= mono-antiplatelet therapy, DPI= dual pathway inhibition (i.e. Rivaroxaban 2.5 mg BID + antiplatelet), MI= myocardial infarction, DM= diabetes mellitus, CAD= coronary artery disease, CKD= chronic kidney disease, revasc= revascularization, CV= cardiovascular, PAD= peripheral arterial disease, ABI= ankle brachial index, TIA= transient ischemic attack, , vit= vitamin, INR= international normalized ratio

22_CSVS_2021

TRENDS IN LOWER EXTREMITY REVASCULARIZATION AND AMPUTATION FOR PERIPHERAL ARTERY DISEASE OVER THE LAST TWO DECADES: A POPULATION-BASED TIME SERIES ANALYSIS

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OBJECTIVE

To examine temporal changes in population-based rates of lower extremity revascularization and amputation procedures for peripheral artery disease (PAD) among residents of Ontario, Canada aged ≥ 40 years from 2002 to 2019.

METHODS

In this cross-sectional time series analysis of all Ontario residents aged ≥40 years between 2002 and 2019, we calculated crude annual rates of lower extremity revascularization (endovascular, open, total [endovascular or open]) and amputation (major, minor, total [major or minor]) for PAD. Annual rates relative to 2002 (RR) adjusted for changes in provincial demographics and comorbidities as well as the correlated nature of longitudinal data were estimated using generalized estimating equation models.

RESULTS

Compared with 2002, the cohort in 2019 was older and exhibited a significantly higher prevalence of diabetes (Table). Despite a higher total revascularization rate in 2019 (86.4/100,000 person-years) than 2002 (75.1/100,000 person-years), the RR of revascularization procedures was lower following adjustment for comorbidity changes over time (0.95; 95% CI=0.92-0.97) (Figure). Endovascular revascularization rates increased significantly from 2002 (10.6/100,000 person-years) to 2019 (37.1/100,000 person-years; Adjusted RR=2.79, 95% CI=2.63-2.97) (Figure). Open revascularization rates decreased significantly from 2002 (64.5/100,000 person-years) to 2019 (49.3/100,000 person-years; Adjusted RR=0.64, 95%CI=0.62-0.66) (Figure). Major amputation rates have decreased from 2002 (27.7/100,000 person-years) to 2019 (21.6/100,000 person-years; Adjusted RR=0.56, 95% CI=0.53-0.58) (Figure). The rate of total amputation decreased from 2002 (49.55/100,000 person-years) to 2019 (45.44/100,000 person-years; adjusted RR=0.66; 95% CI=0.64-0.69).

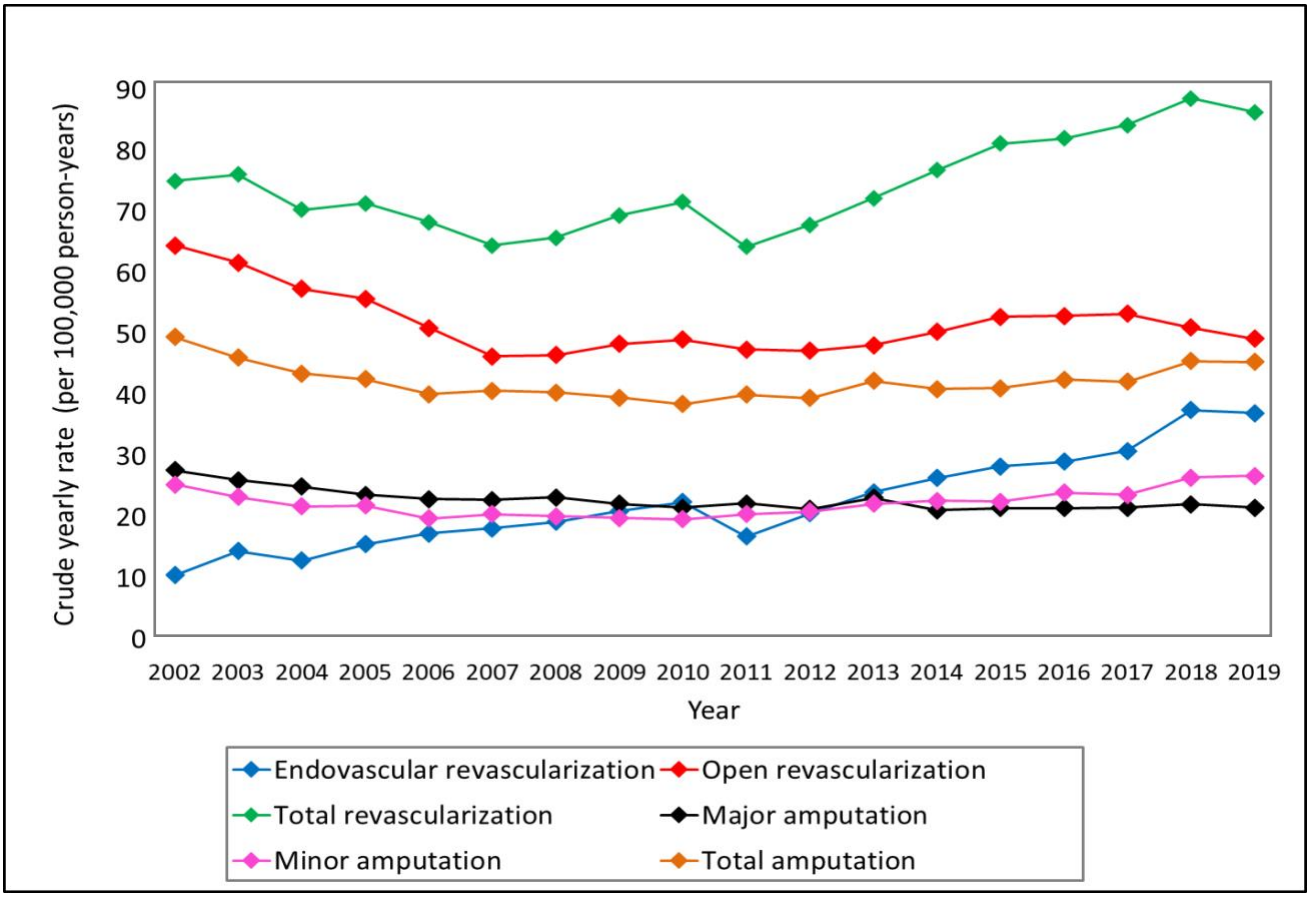
CONCLUSIONS

Strongly influenced by a rising diabetes prevalence, an increase in endovascular revascularization for PAD coincides with a decrease in rates of major amputation over time.

Table 1. Comparison of patient baseline characteristics between 2002 and 2019

Characteristic	Year 2002	Year 2019	Standardized difference
N total	5618476	7824665	NA
Person years	5580659	7774619	NA
Age - Mean (SD)	57.05 (13.07)	59.67 (13.02)	0.20
Male sex - N (%)	2693655 (47.94)	3773114 (48.22)	0.01
Rural living - N (%)	771718 (13.74)	852534 (10.9)	0.09
Income quintile 1 - N (%)	1045544 (18.61)	1515105 (19.36)	0.02
CHF - N (%)	193834 (3.45)	273645 (3.5)	0.00
COPD - N (%)	545108 (9.7)	921747 (11.78)	0.07
Diabetes - N (%)	567467 (10.1)	1384049 (17.69)	0.22

Figure 1. Crude yearly rates of revascularization and amputation events for peripheral arterial disease among Ontarians at least40 years old



23_CSVS_2021

PERCUTANEOUS PROXIMAL AXILLARY ARTERY VERSUS FEMORAL ARTERY ACCESS FOR AORTIC AND PERIPHERAL ENDOVASCULAR INTERVENTIONS

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OBJECTIVE

This study's objective is to describe and illustrate the technique of ultrasound-guided percutaneous proximal axillary artery (PAA) access, and secondarily to evaluate the versatility and safety of this approach in aortic and peripheral endovascular interventions.

METHODS

This is a single-centre retrospective review of peripheral and aortic endovascular cases using either percutaneous PAA or femoral artery access between January 2019 and February 2021. Access entry success, access-site complications, major adverse events, demographics, and procedural details were analyzed using standard statistical analyses.

RESULTS

A total of 115 accesses were completed, with 59 via PAA access and 56 via femoral artery access during the study period. Group demographics were not significantly different with the exception of BMI (27.03 kg/m² for PAA access vs. 24.70 kg/m² for femoral access, p=0.03). Access entry success was achieved in 58 (98.3%) and 56 (100%) of PAA and femoral accesses, respectively (p=1.000) (Table 1). There were no significant differences in access-site complications (13.6% vs. 7.1%, p=0.2598) nor major adverse events (10.2% vs. 8.9%, p=1.000) between the PAA and femoral groups (Table 1). With respect to versatility, PAA cases had no significant difference in the mean number of vessels intervened on per case compared to femoral access (2.37±1.10 vs. 2.02±0.90, p=0.0603) and a wide range of target vessels were intervened on in both groups (Table 2). PAA cases had significantly more bilateral interventions (28.8% vs. 12.5%, p=0.00394) (Table 2). PAA access had a significantly longer mean procedure time (103.2 min vs. 57.9 min, p<0.001) and fluoroscopy time (18.2 min vs. 12.9 min, p=0.024).

CONCLUSIONS

The PAA is a feasible, versatile, and safe percutaneous access option for endovascular intervention. The in-line trajectory from this site facilitates visceral, renal, and bilateral lower extremity interventions with ease. Outcomes, complications, and major adverse events are similar to those of conventional femoral access.

Table 1. Access success, access-site related complications, and major adverse events within 30 days among patients who underwent percutaneous proximal axillary artery or common femoral artery access.

	Proximal Axillary Artery Access (n = 59)	**Common Femoral Artery Access (n = 56)**	**P value**
Access success	58 (98.3%)	56 (100%)	1.0000
Access-site related complications	8 (13.6%)	4 (7.1%)	0.2598
Hematoma	5 (8.5%)	1 (1.8%)	0.2116
Pseudoaneurysm	1 (1.7%)	2 (3.6%)	0.6119
New limb ischemia	0 (0%)	1 (1.8%)	0.4870
Dissection	1 (1.7%)	0 (0%)	1.0000
Failed access	1 (1.7%)	0 (0%)	1.0000
Arteriovenous fistula	0 (0%)	0 (0%)	1.0000
Neurologic complications	0 (0%)	0 (0%)	1.0000
Major adverse events	6 (10.2%)	5 (8.9%)	1.0000
Death	2 (3.4%)	1 (1.8%)	1.0000
Myocardial infarction	2 (3.4%)	1 (1.8%)	1.0000
Stroke or TIA	1 (1.7%)	0 (0%)	1.0000
Immediate vessel repair*	0 (0%)	1 (1.8%)	0.4912
Delayed vessel repair**	1 (1.7%)	2 (3.6%)	0.6119
Major bleeding	0 (0%)	0 (0%)	1.0000

*Immediate vessel repair defined as within 24 hours or during the operation

**Delayed vessel repair defined as any vessel repair after 24 hours during hospital admission

Table 2. Target vessel characteristics among patients who underwent percutaneous proximal axillary artery or common femoral artery access.

	Proximal Axillary Artery Access, n = 59 (% or SD)	Common Femoral Artery Access, n = 56 (% or SD)	P-value
Total number of vessels intervened on	140	114	
Mean number of vessels intervened on	2.37 (1.10)	2.02 (0.90)	0.0603
1 vessel procedure	15 (25.4%)	20 (35.7%)	0.3108
2 vessel procedure	18 (30.5%)	16 (28.6%)	0.8409
3 vessel procedure	17 (28.8%)	18 (32.1%)	0.8396
4 vessel procedure	7 (11.9%)	2 (3.6%)	0.1636
5 vessel procedure	2 (3.4%)	0 (0.0%)	0.4960
Target vessels			
Superficial femoral artery	21 (15.0%)	29 (25.4%)	**0.0405**
Popliteal artery	17 (12.1%)	23 (20.2%)	0.0862
External iliac artery	15 (10.7%)	15 (13.2%)	0.5637
Common iliac artery	15 (10.7%)	13 (11.4%)	1.0000
Common femoral artery	13 (9.3%)	4 (3.5%)	0.0797
Tibial artery	5 (3.6%)	13 (11.4%)	**0.0246**
Profunda femoris artery	6 (4.3%)	0 (0.0%)	**0.0343**
Internal iliac artery	2 (1.4%)	3 (2.6%)	0.6596
Aorta	12 (8.6%)	6 (5.3%)	0.3374
Renal artery	11 (7.9%)	5 (4.4%)	0.3068
Celiac artery	9 (6.4%)	1 (0.9%)	**0.0254**
Superior mesenteric artery	8 (5.7%)	1 (0.9%)	**0.0445**
Inferior mesenteric artery	1 (0.7%)	0 (0.0%)	1.0000
Subclavian artery	5 (3.6%)	1 (0.9%)	0.2280
Treatment side			
Left lower leg	12 (20.3%)	27 (48.2%)	**0.0029**
Right lower leg	11 (18.6%)	19 (33.9%)	0.0886
Bilateral lower leg	17 (28.8%)	7 (12.5%)	**0.00394**
Other*	19 (32.2%)	3 (5.4%)	**0.000254**

*Predominate target vessel was the aorta, visceral, renal, or subclavian arteries

24_CSVS_2021

OUTCOMES AFTER RECEIPT OF NEURAXIAL OR REGIONAL ANESTHESIA INSTEAD OF GENERAL ANESTHESIA FOR LOWER LIMB REVASCULARIZATION SURGERY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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OBJECTIVE

To determine whether receipt of neuraxial or regional anesthesia instead of general anesthesia in adults undergoing lower limb revascularization surgery results in differences in health outcomes and length of hospital stay.

METHODS

We searched MEDLINE, EMBASE, and Evidence-Based Medicine Reviews; identified review articles; and included article bibliographies for randomized and non-randomized studies comparing use of neuraxial or regional anesthesia instead of general anesthesia in adults undergoing lower limb revascularization surgery. Two investigators independently extracted data and evaluated risk of bias. We calculated summary odds ratios and standardized mean differences using DerSimonian and Laird random-effects models.

RESULTS

Among 6,509 citations identified, we included 5 randomized (n=970 patients) and 12 non-randomized (n=73,840 patients) studies (**Table 1**). Use of neuraxial instead of general anesthesia was associated with a nonsignificant decrease in 30-day mortality in randomized studies [pooled-odds ratio (pooled-OR=0.77; 95% confidence interval (CI)=0.33-1.80; n=5 studies] and a significant decrease in adjusted 30-day mortality in non-randomized studies (pooled-OR=0.61; 95% CI=0.31-0.92; n=2 studies) (**Figure 1**). Patients allocated to neuraxial anesthesia in randomized studies had a lower odds of pulmonary complications (pooled-OR=0.37; 95% CI=0.17-0.81; n=2 studies). In non-randomized studies, receipt of neuraxial instead of general anesthesia was associated with a lower adjusted odds of cardiopulmonary and renal complications (OR=0.73; 95% CI=0.63-0.85; n=1 study), myocardial infarction (OR=0.56; 0.40-0.77; n=1 study), pneumonia (pooled-OR=0.65; 95% CI=0.30-1.00; n=2 studies), venous thromboembolism (OR=0.42; 95% CI=0.24-0.73; n=1 study), and acute kidney injury (pooled-OR=0.48; 95% CI=0.33-0.63; n=2 studies). Neuraxial anesthesia was also associated with a lower pooled standardized mean difference in hospital length of stay across eight non-randomized studies (-0.11; 95% CI=-0.01 to -0.21).

CONCLUSION

Non-randomized data suggests that receipt of neuraxial instead of general anesthesia for lower limb revascularization surgery is associated with decreased mortality and perioperative complications and a shorter length of hospitalization.

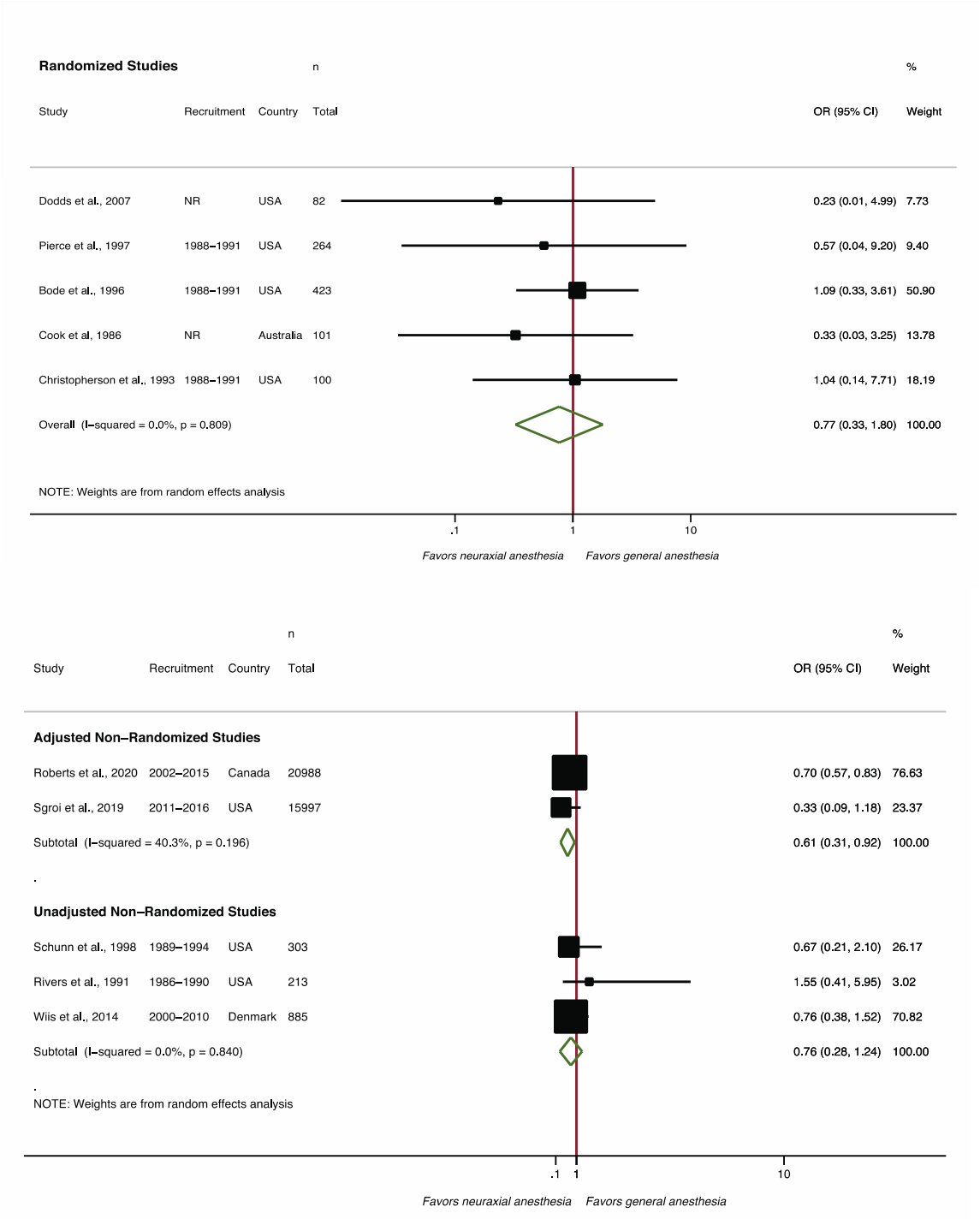
Table 1. Characteristics of the Included Randomized and Non-Randomized Studies.

Study; Country	Data Source	Recruit-ment	Mean Age	Intervention	N		Patient Characteristics	Surgical Procedures (%)		FU (m)
					NA/RA	GA	CAD, DM, CKD, CLTI (%)	Urgent/ Emergent	Type (%)	
Randomized Studies										
Dodds *et al.*, 2007; USA	Single Center	NR	67.9	Epidural	37	45	CAD (28), DM (61), CKD (NR), CTLI (NR)	0	Femoral-above knee bypass (6) Femoral-below knee bypass (94)	12
Pierce *et al.*, 1997; USA	Single Center	1988-91	67.6	Spinal & Epidural	168	96	CAD (36), DM (85), CKD (NR), CLTI (84)	0	Femoral-distal bypass (100)	1
Bode *et al.*, 1996; USA	Single Center	1988-91	68	Spinal Epidural	285	138	CAD (36) DM (86), CKD (NR), CLTI (84)	0	Femoral-distal bypass (100)	1
Christopherson *et al.*, 1993; USA	Single Center	1988-91	65	Epidural	49	51	CAD (27), DM (35), CKD (NR), CLTI (NR)	0	NR	6
Cook *et al.*, 1986; Australia	Single Center	NR	66.8	Spinal	50	51	CAD(NR), DM (9), CKD (NR), CLTI (NR)	NR	NR	12
Non-Randomized Studies										
Bisgaard *et al.*, 2021; Denmark	Danish Vascular Registry	2005-17	71.0	Spinal & Epidural	6850	10509	CAD(NR), DM (NR), CKD (NR), CLTI (54)	3.2	Inguinal and infrainguinal reconstructions; Femoral-distal bypass (45)	NR
Roberts *et al.*, 2020; Canada	ICES	2002-15	69.7	Spinal & Epidural	6453	14535	CAD (13), DM (45), CKD (8), CLTI (NR)	12.4	Infrainguinal bypass, endarterectomy, patch angioplasty, thrombo-embolectomy	NR
Fereydooni *et al.*, 2020; USA	NSQIP	2005-17	72.1	Spinal & Epidural	452	8631	CAD (NR), DM (33), CKD (7), CLTI (34)	5.1	Hybrid lower limb revascularization procedures	NR
Fereydooni *et al.*, 2019; USA	NSQIP	2005-17	70.8	Local & peripheral nerve block	350	8631	CAD (NR), DM (37), CKD (4), CLTI (35)	10.0	Hybrid lower limb revascularization procedures	NR
Sgroi *et al.*, 2019; USA	VQI	2011-16	67.3	Spinal & Epidural	572	15425	CAD (31), DM (56), CKD (8), CLTI (100)	1.3	Femoropopliteal (42); femoral-distal (43); popliteal-distal (10) bypass	12

Kikuchi *et al*., 2019; Japan	Single Center	2012-17	71.7	Ultrasound guided nerve block	67	137	CAD (56), DM (79), CKD (55), CLTI (100)	NR	Femoral-distal bypass +/- endarterectomy, patch angioplasty, endovascular intervention	NR
Wiis *et al*., 2014; Denmark	Single Center	2000-10	71.1	Epidural	389	499	CAD (10), DM (NR), CKD (NR), CLTI (NR)	18.5	Infrainguinal bypass; femoral-distal (29)	NR
Ghanami *et al.*, 2013; USA	NSQIP	2005-8	68.7	Spinal & Epidural	694	4768	CAD (45), DM (49), CKD (10), CLTI (78)	0	Femoral-popliteal (49) or femoral-distal (51) bypass	1
Singh *et al.*, 2006; USA	NSQIP	1995-03	65.8	Spinal & Epidural	5031	9757	CAD (NR), DM (44), CKD (NR), CLTI (NR)	NR	Femoral-popliteal (56) or femoral-distal (36) bypass	1
Schunn *et al.*, 1998; USA	Single center	1989-94	NR	Epidural	145	158	CAD (58), DM (45), CKD (9), CLTI (86)	NR	Femoral-popliteal (58) or femoral-distal (42) bypass	NR
Rivers *et al.*, 1991	Single center	1986-90	69	Epidural	96	117	CAD (31), DM (67), CKD (9), CLTI (86)	NR	Femoral-distal (100) bypass	NR
Manolio *et al.*, 1989	Single center	1983-85	63.7	Spinal & Epidural	78	56	CAD (26), DM (28), CKD (NR), CLTI (NR)	8.2	NR	NR

Where CAD indicates Coronary Artery Disease; CLTI, Chronic Limb-Threatening Ischemia; CKD, Chronic Kidney Disease, DM, Diabetes Mellitus; GA, General Anesthesia; ICES, Institute for Clinical Evaluative Services; NA/RA, Neuraxial or Regional Anesthesia (*where neuraxial anesthesia is defined as local anesthetic applied to nerves of the central nervous system, such as spinal anesthesia and epidural anesthesia; and regional anesthesia is defined as local anesthetic applied to the peripheral nerves, such as femoral nerve block*); NR, Not Reported; NSQIP, National Surgical Quality Improvement Program; VQI, Vascular Quality Initiative

Figure 1. Forest Plot of Mortality After Receipt of Neuraxial Instead of General Anesthesia for Lower Limb Revascularization Surgery in Randomized and Non-Randomized Studies.



25_CSVS_2021

OUTCOMES FOLLOWING SUPRACLAVICULAR THORACIC OUTLET DECOMPRESSION WITH FIRST RIB RESECTION

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OBJECTIVE
The optimal approach to decompression in patients with thoracic outlet syndrome (TOS) is controversial. In this study, we sought to report outcomes of supraclavicular TOS decompression with first rib resection.

METHODS
A retrospective analysis of consecutive patients with neurogenic, venous, and/or arterial TOS was conducted between 2013 and 2020 at a tertiary vascular centre. All patients underwent supraclavicular decompression with anterior and middle scalenectomy; brachial plexus mobilization +/- neurolysis; first rib resection; and concomitant adjunctive procedures in the presence of bony abnormalities and/or arterial pathology. We recorded 90-days outcomes and patient-reported satisfaction at follow-up.

RESULTS
A total of 260 supraclavicular TOS decompressions were carried out among 206 patients. Mean (SD) age was 37.4 (11.8) years; 59.7% were female. The majority (80.8%) had neurogenic TOS with venous and/or arterial components based on clinical presentation and/or radiological evidence; 16.5% had isolated venous TOS; and 2.7% had isolated arterial TOS. Surgical approach was supraclavicular in 99.2% and paraclavicular for arterial reconstruction in 0.8%. Adjunctive procedures included accessory cervical rib resection (12.3%); long C7 resection (2.7%); subclavian artery reconstruction (1.5%); and arterial thrombectomy (0.4%). Mean (SD) hospital length of stay was 3.4 (2.8) days. Most common 90-day complications were pleural effusion requiring thoracostomy tube (5.0%), pneumonia (3.8%), chyle leak (3.1%), transient long-thoracic nerve neuropraxia requiring intensive physiotherapy (1.2%), and hemothorax requiring re-intervention or thoracostomy tube (1.2%) (**Table 1**). There were no perioperative mortalities. Rates of 90-day readmission and emergency room visit were 3.9% and 8.5%, respectively. After a mean (SD) follow-up of 202 (273) days, 93.3% of patients reported improvement or resolution of TOS symptoms.

CONCLUSIONS
Supraclavicular decompression in patients with neurogenic, venous, and/or arterial TOS can be performed safely with low perioperative event rates. Careful patient selection and a comprehensive approach to decompression are keys to achieving optimal outcomes.

Table 1. 90-day outcomes of supraclavicular TOS decompression.

Outcome	Total (N = 260)
Pleural effusion requiring thoracostomy tube	13 (5.0%)
Pneumonia	10 (3.9%)
Chyle leak	8 (3.1%)
Required thoracostomy tube	6 (2.3%)
Required TPN or PEG supplemental nutrition	3 (1.2%)
Required VATS ligation	2 (0.8%)
Transient long-thoracic nerve neuropraxia requiring intensive physiotherapy	3 (1.2%)
Hemothorax	3 (1.2%)
Blood transfusion and re-intervention for bleeding	2 (0.8%)
Thoracostomy tube only	1 (0.4%)
Phrenic nerve neuropraxia with partial recovery requiring intensive respiratory therapy and/or thoracic surgery consult	2 (0.8%)
Subclavian vein injury with thrombosis	2 (0.8%)
Wound seroma requiring drainage	2 (0.8%)
Superficial thrombophlebitis	2 (0.8%)
COPD exacerbation	2 (0.8%)
Transient brachial plexus neuropraxia (C5/C6)	1 (0.4%)
Transient sympathetic chain neuropraxia (Horner Syndrome)	1 (0.4%)
Seizure	1 (0.4%)

Abbreviations: TPN = total parenteral nutrition; PEG = percutaneous endoscopic gastrotomy; VATS = video-assisted thoracoscopic surgery; COPD = chronic obstructive pulmonary disease.

SESSION VI - VASCULAR MEDICINE | DIALYSIS | VARIOUS

26_CSVS_2021

LONG-TERM OUTCOMES FOLLOWING THROMBOLYSIS OF ARTERIOVENOUS GRAFTS

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OBJECTIVES

Thrombolysis for arteriovenous grafts (AVG) yields high initial technical success rates, however, long-term outcomes are unclear. We conducted a multicenter retrospective cohort study to analyze 5-year patency rates following AVG thrombolysis.

METHODS

All patients who underwent AVG thrombolysis between 2005-2015 at 3 academic hospitals were included. Prospectively maintained institutional nephrology and radiology databases were used to record demographic, clinical, and AVG characteristics. The primary outcome was primary patency, defined as AVG access survival without re-intervention including angioplasty with/without re-thrombolysis. Secondary outcomes were assisted primary patency and cumulative patency, defined as AVG access survival until re-thrombosis requiring re-thrombolysis or abandonment, respectively. Technical success was defined as restoration of flow with <30% residual stenosis. Patients were followed until 2017. Patency rates were calculated using Kaplan-Meier survival analysis and Cox proportional hazards were calculated to determine associations between covariates and patency loss.

RESULTS

74 patients underwent AVG thrombolysis during the study period with a mean follow-up period of 2.51 (SD 2.47) years. The average age was 58.6 years with a high rate of comorbidities, including hypertension (82.4%) and diabetes (54.1%). Thrombolysis technical success was 96%. There were 147 re-interventions in 46 patients, of which 98 were re-thrombolysis (mean re-intervention rate of 1.27/patient/year). Primary patency at 1, 3, and 5 years were 43.2%, 20.2%, and 7.7% (Figure 1). Assisted primary patency at 1, 3, and 5 years were 47.5%, 20.2%, and 7.7%. Cumulative patency at 1, 3, and 5 years were 75.0%, 38.8%, and 22.6% (Table 1). Cox proportional hazards analysis demonstrated no associations between demographic, clinical, and procedural characteristics and patency rates.

CONCLUSIONS

Despite a high initial technical success rate, thrombolysis for AVG dysfunction is associated with poor long-term patency. Future studies are needed to determine risk factors for re-thrombosis to identify patients who will benefit from AVG thrombolysis in the long-term.

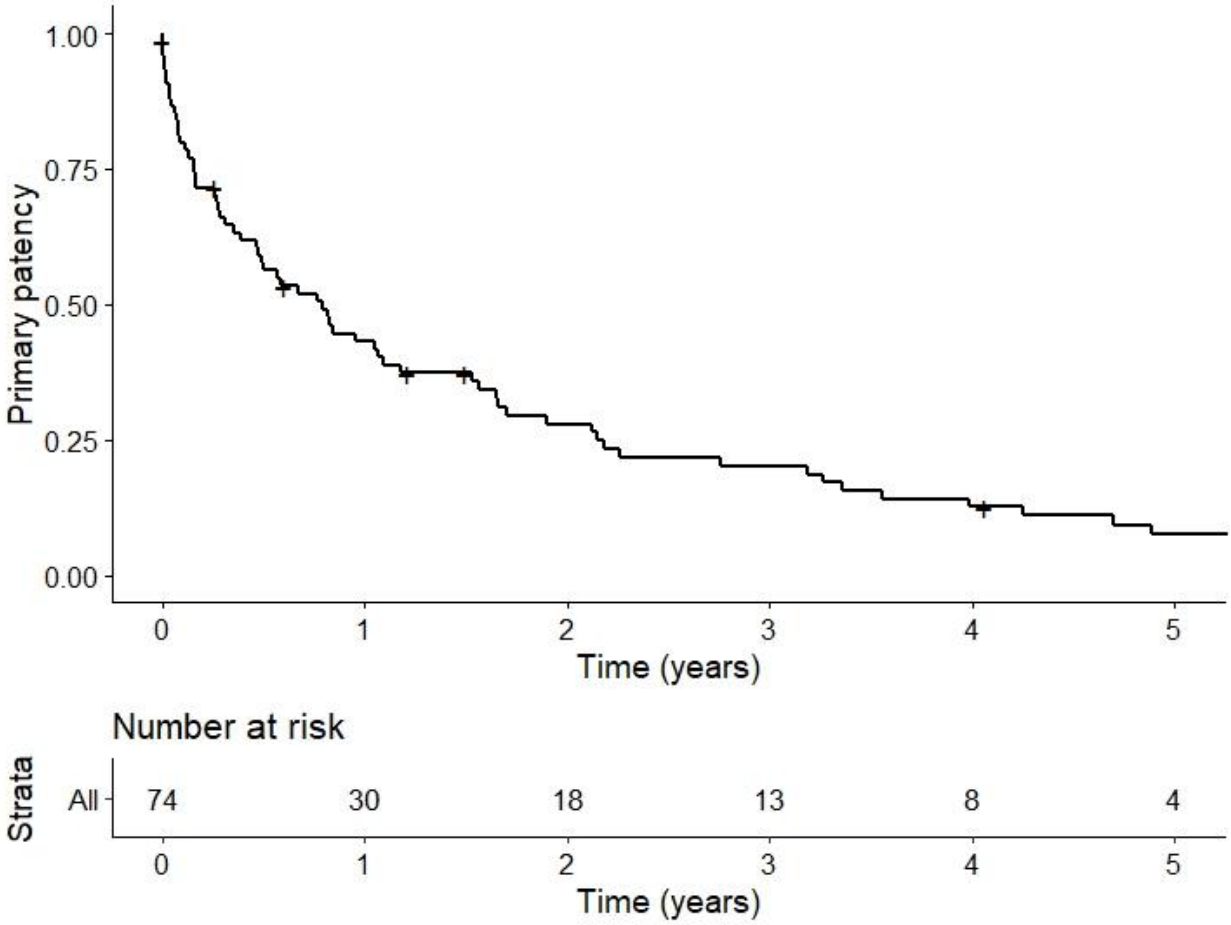

Figure 1. Primary patency following AVG thrombolysis

Table 1. Long-term AVG patency following thrombolysis

	1 year	2 years	3 years	4 years	5 years
Primary patency	43.2%	27.9%	20.2%	12.7%	7.7%
Assisted primary patency	47.5%	29.4%	20.2%	12.7%	7.7%
Cumulative patency	75.0%	55.0%	38.8%	30.0%	22.6%

27_CSVS_2021

RACIAL DIFFERENCES IN PRESENTATION SEVERITY AND OUTCOMES FOR PATIENTS UNDERGOING MAJOR VASCULAR SURGERY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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OBJECTIVE

Many studies have investigated the impact of race on vascular surgery care, however, no comprehensive synthesis of the literature has been performed. We conducted a systematic review and meta-analysis on racial differences in presentation severity and outcomes for patients undergoing major vascular surgery.

METHODS

MEDLINE, Embase, and Cochrane CENTRAL were searched from inception to December 2020. All observational studies and randomized controlled trials evaluating racial differences in presentation severity or outcomes for patients undergoing open/endovascular abdominal aortic aneurysm (AAA) repair, carotid endarterectomy/stent, or lower extremity bypass/angioplasty/amputation were included. Presentation severity was defined as follows: AAA (symptomatic/ruptured vs. asymptomatic), carotid artery disease (symptomatic vs. asymptomatic), and peripheral artery disease (critical limb ischemia vs. claudication). Post-operative outcomes included 30-day and long-term mortality, stroke, myocardial infarction, and graft/stent thrombosis. Study selection, data abstraction, and quality assessment were conducted by two independent reviewers, with a third author resolving discrepancies. Meta-analysis was conducted using random-effects models.

RESULTS

Our search yielded 3,111 articles. One RCT and 76 observational studies comparing 6,405,837 white, 868,058 black, 377,588 Hispanic, 66,890 Asian, and 22,137 indigenous patients were included. Black, Hispanic and Indigenous patients were more likely to present with ruptured AAA compared to white patients (Black: OR: 3.23, 95% CI 1.33-7.84, P=0.01, Hispanic: OR: 1.44, 95% CI 1.19-1.75, P<0.0001, Indigenous: OR: 1.97, 95% CI 1.39-2.80, P<0.0001). Black and Hispanic patients were also more likely to present with symptomatic carotid artery disease (Black: OR: 1.32, 95% CI 1.18-1.49, P<0.0001; Hispanic: OR: 1.30, 95% CI 1.21-1.41, P<0.0001) and critical limb ischemia (Black: OR: 1.47, 95% CI 1.09-2.0, P=0.01; Hispanic: OR: 1.92, 95% CI 1.56-2.38, P<0.0001). Black patients also had significantly higher 30-day mortality following AAA repair (RR: 1.35, 95% CI 1.15-1.58, P<0.0001) and carotid endarterectomy/stenting (RR: 1.50, 95% CI 1.27-1.77, P<0.0001).

CONCLUSION

Minority race is associated with more severe disease at presentation and worse outcomes following major vascular surgery. Future studies are needed to evaluate reasons for these disparities and develop interventions to improve racial equity in vascular surgery.

28_CSVS_2021

STABILIN-2 DEFICIENCY ENHANCES VENOUS THROMBUS SIZE, ALTERS THROMBUS COMPOSITION AND INCREASES PLASMA PROCOAGULANT ACTIVITY IN MICE

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OBJECTIVE

Stabilin-2 is an endocytic scavenger receptor that has been shown to mediate clearance of glycosaminoglycans, glycoproteins and phosphatidylserine-expressing cells. In a genome-wide screening study, pathogenic variants in the human *STAB2* gene associated with an increased incidence of unprovoked venous thromboembolism (OR 3.37). The study aim was to assess the influence of stabilin-2 on deep vein thrombosis (DVT) and to characterize the underlying prothrombotic phenotype of stabilin-2 deficiency.

METHODS

Two independent cohorts (littermates and non-littermates) of wild-type (*Stab2*$^{+/+}$) and stabilin-2 (*Stab2*$^{-/-}$) deficient C57Bl/6J mice were used. DVT was induced by ligating the IVC below the left renal vein around a 30-gauge needle spacer. Spacer removal creates an approximate 90% stenosis. The thrombus was weighed after 24 hours, formalin fixed, paraffin embedded, and sections were used for quantitative immunohistochemistry. Plasma coagulation factors levels were measured by ELISA, activity assay or thrombin generation assay.

RESULTS

We observed that *Stab2*$^{-/-}$ mice developed significantly larger thrombi than *Stab2*$^{+/+}$ controls in both independent cohorts (1.56-fold,p=0.023). Stabilin-2 deficiency did not alter DVT incidence. Immunohistochemical analysis demonstrated that thrombi from *Stab2*$^{-/-}$ mice were erythrocyte (1.90-fold,p=0.004) and fibrin-rich (1.29-fold,p=0.04) and contained significantly more leukocytes (2.25-fold,p<0.001) than in *Stab2*$^{+/+}$ thrombi. Platelet and von Willebrand factor (VWF) content in thrombi did not differ. Citrullinated histone H3 (a marker for neutrophil-extracellular trap (NET) formation) was also elevated in thrombi from *Stab2*$^{-/-}$ mice (1.72-fold,p=0.022, Figure 1). *Stab2*$^{-/-}$ murine plasma demonstrated enhanced thrombin generation (1.45-fold,p=0.03), and FVIII (1.16-fold,p=0.015), and FXIII activities (1.08-fold,p=0.054) despite comparable VWF, fibrinogen, FIX and FX levels. Circulating levels of monocytes (1.56-fold,p<0.0001) and granulocytes (1.34-fold,p=0.005) were also significantly elevated in *Stab2*$^{-/-}$ mice.

CONCLUSION

Together, this data suggests that stabilin-2 deficiency associates with a prothrombotic phenotype involving elevated levels of NET-releasing leukocytes coupled with increased FVIII activity, thrombin generation and fibrin formation, resulting in larger and qualitatively distinct venous thrombi.

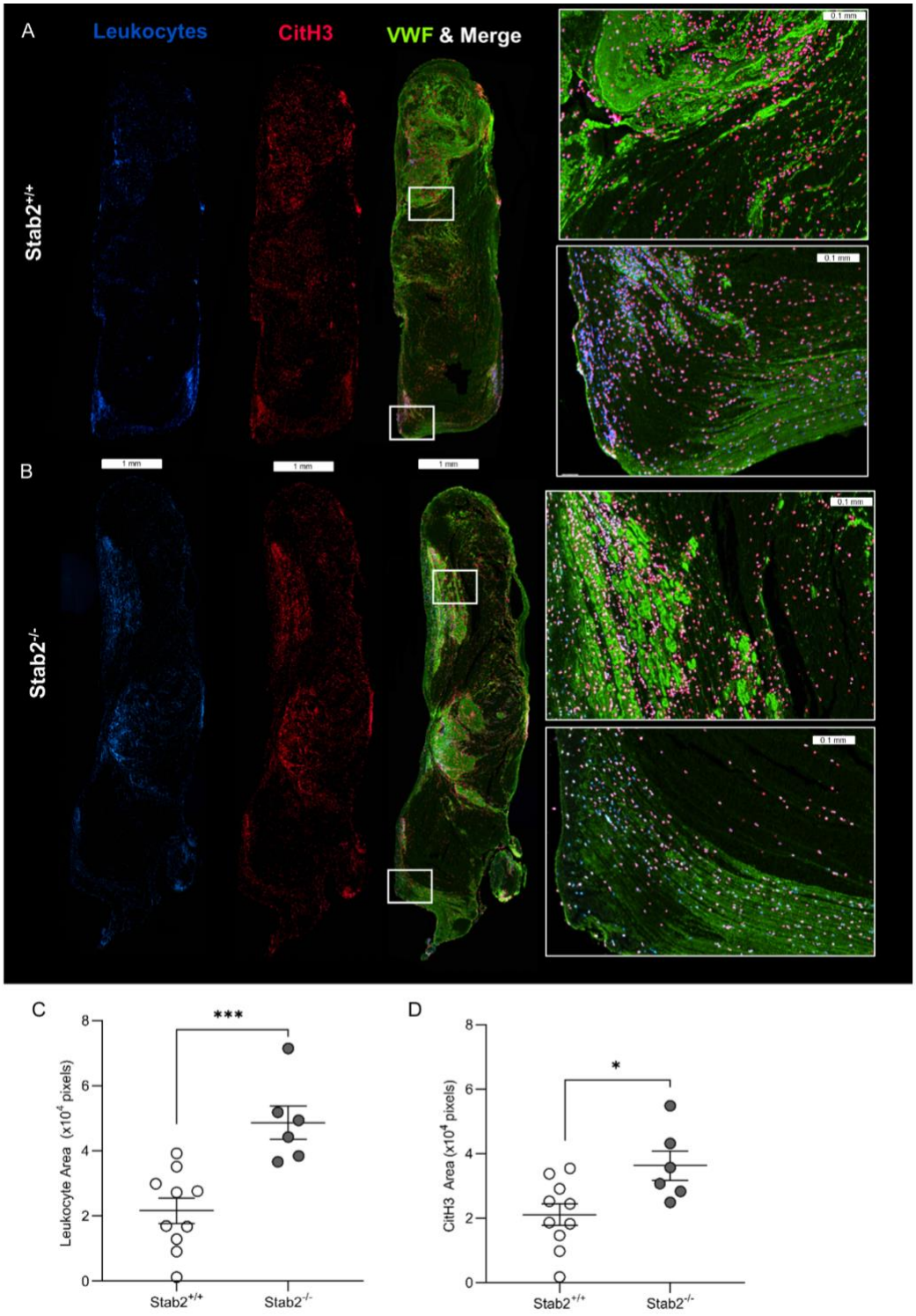

Figure 1. Thrombi from stabilin-2 deficient mice contain more leukocytes and NETs.

29_CSVS_2021

PREDICTORS OF INFERIOR VENA CAVA FILTER RETRIEVAL IN POPULATION-BASED CANADIAN COHORT

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OBJECTIVE

The objective of this study was to determine the predictors of inferior vena cava (IVC) filter retrieval in a contemporary North American cohort of patients derived from administrative health data.

METHODS

A retrospective population-based cohort study was conducted using Ontario administrative data from April 1, 2009 to March 31, 2020. Patients in whom IVC filters were placed were identified using Ontario Health Insurance Plan billing code R838. Retrieved filters were identified with subsequent billing of code J041. The cumulative incidence of filter retrieval over time was calculated, accounting for death as a competing risk. Multivariable subdistribution hazard regression models were constructed to study the effects of covariates on likelihood of filter retrieval.

RESULTS

A total of 5,617 IVC filters were placed during the study period. Median follow-up was 1.8 years (interquartile range 0.2 – 5.4 years). Absolute numbers of IVC filters placed decreased during the study period, from 627 in 2010, to 415 in 2018. The probability of filter retrieval plateaued under 40% (**Table**), and 96% of retrieved IVC filters were retrieved within 1 year of placement. Placement in a teaching hospital (HR 1.85, 95% CI 1.60, 2.02), and placement after the 2015 fiscal year were statistically significant predictors of retrieval. Meanwhile, a history of venous thromboembolism (HR 0.83, 95% CI 0.76, 0.91), and cancer (HR 0.56, 95% CI 0.56, 0.61) were associated with reduced likelihood of filter retrieval. Older age, greater comorbidity and frailty were also associated with lower likelihood of retrieval.

CONCLUSION

In this provincial study of IVC filter retrieval, less than 40% of filters were retrieved, the majority within 1 year of insertion. Although likelihood of filter retrieval increased after 2015, most filters are never retrieved. Better co-ordination and standardization of services responsible for follow-up may improve this figure and reduce complications related to prolonged dwell times.

TABLE. Probability of Inferior Vena Cava Filter Retrieval and Death with Indwelling Filter by Time from Filter Placement

Time from filter placement	Number at risk	Probability of Outcome (%, 95% confidence interval)	
		Filter Retrieval	Death with Indwelling Filter
0	5617	0	0
3 months	2665	0.27 (0.26, 0.28)	0.26 (0.25, 0.27)
6 months	1989	0.34 (0.32, 0.35)	0.31 (0.3, 0.32)
1 year	1529	0.37 (0.36, 0.38)	0.36 (0.35, 0.37)
2 years	1219	0.38 (0.36, 0.388)	0.40 (0.38, 0.41)
3 years	1012	0.38 (0.36, 0.39)	0.42 (0.41, 0.44)
4 years	850	0.38 (0.37, 0.39)	0.44 (0.43, 0.46)
5 years	690	0.38 (0.37, 0.39)	0.46 (0.44, 0.47)
6 years	547	0.38 (0.37, 0.39)	0.47 (0.45, 0.48)
7 years	402	0.38 (0.37, 0.39)	0.48 (0.47, 0.49)
8 years	291	0.38 (0.37, 0.39)	0.50 (0.48, 0.50)
9 years	202	0.38 (0.37, 0.40)	0.50 (0.48, 0.51)
10 years	96	0.38 (0.37, 0.40)	0.51 (0.49, 0.52)

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TIME UNTIL ELECTIVE OPERATION FOR ENDOVASCULAR AORTIC ANEURYSM REPAIR IN THE CANADIAN VASCULAR QUALITY INITIATIVE

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OBJECTIVES

To describe the determinants of time until operation in patients undergoing elective endovascular aortic repair (EVAR) for abdominal aortic aneurysm (AAA) treated at Canadian centres participating in the Vascular Quality Initiative (VQI) and its relationship with clinical outcomes.

METHODS

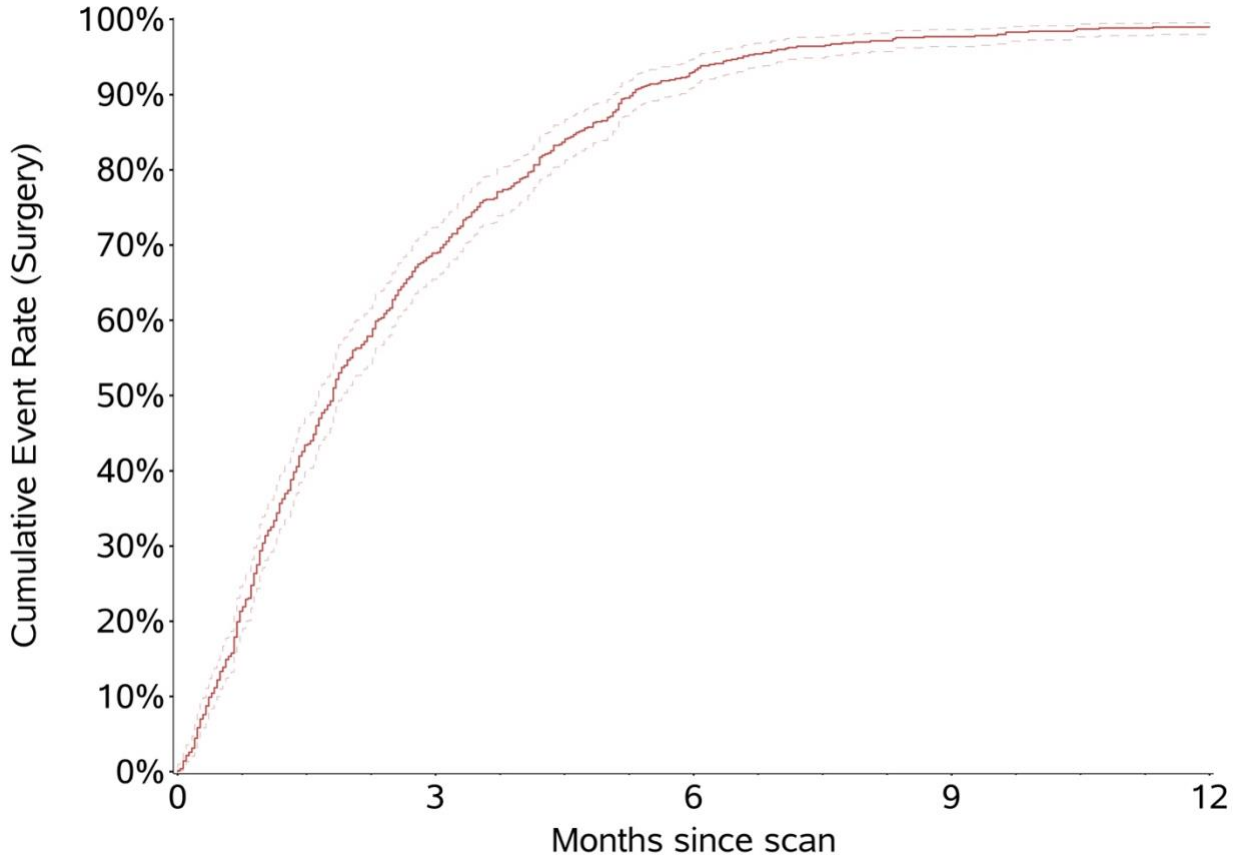
The VQI dataset was obtained for all patients who underwent elective EVAR between January 2016 and November 2020 in participating Canadian centres. Time to operation (TIMOP) was defined as the delay between the date of preoperative imaging and the operative date. TIMOP was analyzed with cumulative event rate curves with and without stratification by centre. Uni- and multivariate analyses were performed examining demographic and imaging characteristics as well as postoperative outcomes with respect to TIMOP.

RESULTS

There were 698 patients from six centres in the VQI dataset during the study period. Most (54.7%) of patients had surgery within two months, with 68.9% having surgery within three months (Figure 1). There were 148 patients (21.2%) waiting for operation at four months. Significant differences were found between centres ($p < 0.0001$). In-hospital mortality was 0.29% (2/698) and there was no impact of TIMOP on intra- or postoperative complications (p = 0.723 and 0.196). On multivariate analysis, AAA diameter on the preoperative imaging was associated with earlier surgery (HR 1.27/5 mm 95% CI 1.210-1.333) while presence of congestive heart failure (HR 0.699 95% CI 0.505-0.967) and preoperative angiotensin converting enzyme-inhibitor use (HR 0.778 95% CI 0.665-0.911) were both associated with longer TIMOP.

CONCLUSION

Most patients in Canadian VQI centres undergo EVAR in less than 3 months after their imaging; however 21.2% wait more than four months with longer delays in some centres, suggesting opportunity for improvement. TIMOP did not impact in-hospital mortality, which was very low, nor perioperative complications. Patients with larger AAA underwent surgery more quickly.


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Event Rate (Surgery)
0
3
6
9
12
Months since scan