

PREDICTING OUTCOMES IN VASCULAR SURGERY

-when not to operate

**South Australian Audit of Perioperative
Mortality Seminar**

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VASCULAR SURGERY

- Rapid changes in interventional options
- Changes in patient profile
- Changes in patient / family expectations

VASCULAR SURGERY IN THE ELDERLY

- Discuss two patient groups
 - Aortic interventions
 - All vascular admissions

AORTIC INTERVENTIONS

- Aneurysms
 - Stent graft (EVAR)
 - Open AAA repair
- Occlusive diseases
 - Angioplasty, stent, “hybrid” procedures, bypass surgery

PREDICTION OF OUTCOMES FOLLOWING AORTIC SURGERY - SOURCES

- ASERNIP-S audit of endovascular AAA repair
 - 961 cases performed from 1999-2001
 - followed up for eight years
- Australasian Vascular Audit (AVA)
 - 13, 995 aortic procedures in five years

AORTIC MORTALITY IN AUSTRALIA AND NEW ZEALAND (AVA)

- Open elective 3.5%
- Open ruptured 34%
- EVAR elective 0.7%
- EVAR ruptured 18%

OPEN AORTIC SURGERY

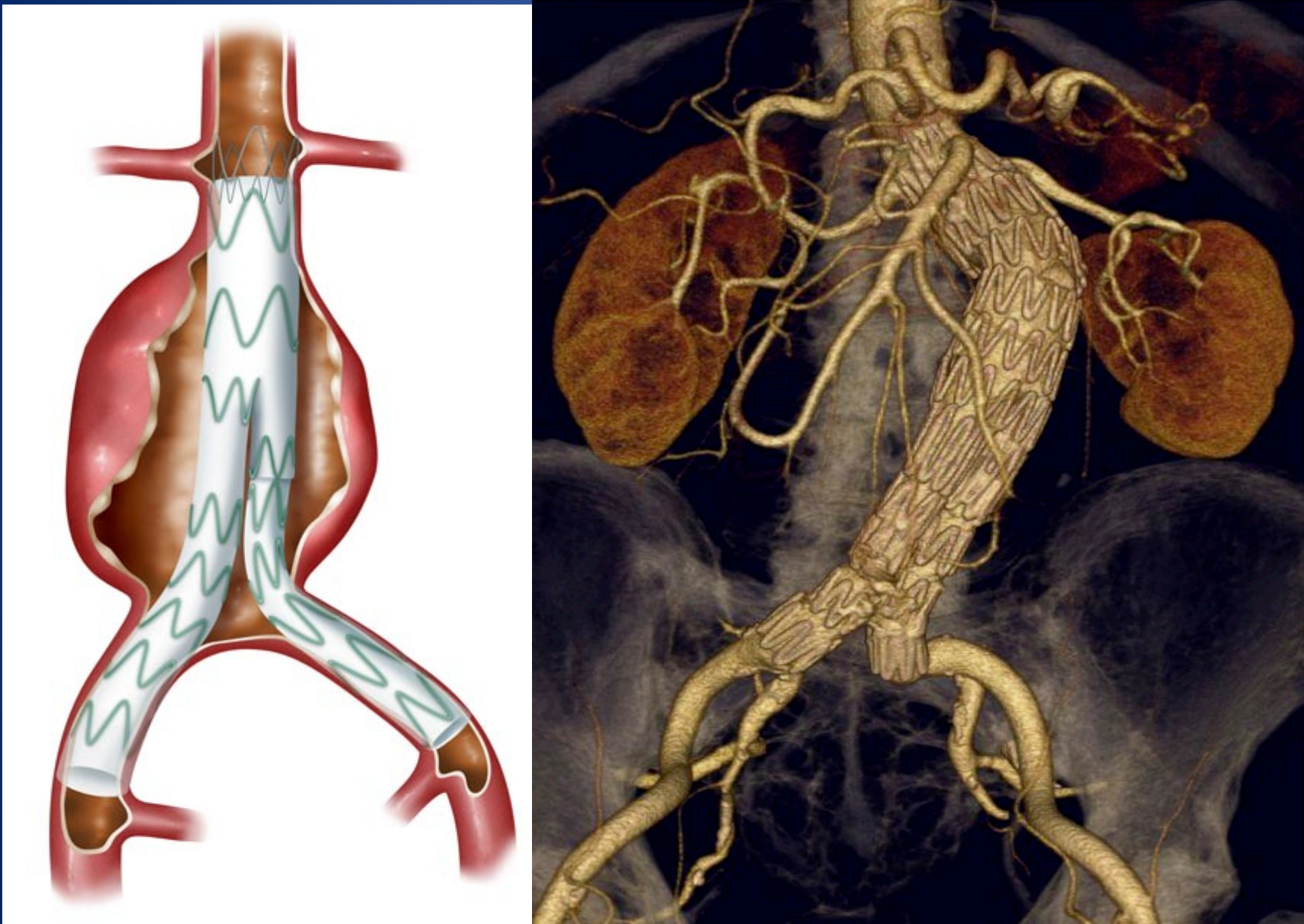
Factors affecting perioperative mortality (AVA)

	VARIABLES	ODDS RATIO	P-VALUE
PREOPERATIVE			
	Ischaemic heart disease	1.6	0.0002
	Age >80 years	2.5	<0.0001
	Female	1.5	0.0049
	(Rupture)	8.8	<0.0001
PERIOPERATIVE			
	>4 litre blood loss	5.5	<0.0001
	Suprarenal clamp	1.9	<0.0001
	Suprarenal AAA	2.2	0.0002

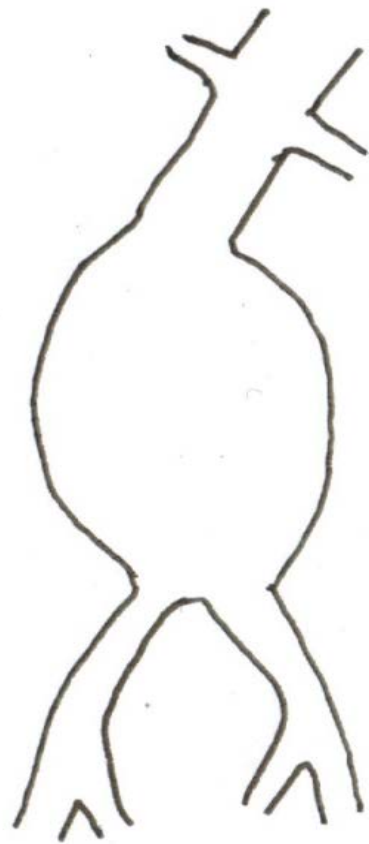
ENDOVASCULAR AAA REPAIR

- Requires anatomic suitability
- Procedural mortality varies
- (<1% to 10% for elective procedures)

ENDOVASCULAR ANEURYSM REPAIR (EVAR)



INFRARENAL ABDOMINAL AORTIC ANEURYSM



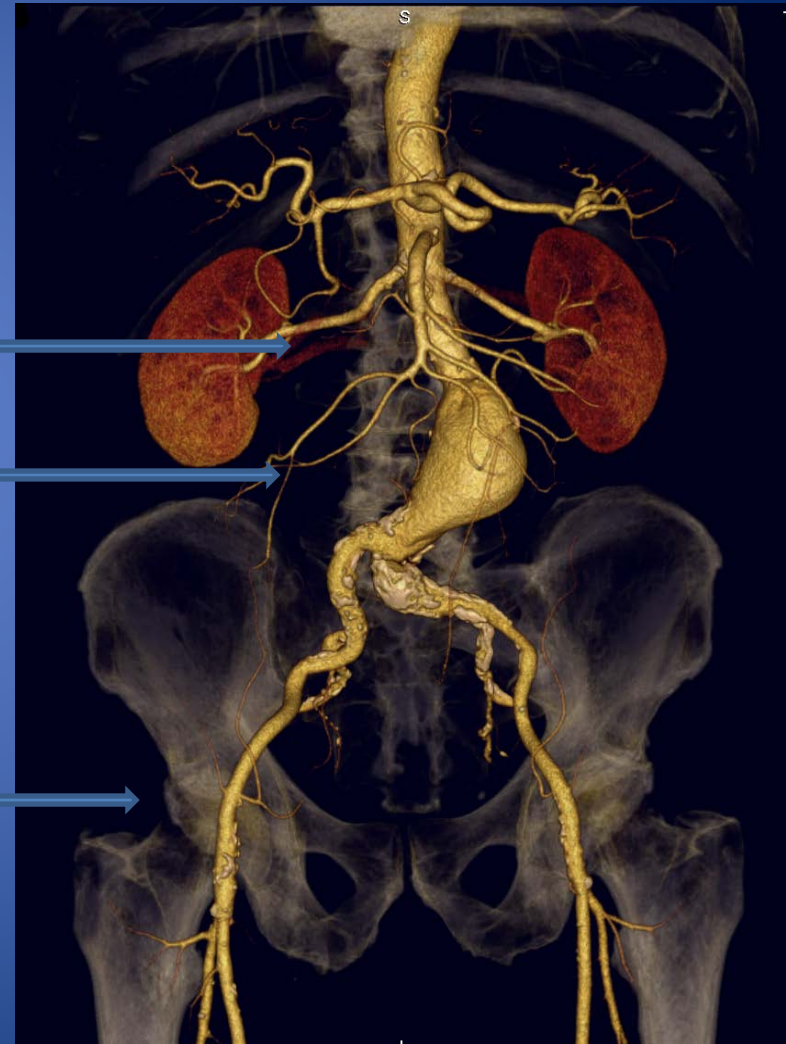
Infrarenal neck



Aneurysm



Iliac arteries



BEST MULTIVARIATE MODEL FOR ONE YEAR SURVIVAL (EVAR TRIAL DATA)

Overall 89-93% in literature

Cox proportional hazard

Variable	P-value	Hazard ratio	Unit change*	
			From	To
ASA	0.006	3.31	2	4
Aneurysm diameter	<0.001	1.52	51	62
Creatinine	0.001	1.44	81	120
Respiratory assessment	0.047	1.63	2	4
Calcification grade	0.026	2.08	2	4

* 25 & 75 percentiles were contrasted in the Hazard Ratios

EVAR - FACTORS AFFECTING SURVIVAL

3 year:

- Age
- Aneurysm diameter
- ASA

5 year:

- Age
- ASA
- Aneurysm diameter
- Creatinine

ASA-3

- Severe systemic disease
- >60% of AAA patients and vascular patients in general
- Highly variable exercise tolerance

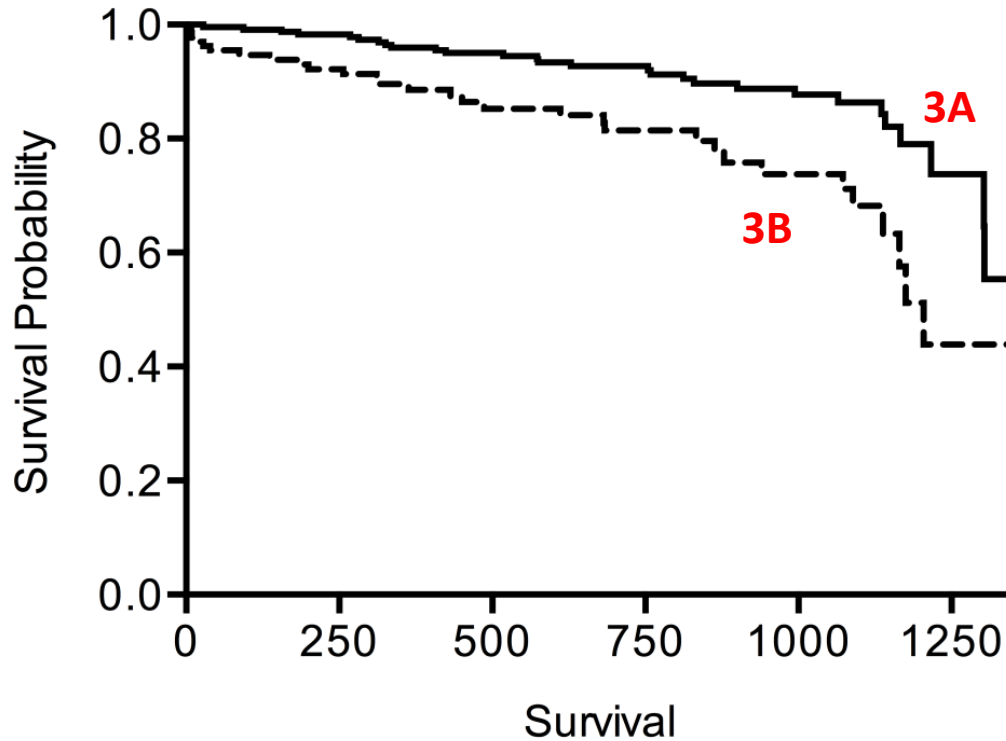
METHODS

- Patients were enrolled in the EVAR outcomes modelling trial between 2009 and 2013
- In addition to asking for the ASA status, we also included the following questions:

*Exercise tolerance:	Can patient walk up two flights of stairs (40 steps)?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	How far can patient walk briskly? (5km/hr)		metres

- Mortality data was obtained from the National Death Index in August 2014
- Survival for each fitness group was assessed using Cox Proportional Hazards models.

KAPLAN MEIER SURVIVAL CURVES



ASA 3A = FIT
ASA 3B = UNFIT

P = 0.0002
(log rank
test)

Days	0	250	500	750	1000	1250
ASA 3A	217	194	154	113	71	12
ASA 3B	114	90	58	43	27	6

SURVIVAL POST PROCEDURE

UNADJUSTED AND ADJUSTED ANALYSIS

Unadjusted (univariate)

Parameter	Level	Hazard Ratio	Lower CL	Upper CL	P
Fitness group	FIT	1.00			
	UNFIT	3.55	1.93	6.54	<0.0001

Adjusted (multivariate)

Fitness group	FIT	1.00			
	UNFIT	3.03	1.56	5.89	0.0011

AVERAGE RISK PATIENT

Enter Patient details in green cells		Predicted Outcome Rates		95% Confidence		
Aneurysm Dia. Maximum	60 mm	Early Death	1%	Ideally ↓ 0%	1%	3%
Age	75 years	Aneurysm Related Death	3%		2%	4%
ASA	3	Mid-term Re-interventions	13%		10%	16%
Gender	Male	Initial Endoleak Type I	4%		2%	5%
Creatinine	100 μ moles/L	Mid-term Endoleak Type I	3%	2%	6%	
Aortic Neck angle	30 degrees	3 year Survival	80%	Ideally	77%	83%
Infrarenal Neck Diameter	15 17 - 32mm	5 year Survival	67%	100%	63%	71%
Infrarenal Neck Length	20 mm	Technical Success	91%	Ideally	88%	93%
Have you got all 8 above?	All 8	Initial Clinical Success	90%	100%	88%	92%
		Initial Endoleak Type II	8%	Ideally ↓ 0%	7%	11%
		Mid-term Endoleak Type II	15%		12%	17%
		Initial Graft Complications	26%		20%	33%
		Mid-term Graft Complications	8%		5%	13%
		Initial Re-interventions	32%	29%	36%	
		Migrations	1%	1%	3%	
		Convert to Open Repair	2%	1%	4%	
		Ruptures	1%	1%	3%	

ELDERLY CO-MORBID MALE

Aneurysm Dia. Maximum	80 mm
Age	84 years
ASA	4
Gender	Male
Creatinine	160 μ moles/L
Aortic Neck angle	50 degrees
Infrarenal Neck Diameter	25 mm
Infrarenal Neck Length	20 mm
Have you got all 8 above?	All 8

Predicted Outcome Rates			95% Confidence	
Early Death	7%		Ideally	3%
Aneurysm Related Death	15%	↓ 0%	7%	29%
Mid-term Re-interventions	17%		11%	26%
Initial Endoleak Type I	4%		2%	5%
Mid-term Endoleak Type I	11%		7%	18%
3 year Survival	38%	Ideally	27%	50%
5 year Survival	23%	100%	16%	33%
<hr/>				
Technical Success	82%	Ideally	70%	90%
Initial Clinical Success	81%	100%	72%	87%
Initial Endoleak Type II	13%	Ideally	8%	20%
Mid-term Endoleak Type II	17%	↓ 0%	13%	22%
Initial Graft Complications	36%		27%	45%
Mid-term Graft Complications	15%		9%	22%
Initial Re-interventions	37%		30%	45%
Migrations	5%		2%	15%
Convert to Open Repair	6%		2%	13%
Ruptures	6%		3%	10%

ERA Model (EVAR)

The app for iPad looks like this



- Patient details are entered into the left hand column
- The predicted outcomes are displayed in the right hand column
- By selecting an outcome, additional information is provided at the base of the right hand column
- This information can be enlarged

Required

Patient Age 84
55-90 yrs

Sex Male Female

ASA 1 2 3 4

Max. Aneurysm Diameter 80
40-80mm

Creatinine 160
60-200 μ M

Optional

Aortic Angle <45° \geq 45°

Infra-renal Neck Diameter 25
17-32mm

Infra-renal Neck Length 20
6-60mm

Patient-Related

Early Death 6.6% (3.1% - 13.6%)

Aneurysm Related Death 15.4% (7.4% - 29.2%)

3-Year Survival 37.6% (26.8% - 49.7%)

5-Year Survival 23.3% (15.9% - 32.8%)

Initial Clinical Success 80.7% (71.5% - 87.4%)

Graft

Initial Type 1 Endoleak 3.6% (2.5% - 5.3%)

Midterm Type 1 Endoleak 11.2% (6.7% - 18.1%)

Initial Type 2 Endoleak 12.5% (7.7% - 19.8%)

Midterm Type 2 Endoleak 17.2% (13.3% - 22.0%)

Initial Graft Complication 35.8% (27.2% - 45.4%)

Midterm Graft Complication 14.6% (9.5% - 21.8%)

Graft Migration 4.9% (1.5% - 15.0%)

Rupture 5.5% (2.9% - 10.2%)

Operative

Midterm Reintervention 17.0% (10.5% - 26.3%)

Technical Success 81.7% (70.0% - 89.5%)

Initial Reintervention 37.3% (30.3% - 45.0%)

Conversion to Open Procedure 5.6% (2.4% - 12.7%)

ERA Model

App Information Disclaimer

SHORT AND MID-TERM OUTCOMES IN VASCULAR SURGICAL PATIENTS

(Ambler et al, Addenbrooke's Hospital, Cambridge)

- All patients admitted to vascular unit (413 patients)
 - > 65 years of age
 - LOS >2 days

FACTORS ASSOCIATED WITH INCREASED 12 MONTH MORTALITY (Overall 13.8%)

	P-VALUE
Anaemia on admission (<119 g/L)	0.01
Not independently mobile	0.06
Polypharmacy (>8meds) or high co-morbidity index	0.002
Malnutrition	0.016
History of falls	0.01
Depression	0.04
Emergency admission	<0.001

PREDICTORS OF DISCHARGE TO A CARE FACILITY

- Age
- (emergency admission)
- High co-morbidity index
- Polypharmacy
- Poor mobility
- Malnutrition
- Memory problems
- History of falls

FRAILTY CHARACTERISTICS

- Co-morbidity
 - Polypharmacy
 - Co-morbidities
- Physical function
 - Anaemia
 - Mobility
- Nutrition
- Cognition
- Geriatric syndrome – falls, visual impairment
- Social vulnerability – lives alone

Strong predictors of 12 month mortality, discharge to a care institution, prolonged length of stay, likelihood of readmission

Will modification of these features help improve outcomes?

ADENBROOKE'S VASCULAR FRAILITY SCORE (AVFS)

- Not independently mobile on admission
- Depression
- Polypharmacy on admission (>8 medications)
- Anaemia (Hb <119g/L)
- Waterlow score >13 on admission
- Emergency admission

AVFS SCORE – PREDICTION OF OUTCOMES

ADDERBROOKES VASCULAR FRAILITY SCORE	12 MONTH MORTALITY (AUC 0.83)	READMISSION FREE SURVIVAL (AUC 0.7)
0	0	68
1	2	60
2	12	50
3	22	38
4	39	30
5	58	17
6		0

COPART STUDY

(COHORT OF PATIENTS WITH ARTERIAL DISEASE)

- 640 patients in France
- Factors associated with 12 month mortality OR non-fatal stroke OR non-fatal myocardial infarction
- Age
 - 75-84 (+2)
 - >85 (+3)
- Previous MI (+1)
- Creat clearance <30ml/min (+1.5)
- ABI <0.5 or >1.3 (+2)
- CRP >70mg/L (+2)
- Statin, antiplatelet, ACE/ARB (-1.5)

COPART STUDY

POINTS	RISK
≤ 0	2% (low)
0.5 – 2	13% (medium)
2.5 – 4	23% (high)
≥ 4.5	42% (very high)

(externally validated)

WHY USE DECISION SUPPORT TOOLS?

- They may help surgeons achieve better outcomes by providing more personally relevant information to patients
- A recent survey of 59 Australian vascular surgeons showed they were largely (95%) in favour of tools to support information exchange between themselves and their patients
- Decision support tools can identify high-risk patients / individuals likely to have poor outcomes
- They may be useful for auditing, policy making and research
- If patients are to have greater autonomy and ownership over medical decisions they must be provided with enough information for them to assess their options and understand potential gains or losses.