

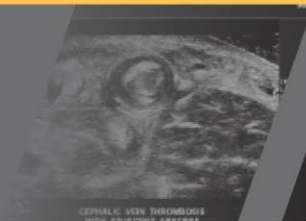
2024 MID-ATLANTIC CONFERENCE
12th ANNUAL CURRENT CONCEPTS IN
VASCULAR THERAPIES

2024



Hilton Virginia Beach Oceanfront
Virginia Beach, Virginia

APRIL 18-20



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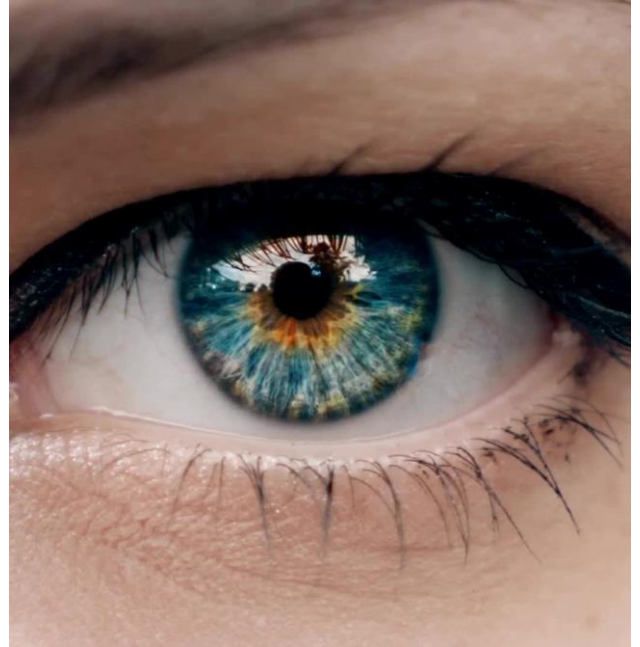
The eyeball test and
aortic surgery.

What is the optimal pre-
operative work-up?

Michael E Landis, MD FACS



Historically the 'eyeball test' has been employed as part of surgical preoperative assessment to predict a patient's likelihood of surviving a planned procedure without major complications.



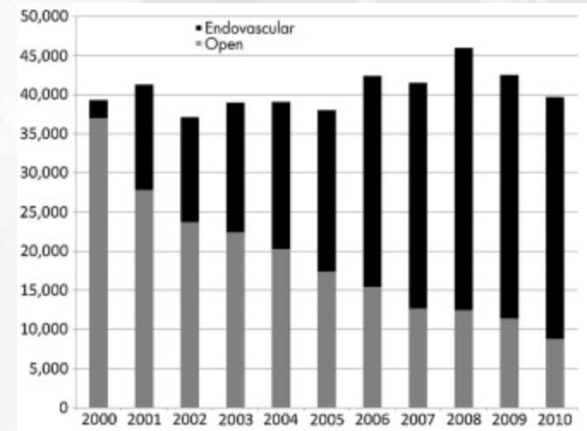
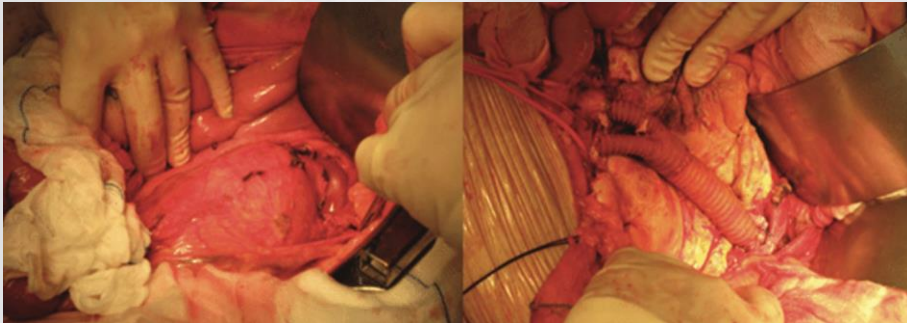
- “Good surgeons know how to operate; better surgeons know when to operate. But only the wisest surgeons know when *not* to operate.”



Hartzell Schaff

Aortic Surgery epidemiology

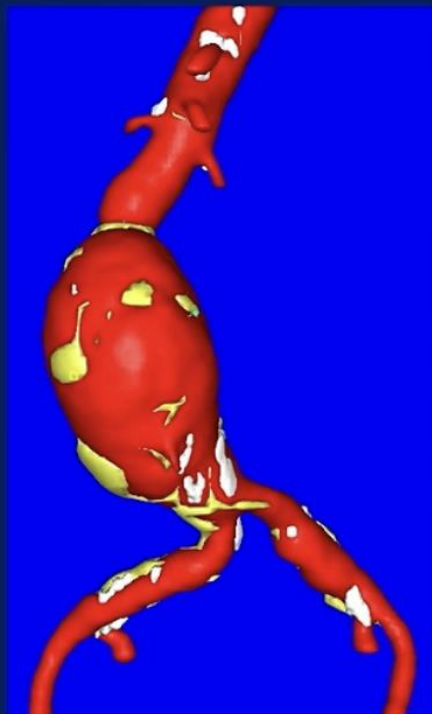
- Most aortic surgery literature centered on aneurysm repair
- 200,000/y diagnosed with AAA (> 3 cm)
- 30 – 40,000 procedures (4 K ruptures).
- Majority (>75%) done with endovascular techniques, though number of OSR increasing.



OLD FIGURES (20+y)

AAA Diameter (cm)	Rupture Risk (%/yr)
<4	0
4-5	0.5-5
5-6	3-15
6-7	10-20
7-8	20-40
>8	30-50

Reproduced with permission from Brewster DC, Cronenwett JL, Hallett JW Jr, et al. Guidelines for the treatment of abdominal aortic aneurysms. Report of a subcommittee of the Joint Council of the American Association for Vascular Surgery and Society for Vascular Surgery. *J Vasc Surg* 2003;37:1106-1117.



**New figures have emerged indicating a
more realistic contemporary annual risk of
AAA rupture**

<5.5cm = 1% (or less)

5.5-6.0cm = 3.5%

6.1-7.0cm = 4.5%

>7.0cm = 6.3% (and higher)



“Will this high risk patient survive the procedure?” but rather “Will this procedure prolong this patient’s life?”

EVAR

In hospital mortality 0.87%

1- year mortality 9.3% \pm 0.3%

2-year mortality 14.8% \pm 0.4%

OAR

In hospital mortality 7.55%

1- year mortality 15.2% \pm 1.3%

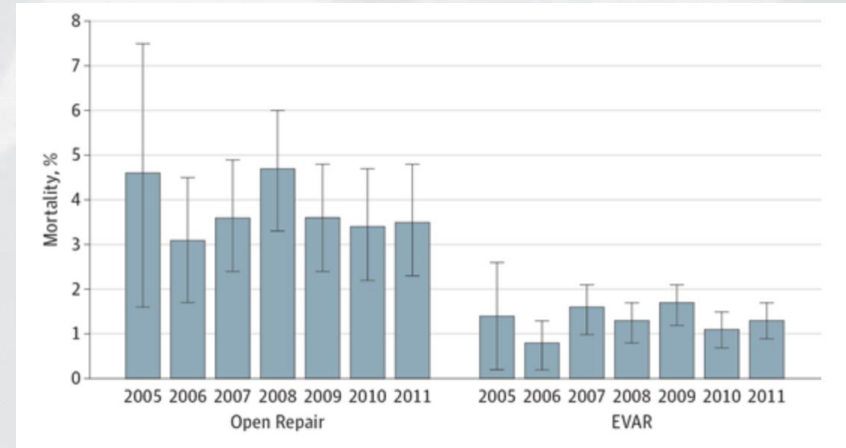
2-year mortality 18.9% \pm 1.5%

The high mortality following aortic repair in octogenarians exceeds the published risk of rupture for 5- to 5.5-cm AAA.

AAA repair Mortality

Combined mortality with severe morbidity

3.7 - 9.8% OSR 1.3 - 1.7% EVAR

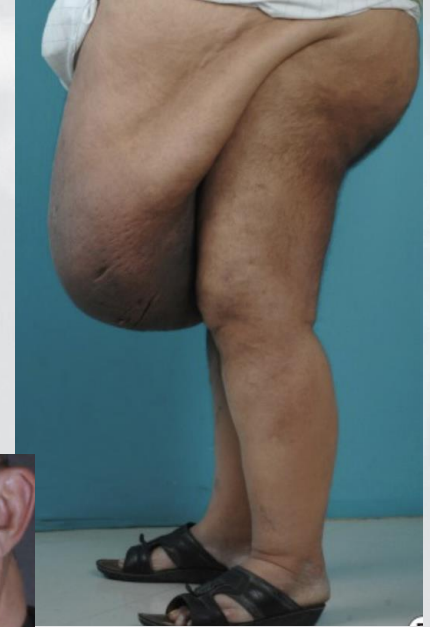


Elective CABG 1.7 – 2.8%

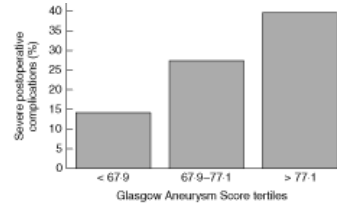
CABG + AVR/MVR 6.8 - 13.3%

AAA repair Surgical risk factors

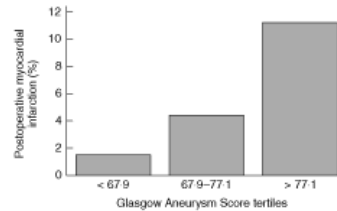
- Age
- Obesity
- Cardiovascular Disease
- COPD/tobacco history
- Renal insufficiency
- PVD/CVD
- EtOH
- h/o prior laparotomy
- Hematologic d/o
- Functional status



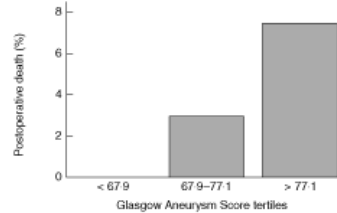
Post-operative complication risk stratified by Glasgow Aneurysm Score



a Severe postoperative complications




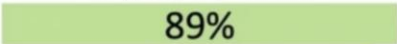
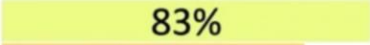
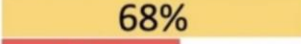
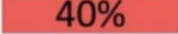


b Postoperative myocardial infarction

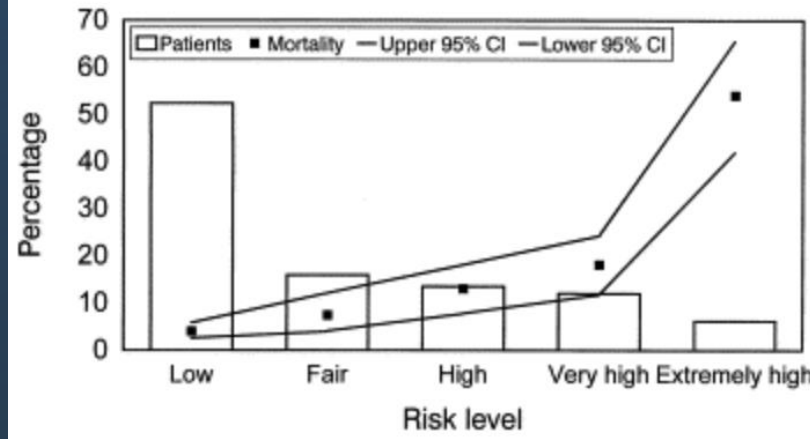
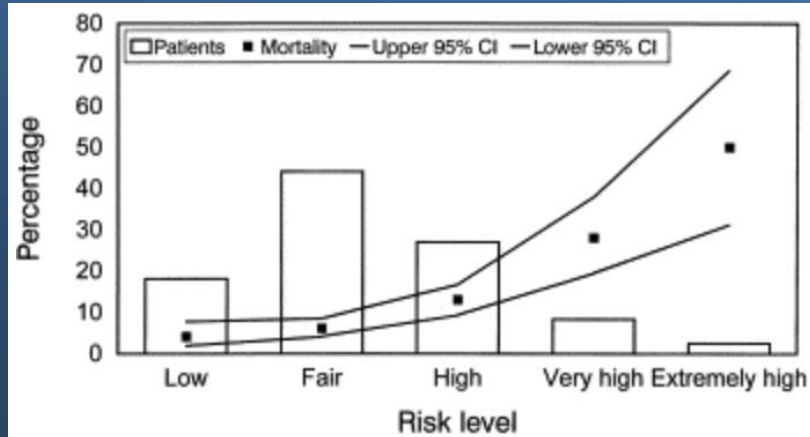


c Postoperative mortality rates



Age, years		Points	
< 70		0	
70 - 74.9		9	
75 - 79.9		10	
≥ 80		17	
KDIGO			
G1	>90	0	
G2	60 - 89.9	1	
G3a	45 - 59.9	3	
G3b	30 - 44.9	6	
G4/5	<30	15	
COPD			
No		0	
Yes		7	
Risk Category		Sum:	5-year Survival
Low		≤ 8	 89%
Low to Moderate		9 - 13	 83%
Moderate to High		15 - 18	 68%
High		≥ 19	 40%

Assessment of surgical mortality risk by Subjective assessment (top) And Statistical model (bottom)



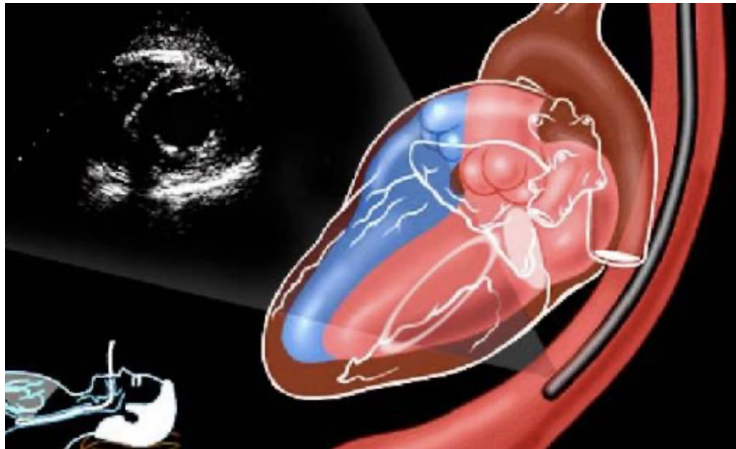
Cardiovascular risk

- ½ of patients >45 yo undergoing major non-CT surgery had at least 2 risk factors for cardiovascular disease.
- Review of 40,000 patients undergoing non-CT surgery
1 in 7 has ACS or stroke within 30d of surgery.
- Estimated that 20% of patients > 75 yo will require surgery each year.

The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm

Elliot L. Chaikof, MD, PhD   • Ronald L. Dalman, MD • Mark K. Eskandari, MD • ...

Madhukar S. Patel, MD, MBA, ScM • Marc L. Schermerhorn, MD, MPH • Benjamin W. Starnes, MD •



In patients with active cardiac conditions, including unstable angina, decompensated heart failure, severe valvular disease, and significant arrhythmia, we recommend cardiology consultation before EVAR or OSR.

Level of recommendation 1 (Strong)

Quality of evidence B (Moderate)

In patients with significant clinical risk factors, such as coronary artery disease, congestive heart failure, cerebrovascular disease, diabetes mellitus, chronic renal insufficiency, and unknown or poor functional capacity (MET < 4), who are to undergo OSR or EVAR, we suggest noninvasive stress testing.

Level of recommendation 2 (Weak)

Quality of evidence B (Moderate)

We recommend a preoperative resting 12-lead ECG in all patients undergoing EVAR or OSR within 30 days of planned treatment.

Level of recommendation 1 (Strong)

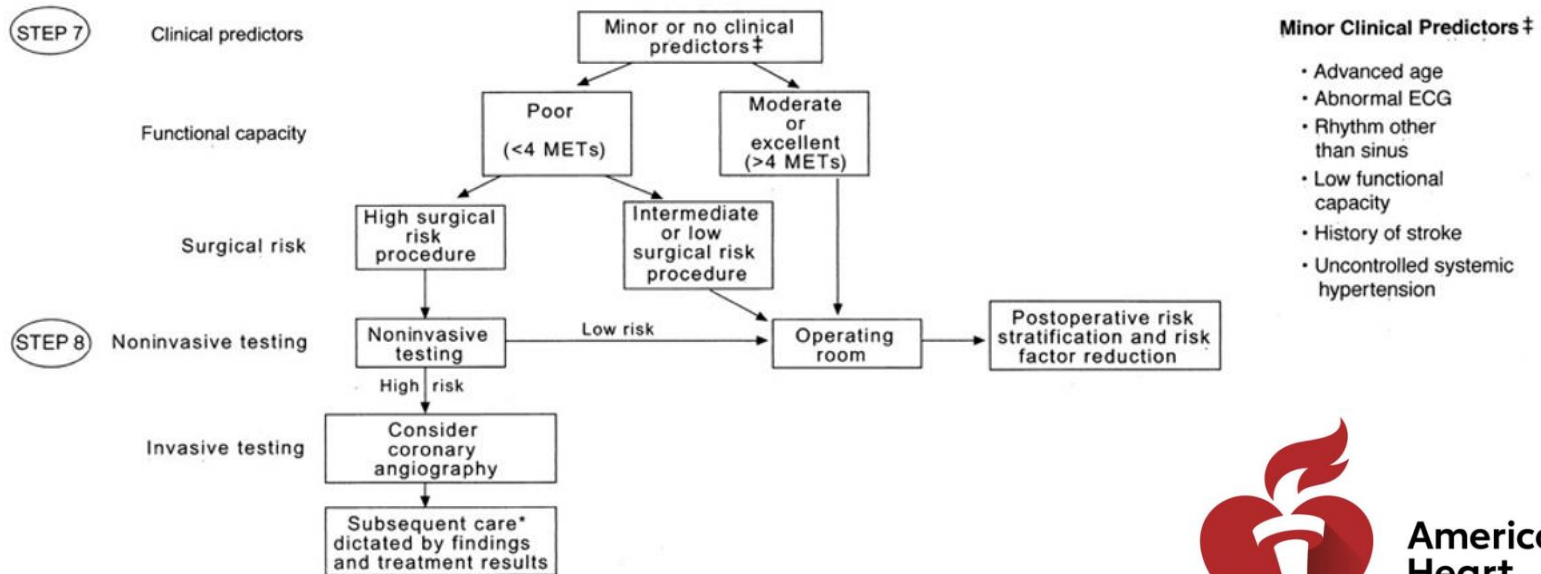
Quality of evidence B (Moderate)

We recommend echocardiography before planned operative repair in patients with dyspnea of unknown origin or worsening dyspnea.

Level of recommendation 1 (Strong)

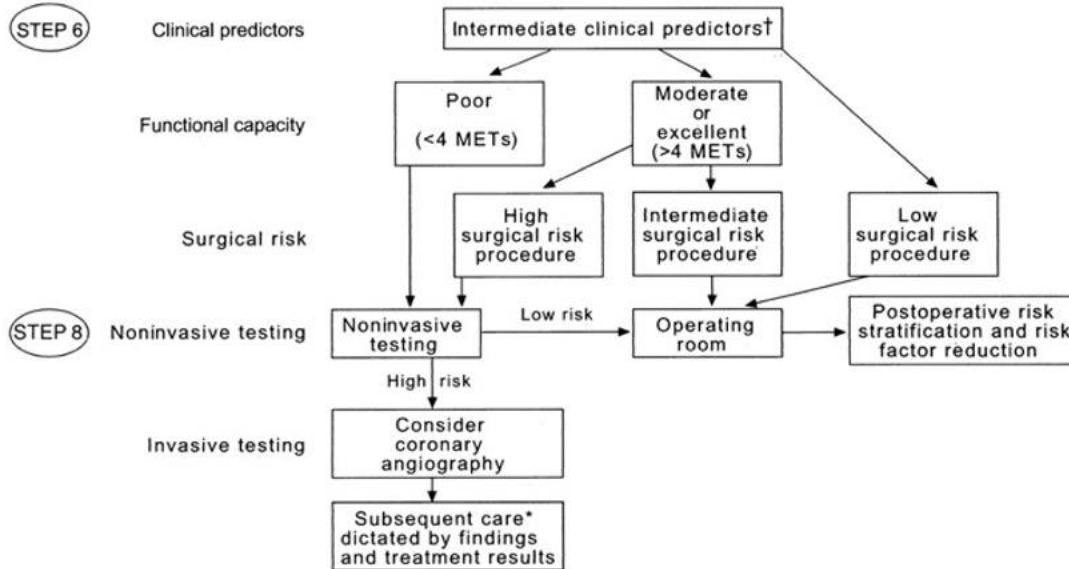
Quality of evidence A (High)

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery



**American
Heart
Association.**

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery



Intermediate Clinical Predictors†

- Mild angina pectoris
- Prior MI
- Compensated or prior CHF
- Diabetes mellitus
- Renal insufficiency

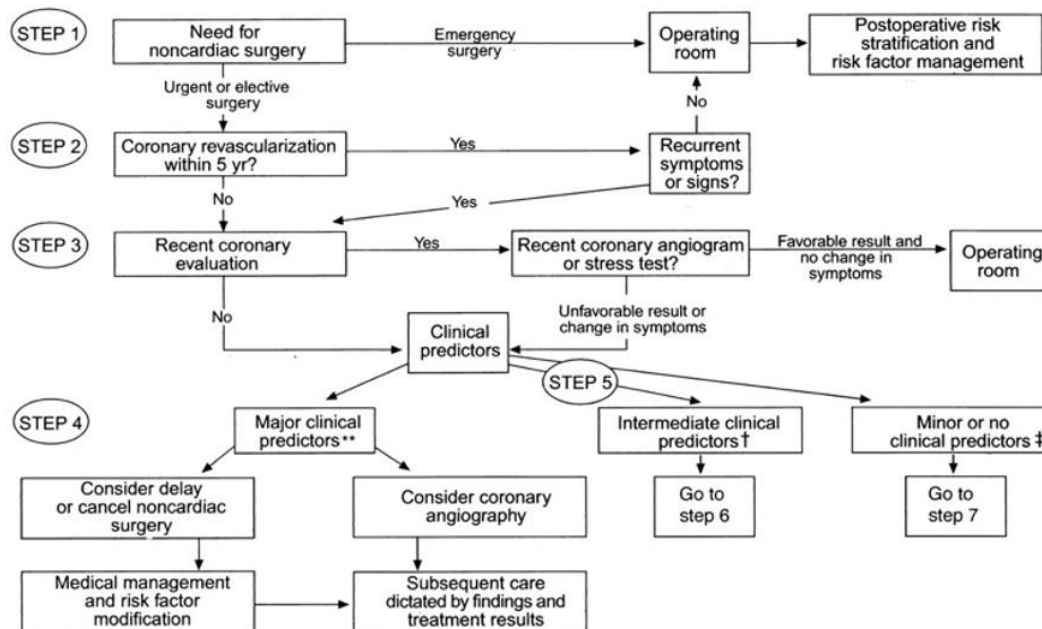


**American
Heart
Association.**

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery



American Heart Association.



Major Clinical Predictors **

- Unstable coronary syndromes
- Decompensated CHF
- Significant arrhythmias
- Severe valvular disease



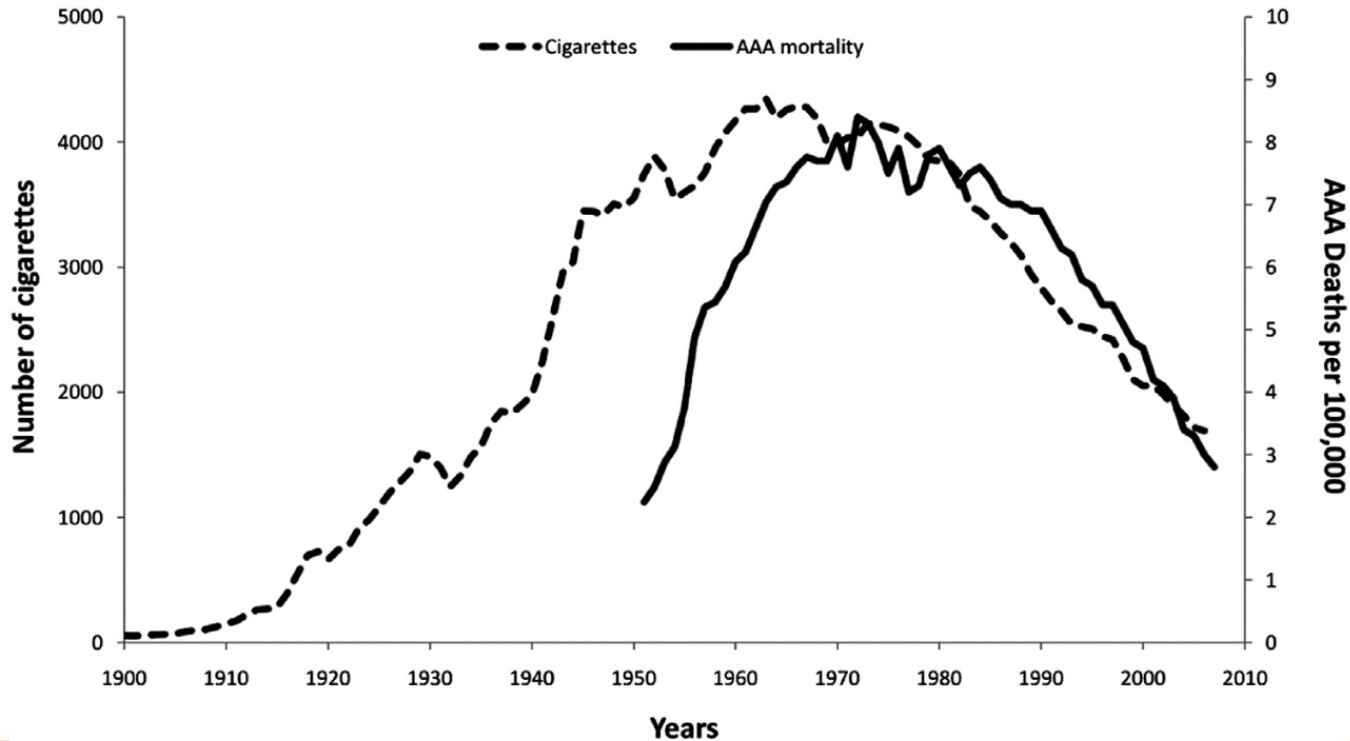


Fig 1. The annual adult per capita cigarette consumption and age-adjusted abdominal aortic aneurysm (AAA) deaths per 100,000 white men by year in the United States. (From Lederle FA. The rise and fall of abdominal aortic aneurysm. *Circulation* 2011;124:1097-9.).

Pulmonary Disease

- COPD independent predictor of mortality following OSR
- Severe COPD associated with increased in-hospital mortality, MACE and decreased 5 yr survival with either EVAR or OSR
- Cigarette abstinence a must, with greatest benefits seen with 4 – 8 weeks of cessation

We suggest preoperative pulmonary function studies, including room air arterial blood gas determinations, in patients with a history of symptomatic COPD, long-standing tobacco use, or inability to climb one flight of stairs.

Level of recommendation 2 (Weak)

Quality of evidence C (Low)

We recommend smoking cessation for at least two weeks prior to aneurysm repair.

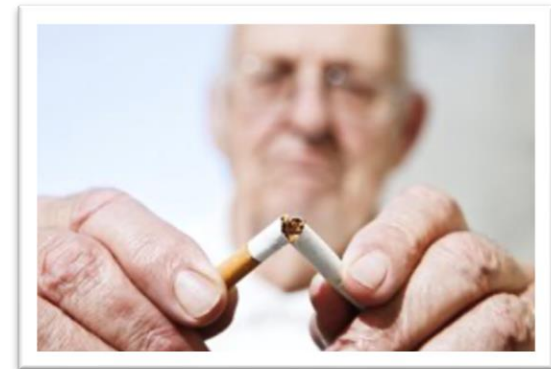
Level of recommendation 1 (Strong)

Quality of evidence C (Low)

We suggest administration of pulmonary bronchodilators for at least 2 weeks before aneurysm repair in patients with a history of COPD or abnormal results of pulmonary function testing.

Level of recommendation 2 (Weak)

Quality of evidence C (Low)



Cardiopulmonary Exercise Testing



Cardiopulmonary Exercise Testing

Ergonomic Bike with monitors

3 min with no resistance,
followed by increasing resistance at 70 rpm
until peak VO_2 reached

Anaerobic threshold (AT) occurs when
 CO_2 production exceeds VO_2

11 ml/kg/min critical AT for elderly patients



Everest Base camp

Risk stratification by pre-operative cardiopulmonary exercise testing improves outcomes following elective abdominal aortic aneurysm surgery: a cohort study

Stephen J Goodyear^{1*}, Heng Yow¹, Mahmud Saedon^{1,2}, Joanna Shakespeare¹, Christopher E Hill¹, Duncan Watson¹, Colette Marshall¹, Asif Mahmood¹, Daniel Higman¹ and Christopher HE Imray^{1,2}

Table 4 Fisher's exact test comparison of total 30-day mortality

Cohort		30-day mortality (%)	Odds ratio (95% CI)	P value
	<i>Open surgery</i>			
Pre-CPET (Jan 03 to Oct 07)	Pre-CPET (<i>n</i> = 103)	12.6		
CPET era (Nov 07 to Jul 11)	CPET era (total) (<i>n</i> = 100)	4.0	0.29 (0.09 to 0.92)	<i>P</i> < 0.05
	CPET-pass (74/100)	2.7	0.19 (0.04 to 0.88)	<i>P</i> < 0.05
	CPET-fail (8/100)	12.5	0.989 (0.11 to 8.70)	<i>P</i> = 1.00
	CPET-submaximal (3/100)	33.3	2.31 (0.22 to 23.90)	<i>P</i> = 0.43
	No-CPET (15/100)	0	0.18 (0.01 to 3.20)	<i>P</i> = 0.21

Risk stratification by pre-operative cardiopulmonary exercise testing improves outcomes following elective abdominal aortic aneurysm surgery: a cohort study

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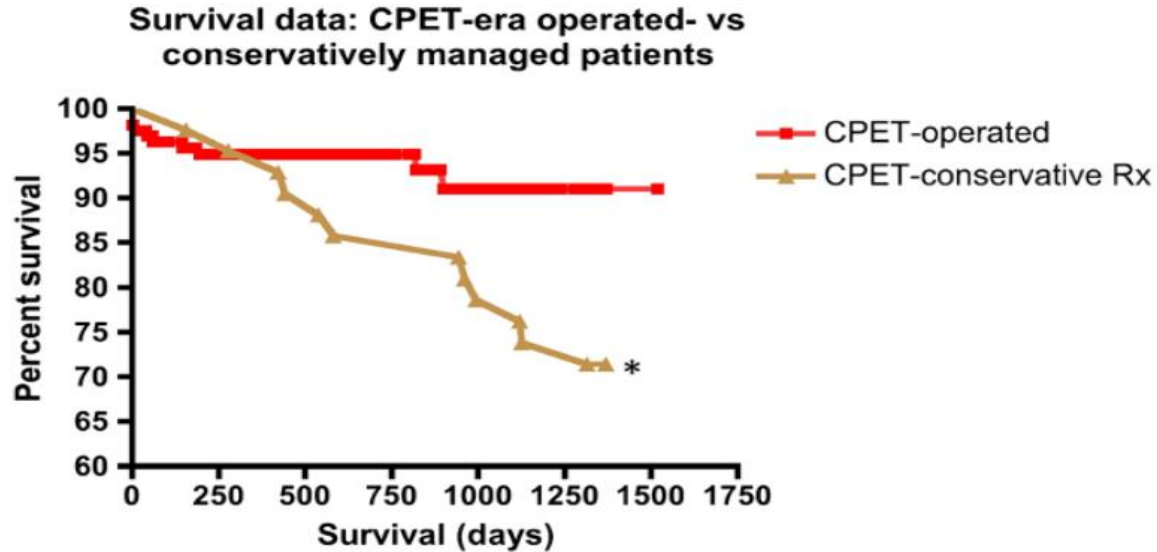


Figure 6 Kaplan–Meier survival analysis (all-cause mortality) for conservatively managed patients in the CPET era in comparison to those who underwent open or endovascular surgery. * $P < 0.05$;

Renal Insufficiency

- Moderate CRI (eGFR 30 – 60 ml/min) – Increased mortality and morbidity with OSR than EVAR.
- Severe CRI – No difference between OSR and EVAR
- Dialysis dependent – 30d mortality 11%. 1 yr survival 66%, 3 yr survival 37%.
- No role for antioxidants or remote ischemic preconditioning. +/- use of n-acetylcysteine

We suggest holding ACE inhibitors and angiotensin receptor antagonists on the morning of surgery and restarting these agents after the procedure, once euvolemia has been achieved.

Level of recommendation 2 (Weak)

Quality of evidence C (Low)

We recommend preoperative hydration in nondialysis-dependent patients with renal insufficiency before aneurysm repair.

Level of recommendation 1 (Strong)

Quality of evidence A (High)

We recommend preprocedure and postprocedure hydration with normal saline or 5% dextrose/sodium bicarbonate for patients at increased risk of CIN undergoing EVAR.

Level of recommendation 1 (Strong)

Quality of evidence A (High)

Perioperative care in open aortic vascular surgery: A consensus statement by the Enhanced Recovery After Surgery (ERAS) Society and Society for Vascular Surgery

Katharine L. McGinagle, MD, MPH,^a Emily L. Spangler, MD, MS,^b Adam C. Pichel, MB, ChB, FRCA,^c Katie Ayyash, MBChB, BSc, FRCA, MSc,^d Shipra Arya, MD, MS,^e Alberto M. Settembrini, MD,^f Joy Garg, MD,^g Merin M. Thomas, PA-C,^h Kate E. Dell, DNP, AGACNP-BC,ⁱ Iris J. Swiderski, DHSc, MPAS, PA-C,^j Fae Lindo, NP,^k Mark G. Davies, MD, PhD, MBA,^l Carlo Setacci, MD,^m Richard D. Urman, MD, MBA,ⁿ Simon J. Howell, MA, MRCP, FRCA, MSc, MD,^o Olle Ljungqvist, MD, PhD,^p and Hans D. de Boer, MD, PhD, BC,^q Chapel Hill, NC; Birmingham, AL; Manchester, York, and Leeds, UK; Palo Alto, CA; Milan, Italy; New Hyde Park, NY; Lafayette, IN; Melbourne, FL; San Antonio, TX; Siena, Italy; Boston, MA; Orebro, Sweden; and Groningen, The Netherlands

Patient information and education

Anemia screening

Nutritional deficiency

Frailty

Delirium risk

Tobacco and alcohol cessation

Medical risk

ERAS[®] Society

SVS | Society for Vascular Surgery

Functional capacity

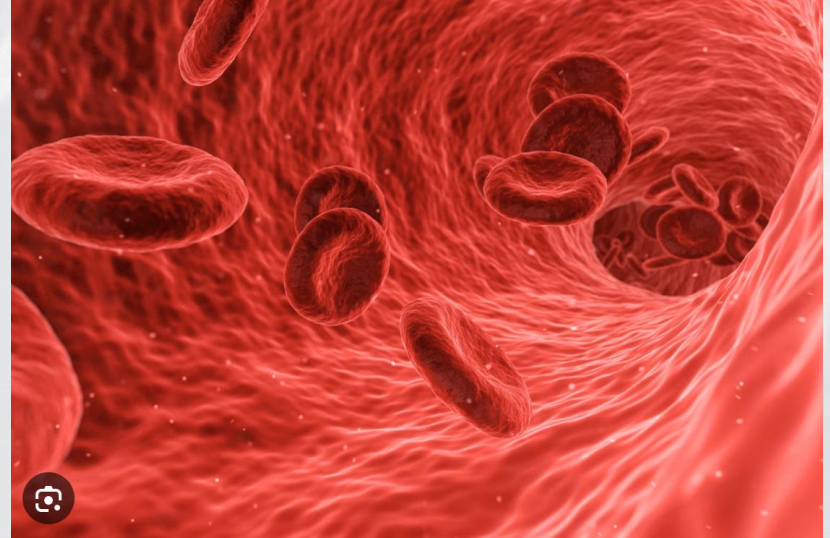
Activity level	Examples of activity level
Poor (1-3 METs)	Eating, walking at 2-3 mph, getting dressed, light housework (washing dishes)
Moderate (4-7 METs)	Climbing a flight of stairs or walking up a hill, running a short distance, heavy housework (scrubbing floors or moving furniture)
Good (7-10 METs)	Doubles tennis, calisthenics without weights, golfing without cart
Excellent (>10 METs)	Strenuous sports such as football, basketball, singles tennis, karate, jogging 10-minute mile or more, chopping wood

METs, Metabolic equivalents (1 MET = 3.5 mL kg⁻¹ min⁻¹ oxygen uptake).
 From Chaikof EL, Brewster DC, Dalman RL, Makaroun MS, Illig KA, Sicard GA, et al. The care of patients with an abdominal aortic aneurysm: the Society for Vascular Surgery practice guidelines. *J Vasc Surg* 2009;50(Suppl):S2-49; originally adapted from Hlatky MA, Boineau RE, Higginbotham MB, Lee KL, Mark DB, Califf RM, et al. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). *Am J Cardiol* 1989;64:651-4.

3. Preoperative exercise therapy and prehabilitation	Recommend 6 weeks of supervised exercise therapy before elective surgery (grade 2C)	Weak	Low
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Anemia

- Transfusion before surgery associated with increased mortality and morbidity
- Medical management and hematology consult should be obtained 4 wks before elective surgery
- No proven role for use of iron, folate or B₁₂ supplements.
- Use of erythropoietin limited by FDA: associated with adverse thrombotic event profile



Nutrition

- CMP, CBC
- Nutritional screening tool
 - MNA-SF, PNI – at risk scores should be referred for Nutritional assessment

•Screening should be performed for malnutrition and nutritional deficiencies corrected, preferably with oral regimens.

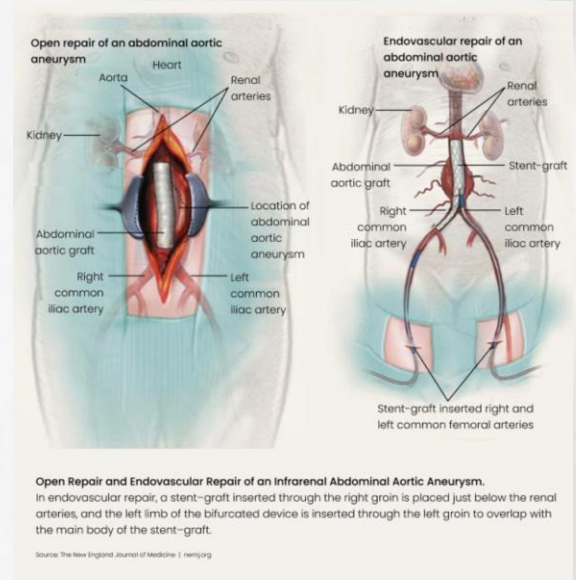
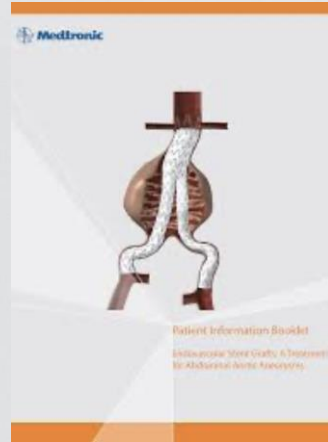
•*Quality of evidence: B (moderate)*

•*Strength of recommendation: Grade 1 (strong)*



Preoperative education

- *Recommendation:* Patients should receive dedicated verbal and written preoperative education and counseling.
 - *Quality of evidence:* C (low)
 - *Strength of recommendation:* Grade 1 (strong)



Delirium

- Associated with prolonged hospital stay, non-home discharge, and increased mortality.
- Estimated 1/3 of cases can be avoided by prevention strategies.
- Identify risk factors pre-operatively;
 - Advanced age
 - Cognitive dysfunction/dementia
 - Use of psychotropic medications, regular EtOH or tobacco use.
 - History of stroke, CRI





Frailty

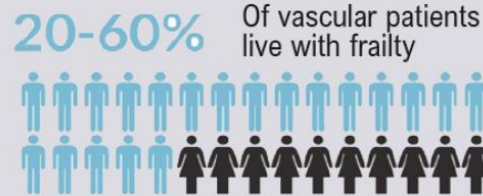
- **Frailty** - Geriatric syndrome of decreased physiologic reserve and impaired resiliency to stressors.
- **Disability** – impaired ability to carry out functional tasks.

Frailty

Figure 4 The implications of frailty in vascular surgery outcomes.^{1,31,39}

FRAILITY IN VASCULAR SURGERY

THE PROBLEM



Compared to robust patients, frail vascular patients have:

4.8 x greater **30-day mortality**

4.0 x greater **5 year mortality**

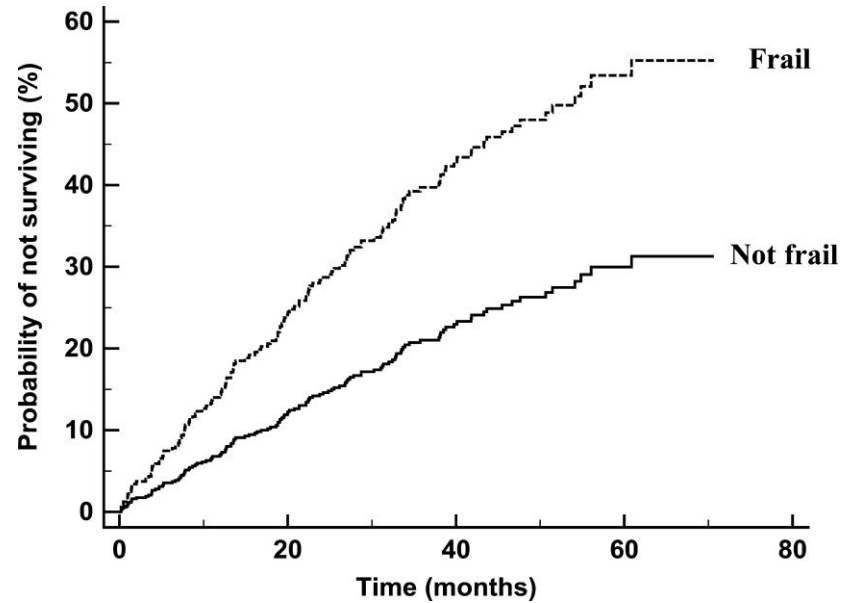
2.2 x greater **post-operative complication**

3.6 x greater **non-home discharge**

2.3 x greater **risk of amputation**

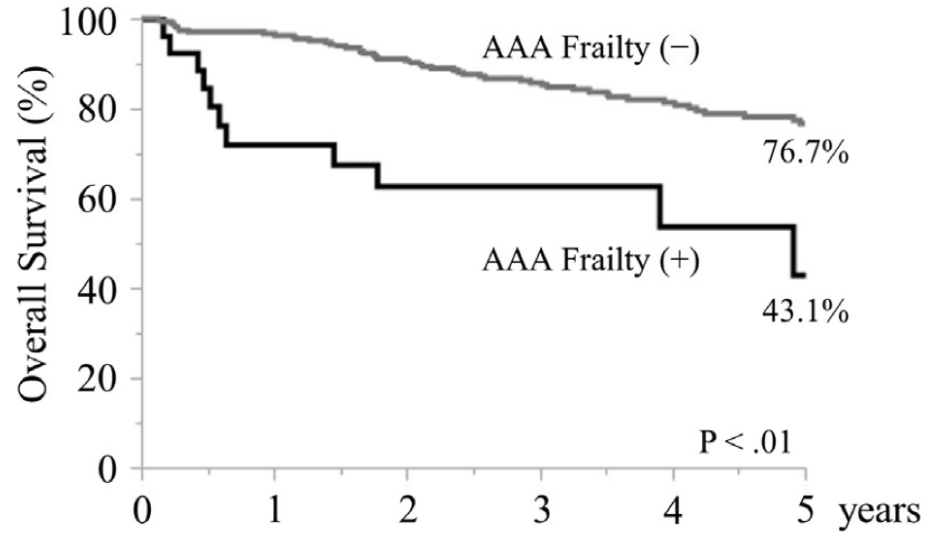


- Do first impressions count? Frailty judged by initial clinical impression predicts medium-term mortality in vascular surgical patients




Frailty

A



Morisaki, et al JVS 2020

CLINICAL FRAILTY SCALE

	1	VERY FIT	People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age.
	2	FIT	People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally , e.g., seasonally.
	3	MANAGING WELL	People whose medical problems are well controlled , even if occasionally symptomatic, but often are not regularly active beyond routine walking.
	4	LIVING WITH VERY MILD FRAILITY	Previously "vulnerable," this category marks early transition from complete independence. While not dependent on others for daily help, often symptoms limit activities . A common complaint is being "slowed up" and/or being tired during the day.
	5	LIVING WITH MILD FRAILITY	People who often have more evident slowing , and need help with high order instrumental activities of daily living (finances, transportation, heavy housework). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, medications and begins to restrict light housework.



6

LIVING WITH MODERATE FRAILITY

People who need help with all **outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.



7

LIVING WITH SEVERE FRAILITY

Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~6 months).



8

LIVING WITH VERY SEVERE FRAILITY

Completely dependent for personal care and approaching end of life. Typically, they could not recover even from a minor illness.



9

TERMINALLY ILL

Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise living with severe frailty**. (Many terminally ill people can still exercise until very close to death.)

SCORING FRAILITY IN PEOPLE WITH DEMENTIA

The degree of frailty generally corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting. In **severe dementia**, they cannot do personal care without help. In **very severe dementia** they are often bedfast. Many are virtually mute.



DALHOUSIE UNIVERSITY

Clinical Frailty Scale ©2005–2020 Rockwood, Version 2.0 (EN). All rights reserved. For permission: www.geriatricmedicineresearch.ca
Rockwood K et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489–495.

A classification tree to assist with routine scoring of the Clinical Frailty Scale

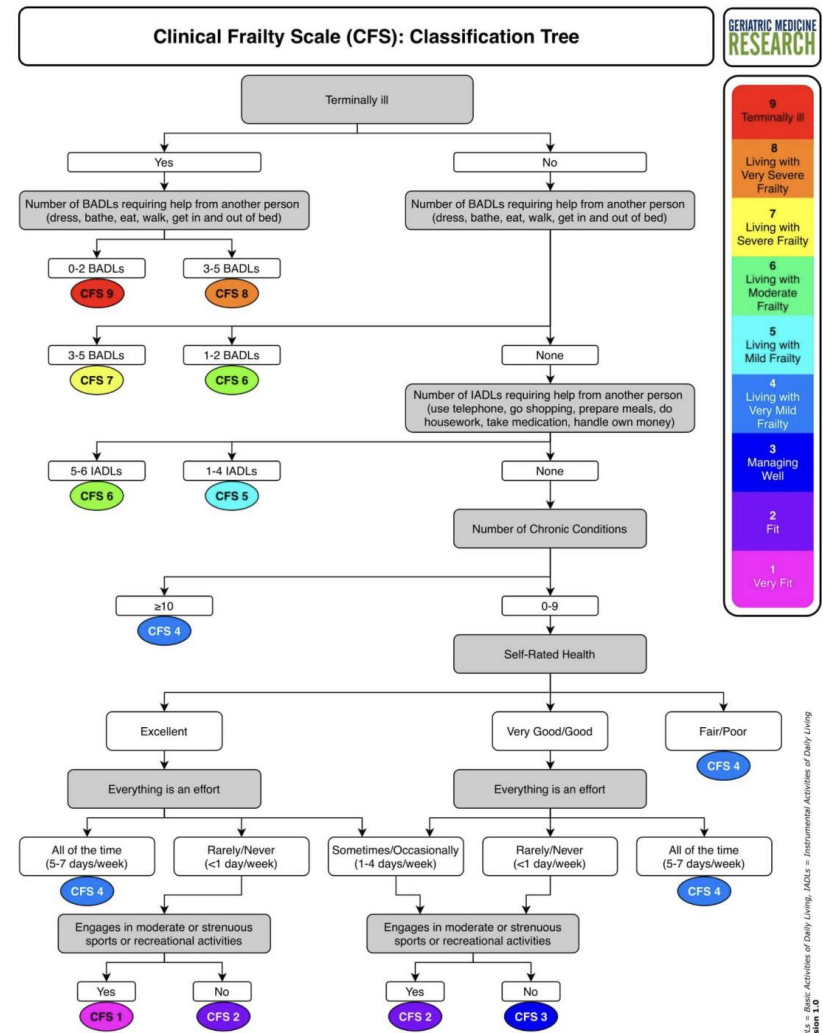
OLGA THEOU^{1,2,3}, MARIO ULISES PÉREZ-ZEPEDA^{2,3}, ALEXANDRA M. VAN DER VALK³, SAMUEL D. SEARLE³, SUSAN E. HOWLETT^{2,4}, KENNETH ROCKWOOD^{2,3}

Canadian Study, 2021

Resource allocation tool and for care rationing.

Comparison between experienced and Inexperienced clinicians

Found good correlation: ICC = 0.83



Methods

77 consecutive patients



Composite 30-Day Outcome

Respiratory complications, anastomotic leak, delirium, length of stay ≥ 14 days, discharge to nursing facility, hospital readmission, and mortality

Conclusion

Esophagectomy
Vitality Index

- Age
- Patient exhaustion
- Grip strength
- 30-second chair sit-stands
- Psoas muscle area/height
- 6-min walk distance

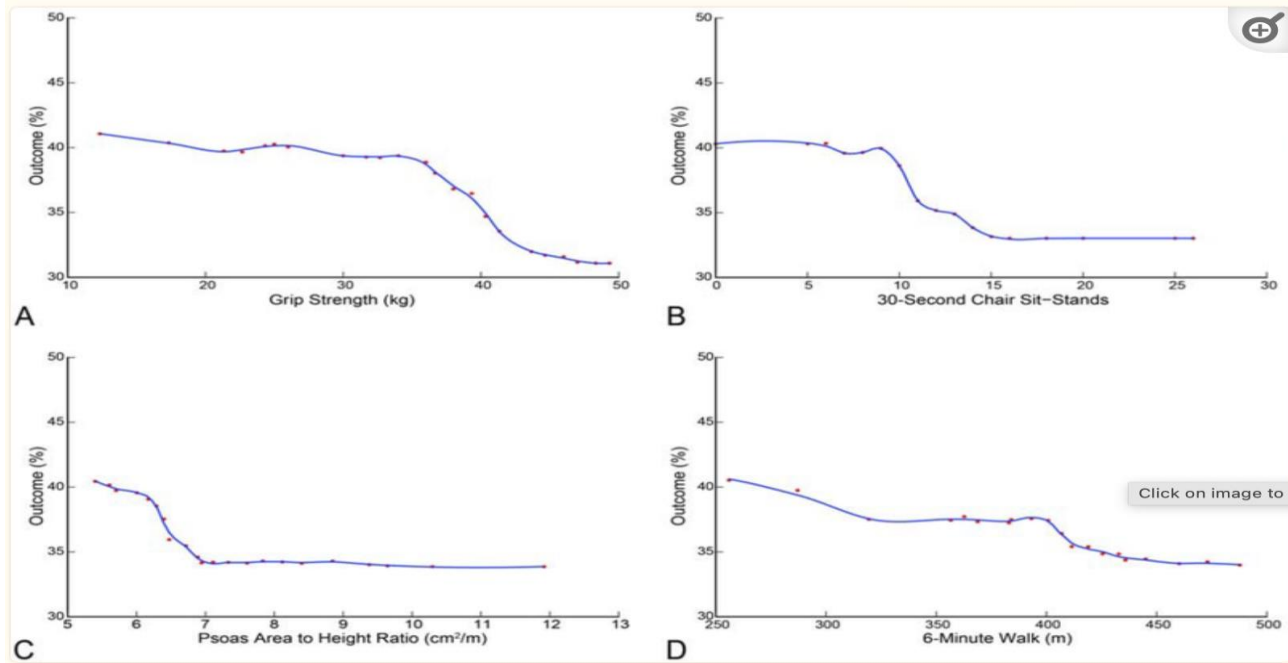
G-Mean Error

Esophagectomy Vitality Index	32%
Fried Frailty Index	37%
Modified Frailty Index	48%

Looking Beyond the Eyeball Test: A Novel Vitality Index to Predict Recovery after Esophagectomy

[Andrew Tang](#), MD,¹ [Usman Ahmad](#), MD,¹ [Siva Raja](#), MD, PhD,¹ [Jesse Rappaport](#), MD,¹ [Daniel P. Raymond](#), MD,¹ [Monisha Sudarshan](#), MD, MPH,¹ [Alejandro C. Bribrisco](#), MD,¹ [Eugene H. Blackstone](#), MD,^{1,2} and [Sudish C. Murthy](#), MD, PhD¹

EVI Risk Adjusted complication estimates



Frailty risk assessment

A combination of Frailty and disability evaluation along with a surgical risk calculator (ie SVS VQI tool) provides the best assessment of peri and post-operative risk.



Table 2. Nagi Scale

Significant disability is defined as any difficulty performing 3 or more of these items

1. Pulling or pushing a large object like a living room chair
2. Bending over, crouching, or kneeling
3. Raising your arms over your head
4. Picking up or handling small objects with your fingers
5. Lifting something that weights >10 pounds (5 kilos)
6. Walking up or down a flight of stairs
7. Walking 1 mile (1.5 km)

Long term survival in patients randomized in the EVAR-2 trial

- Cohort of patients deemed to have a limited life expectancy or extensive comorbidities that AAA repair should not be considered.
- Good clinical judgement: 60% mortality at 4y, and 80% at 8y.
- 20% survived at 8 years. “... although physically frail and ineligible for OR, (this group) may have many life-years ahead and might benefit from EVAR, particularly if conducted under local anesthesia. “
- “... at no time did aneurysm repair confer an overall survival benefit.”

Hippocrates

It is more important to know what sort of person has a disease than to know what sort of disease a person has.



*The best interest of the
patient is the only interest
to be considered.*

William J. Mayo, M.D. – 1910

*This statement is the inspiration for the primary value of Mayo Clinic,
The Needs of the Patient Come First.*

