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Cardiovascular risk in patients undergone orthopedic surgery

SIMPOSIO SIGG-ESC

**COUNCIL FOR CARDIOLOGY PRACTICE and
WORKING GROUP ON CARDIOVASCULAR PHARMACOTHERAPY**

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19 Dicembre 2025

Incidence of major adverse cardiac events following non-cardiac surgery

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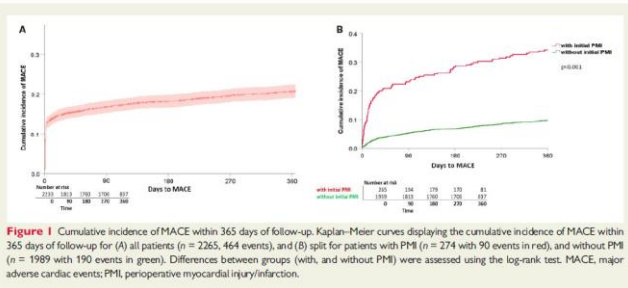


Figure 1 Cumulative incidence of MACE within 365 days of follow-up. Kaplan-Meier curves displaying the cumulative incidence of MACE within 365 days of follow-up for (A) all patients (n = 2265, 464 events), and (B) split for patients with PPI (n = 274 with 90 events in red), and without PPI (n = 1989 with 190 events in green). Differences between groups (with, and without PPI) were assessed using the log-rank test. MACE, major adverse cardiac events; PPI, perioperative myocardial injury/infarction.

Patients developing MACE were:

- older,
- more often had a history of cardiac disease,
- cardiovascular risk factors,
- chronic kidney disease, active cancer
- more often underwent emergency surgery.

Moreover, the incidence of MACE differed according to surgical speciality.

Table 1 Baseline characteristics shown for all patients and classified according to the occurrence of MACE within 30 days after surgery

	Overall (n = 2265; 100%)	No 30-day MACE (n = 1921; 84.8%)	30-day MACE (n = 344; 15.2%)	p-value
Age (years)	73 (68–79)	73 (68–79)	77 (70–82)	<0.001
Sex, male	1281 (56.6)	1086 (56.7)	192 (55.8)	0.77
Medical history				
Coronary artery disease	621 (27.4)	489 (25.5)	132 (38.4)	<0.001
Prior myocardial infarction	303 (13.4)	230 (12.0)	73 (21.2)	<0.001
Congestive heart failure	244 (10.9)	177 (9.2)	67 (20.7)	<0.001
Atrial fibrillation	340 (15.0)	251 (13.1)	89 (25.9)	<0.001
Valvular heart disease	249 (11.0)	180 (9.4)	69 (20.1)	<0.001
Peripheral artery disease	385 (17.0)	298 (15.5)	87 (25.3)	<0.001
Prior stroke	210 (9.3)	173 (9.0)	37 (10.8)	0.31
Hypertension	1453 (64.2)	1209 (62.9)	244 (70.9)	0.005
Diabetes mellitus	521 (23.0)	410 (21.3)	111 (32.3)	<0.001
Chronic kidney disease (CKD ≥ III)	330 (14.6)	236 (12.3)	94 (27.3)	<0.001
Active cancer	568 (25.1)	501 (26.1)	67 (19.5)	0.008
Type of surgery				<0.001
Elective surgery	1492 (65.9)	1306 (68.0)	186 (54.13)	
Urgent surgery (>24 h)	339 (15.0)	265 (13.8)	74 (21.5)	
Emergency surgery (≤24 h)	434 (19.2)	350 (18.2)	84 (24.4)	
Surgical speciality				<0.001
Orthopaedic	262 (11.6)	219 (11.4)	43 (12.5)	
Trauma	417 (18.4)	338 (17.6)	79 (23.0)	
Spinal	355 (15.7)	309 (16.1)	46 (13.4)	
Thoracic	192 (8.5)	149 (7.8)	43 (12.5)	
Urologic	358 (15.8)	327 (17.0)	31 (9.0)	
Vascular	279 (12.3)	220 (11.5)	59 (17.2)	
Visceral	316 (14.0)	286 (14.9)	30 (8.7)	
Other	86 (3.8)	73 (3.8)	13 (3.8)	

Continuous variables are presented as medians (1st and 3rd quartile), categorical variables are presented as numbers (%). Continuous variables were compared with the Mann-Whitney U test, and categorical variables with the Fisher's exact test.

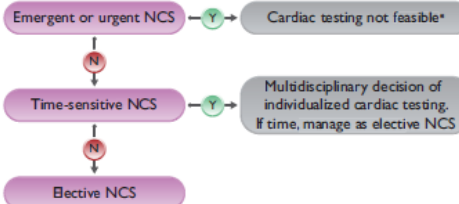
CKD, FPL, chronic kidney disease-epidemiology collaboration; MACE, major adverse cardiac events

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery

Developed by the task force for cardiovascular assessment and management of patients undergoing non-cardiac surgery of the European Society of Cardiology (ESC)

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Management of patients before non-cardiac surgery (NCS)



Accurate history and clinical examination, including standard lab tests (Class I)

Advise on stopping smoking, optimize guideline-recommended medical therapy (Class I)

<65 years without any CVD/CV risk factors*

≥65 years or with CV risk factors*

Patients with established CVD

Low-risk NCS
None

Low-risk NCS
None

Low-risk NCS
None (see section 6)

Intermediate-risk NCS
None

Intermediate-risk NCS
ECG, biomarkers^b (Class I)

Intermediate-risk NCS
ECG, biomarkers^b (Class I)

Functional capacity^c (Class IIa)

Functional capacity^c (Class IIa)

(see section 6)

High-risk NCS
In patients >45 year, consider:
ECG, biomarkers^b
(Class IIa)

High-risk NCS
ECG, biomarkers^b (Class I)

High-risk NCS
ECG, biomarkers^b (Class I)

Functional capacity^c (Class IIa)

Functional capacity^c (Class IIa)

+ cardiology consultation^d
(see section 6)
Multidisciplinary decision

Risk reduction (Surgery)



Surgery-related risk

High risk

Moderate risk

Low risk

Patient-related risk

Low risk

Moderate risk

High risk

Increased attention

High attention

Consider postponing or avoiding

Attention

Increased attention

High attention

Attention

Attention

Increased attention

CV risk reduction (Patient)

Table 5 Surgical risk estimate according to type of surgery or intervention

Low surgical risk (<1%)	Intermediate surgical risk (1–5%)	High surgical risk (>5%)
<ul style="list-style-type: none"> Breast Dental Endocrine: thyroid Eye Gynaecological: minor Orthopaedic minor (meniscectomy) Reconstructive Superficial surgery Urological minor: (transurethral resection of the prostate) VATS minor lung resection 	<ul style="list-style-type: none"> Carotid asymptomatic (CEA or CAS) Carotid symptomatic (CEA) Endovascular aortic aneurysm repair Head or neck surgery Intraperitoneal: splenectomy, hiatal hernia repair, cholecystectomy Intrathoracic non-major Neurological or orthopaedic: major (hip and spine surgery) Peripheral arterial angioplasty Renal transplants Urological or gynaecological: major 	<ul style="list-style-type: none"> Adrenal resection Aortic and major vascular surgery Carotid symptomatic (CAS) Duodenal-pancreatic surgery Liver resection, bile duct surgery Oesophagectomy Open lower limb revascularization for acute limb ischaemia or amputation Pneumonectomy (VATS or open surgery) Pulmonary or liver transplant Repair of perforated bowel Total cystectomy

CAS, carotid artery stenting; CEA, carotid endarterectomy; CV, cardiovascular; MI, myocardial infarction; VATS, video-assisted thoracic surgery.

Surgical risk estimate is a broad approximation of 30 day risk of CV death, MI, and stroke that takes into account only the specific surgical intervention, without considering the patient's comorbidities.

Adapted from data in Glance et al., Muller et al., Bendixen et al., and Falcoz et al.^{18–23}

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Recommendations in 2022 version

Class

In patients who have known CVD or CV risk factors (including age ≥ 65 years), or symptoms or signs suggestive of CVD it is recommended to obtain a pre-operative 12-lead ECG before intermediate- or high-risk NCS.

I

In patients who have known CVD, CV risk factors (including age ≥ 65 years), or symptoms suggestive of CVD, it is recommended to measure hs-cTn T or hs-cTn I before intermediate- and high-risk NCS, and at 24 h and 48 h afterwards.

I

In patients who have known CVD, CV risk factors (including age ≥ 65 years), or symptoms suggestive of CVD, it should be considered to measure BNP or NT-proBNP before intermediate- and high-risk NCS.

IIa

In low-risk patients undergoing low- and intermediate-risk NCS, it is not recommended to routinely obtain pre-operative ECG, hs-cTn T/I, or BNP/NT-proBNP concentrations.

III

What is new



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Recommendations for pre-operative assessment of frailty and functional capacity

Recommendations	Class ^a	Level ^b
In patients aged ≥ 70 years and scheduled to undergo intermediate- or high-risk NCS, frailty screening should be considered using a validated screening tool. ^{84–87,90,91}	Ila	B
Adjusting risk assessments according to self-reported ability to climb two flights of stairs should be considered in patients referred for intermediate- or high-risk NCS. ⁹⁴	Ila	B

Table 3 New concepts and sections in the current guidelines

A new flowchart for general assessment of patients before NCS.

A new section on pre-operative assessment of patients with newly detected murmurs, dyspnoea, oedema, or angina.

A new section on the patient perspective.

A new section on assessment of frailty.

A revised and expanded focus on use of biomarkers in NCS

A revised and expanded section on peri-operative management of antiplatelet therapy.

A revised and expanded section on peri-operative management of oral anticoagulants.

A new section on peri-operative thromboprophylaxis.

A dedicated section on patient blood management.

A new section on management of cardiovascular risk in patients with cancer undergoing NCS.

A small section on NCS in patients with recent COVID-19.

A new section on diagnosis and management of post-operative complications during NCS.

Table S2 The Frail phenotype

Frail phenotype criteria	Measurement
Weakness	Grip strength: lowest 20% (by sex, BMI)
Slowness	Walking time/15 feet: slowest 20% (by sex, height)
Low level of physical activity	Kcal/week: lowest 20% <ul style="list-style-type: none"> • Males: 383 kcal/week • Females: 270 kcal/week
Exhaustion; poor endurance	'Exhaustion' (self-report)
Weight loss	>10 lb lost unintentionally in previous year

BMI, body mass index.
Adapted from Fried et al.²

Table S3 The Mini-Cog®

Instructions for Administration and Scoring		ID: _____	Date: _____
Step 1: Three word registration			
Look directly at person and say, 'Please listen carefully. I am going to say three words that I want you to repeat back to me now and try to remember. The words are [select a list of words from the versions below]. Please say them for me now'. If the person is unable to repeat the words after three attempts, move on to Step 2 (clock drawing). The following and other word lists have been used in one or more clinical studies. ³⁻⁵ For repeated administrations, use of an alternative word list is recommended.			
Version 1	Version 2	Version 3	Version 4
Banana	Leader	Village	River
Sunrise	Season	Kitchen	Nation
Chair	Table	Baby	Finger
Version 5	Version 6		
Captain	Daughter		
Garden	Heaven		
Picture	Mountain		
Step 2: Clock drawing			
Say: 'Next, I want you to draw a clock for me. First, put in all of the numbers where they go.' When that is completed, say: 'Now, set the hands to 10 past 11'. Use the pre-printed circle (see next page) for this exercise. Repeat instructions as needed as this is not a memory test. Move to Step 3 if the clock is not complete within 3 min.			
Step 3: Three words recall			
Ask the person to recall the three words you stated in Step 1. Say: 'What were the three words I asked you to remember?' Record the word list version number and the person's answers below. Word list version: _____ Person's answers: _____			
Scoring			
Word recall: _____ (0-3 points)	1 point for each word spontaneously recalled without cueing.		
Clock drawing: _____ (0 or 2 points)	Normal clock = 2 points. A normal clock has all numbers placed in the correct sequence and approximately correct position (eg. 12, 3, 6, and 9 are in anchor positions) with no missing or duplicate numbers. Hands are pointing to the 11 and 2 (11:10). Hand length is not scored. Inability or refusal to draw a clock (abnormal) = 0 points.		
Total score: _____ (0-5 points)	Total score = word recall score + clock drawing score. A cut point of <3 on the Mini-Cog™ has been validated for dementia screening, but many individuals with clinically meaningful cognitive impairment will score higher. When greater sensitivity is desired, a cut point of <4 is recommended, as it may indicate a need for further evaluation of cognitive status.		

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery

Supplementary data

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2.1. Risk scores

2.1.1. Frailty

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

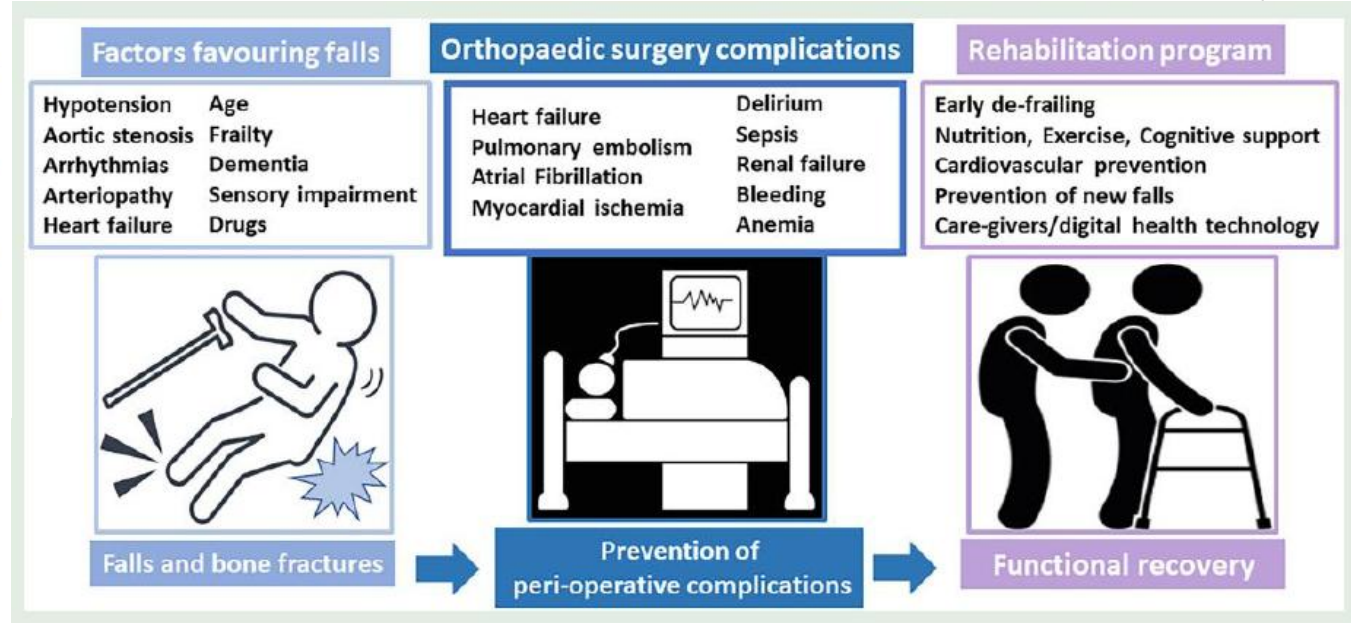
7 Living with severe frailty Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~6 months).
- 

8 Living with very severe frailty 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).
- 

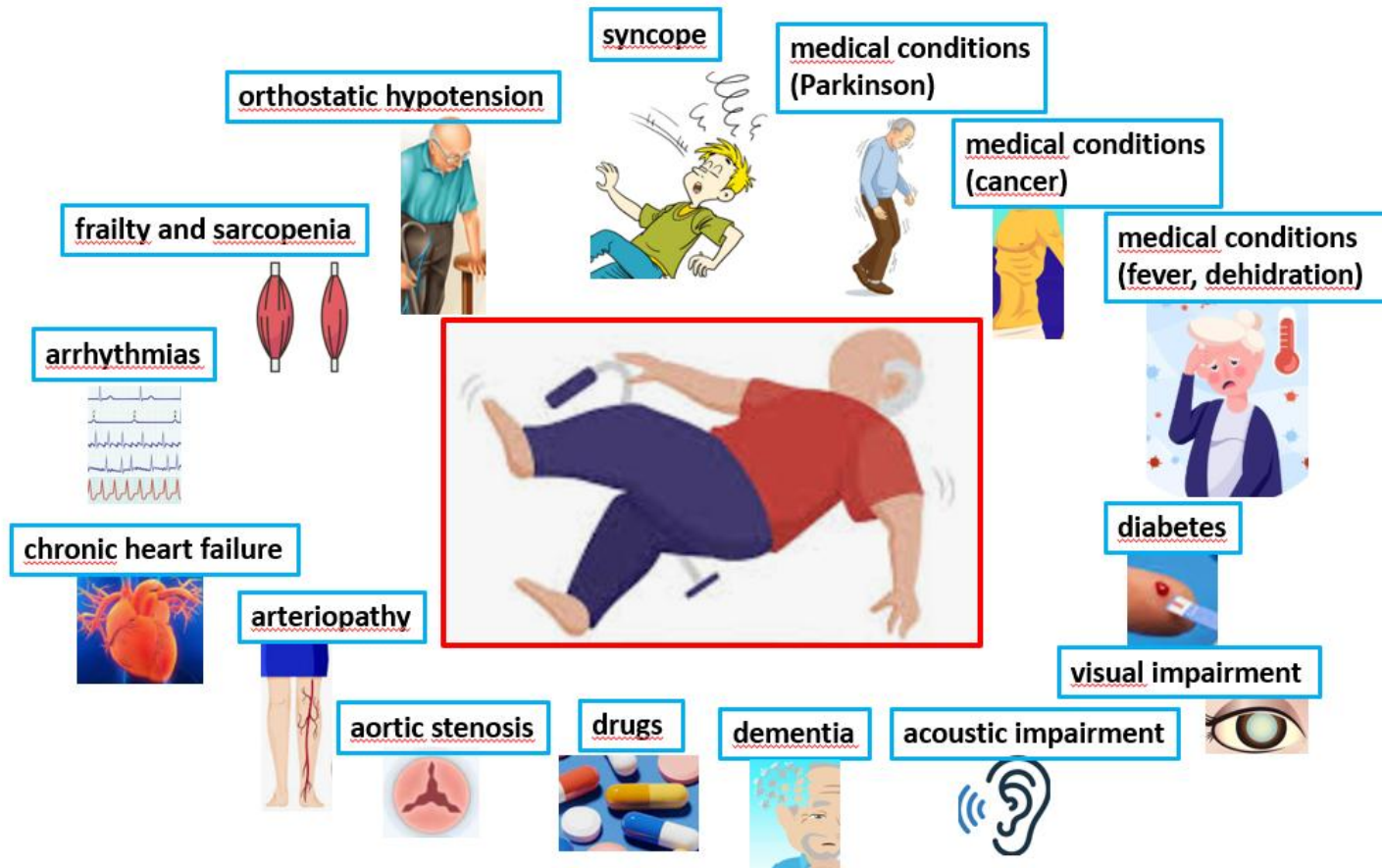
9 Terminally ill Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise living with severe frailty. (Many terminally ill people can still exercise until very close to death).

Cardiovascular diseases, prevention, and management of complications in older adults and frail patients treated for elective or post-traumatic hip orthopaedic interventions: a clinical consensus statement of the ESC Council for Cardiology Practice (CCP), the European Association of Preventive Cardiology (EAPC), the Association for Acute CardioVascular Care (ACVC), the Association of Cardiovascular Nursing & Allied Professions of the ESC (ACNAP), the ESC Working Group on Aorta and Peripheral Vascular Diseases (WG APVD), and the ESC Working Group on Thrombosis (WG T)

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Fattori predisponenti cadute



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Focus on CVD →

Focus on frailty →

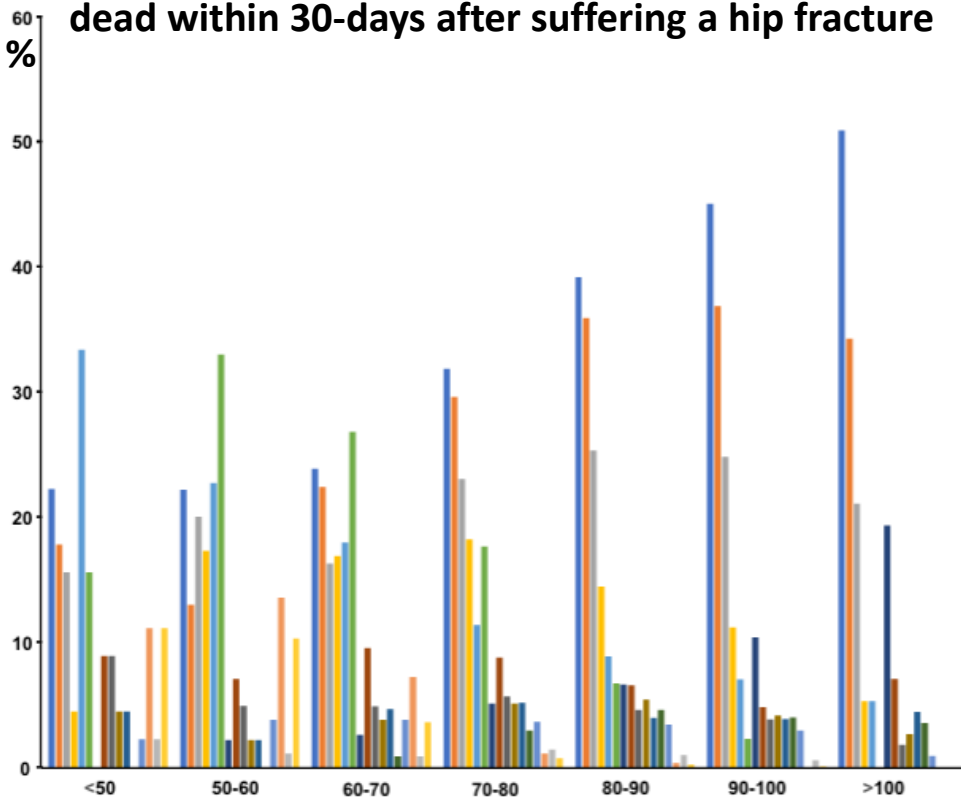
Box 1 Clinical consensus statement—Check list before surgery

C

- Is a cardiovascular disease the cause of fall leading to a hip fracture? If so, does it need to be resolved urgently and/or to be closely monitored after surgery?
- Consider specific issues in patients with known cardiovascular disease.
 - peri-operative management of antithrombotic drugs—short interruption of some cardiovascular drugs (e.g. diuretics, RAAS inhibitors, SGLT2 inhibitors).
 - fluid management in heart failure patients.
 - identify the potential need for cardiovascular postoperative follow-up or monitoring.
 - pre- and postoperative management plan for cardiovascular diseases.
 - preventive measures and optimization of guideline recommended therapy.
- Consider evaluation for frailty.
- Consider evaluation for risk of delirium.
- Is it possible to target frailty for treatment before intervention and /or schedule interventions soon after surgery?

Causes of death among 93.637 hip fracture patients– data based on the Danish National Registry of causes of death

dead within 30-days after suffering a hip fracture



- Fracture related diagnosis
- Cardiovascular disease
- Pneumonia
- Pulmonary disease, unspecified
- Other non specified disease
- Cancer
- Frailty
- Infection (except pneumonia)
- Gastrointestinal disease
- Stroke
- Thromboembolic disease
- Dementia
- Kidney disease
- Hepatic disease
- Diabetes
- Alcohol abuse

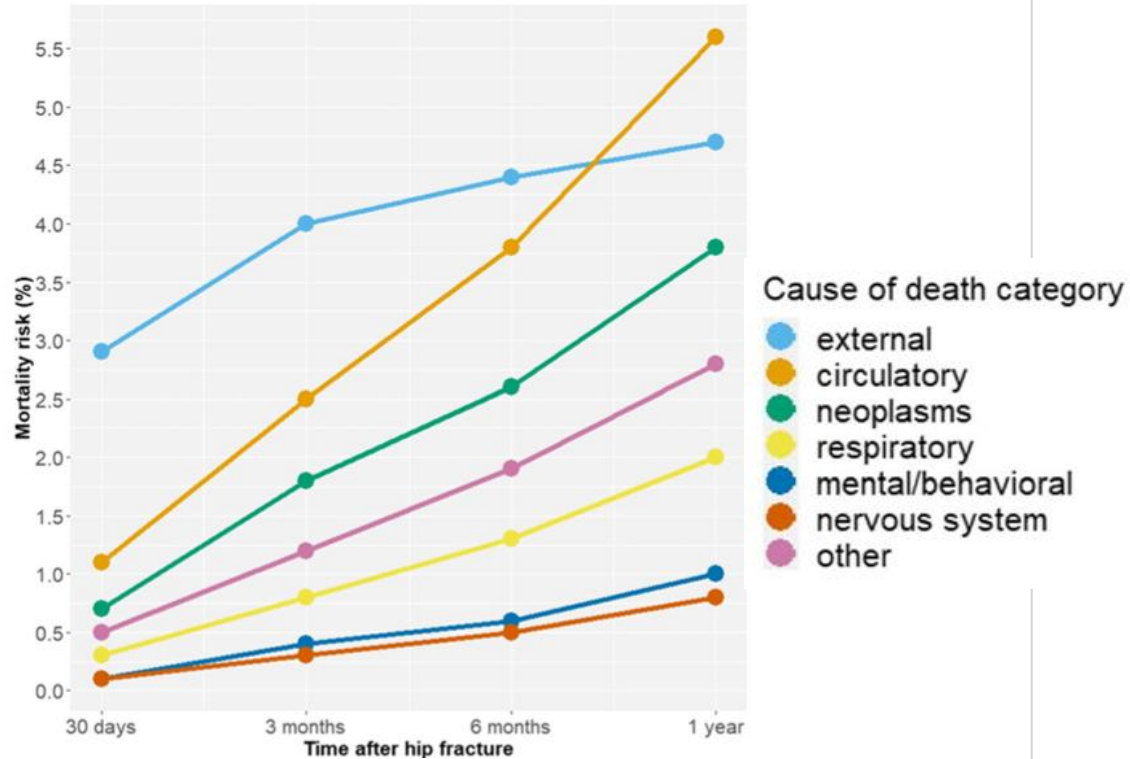
Age groups

Over the 70 y of age the most frequent causes of death were CVD and pneumonia apart from fracture-related diagnosis (which becomes the most frequently registered cause of death due to the outline of the death certificates)

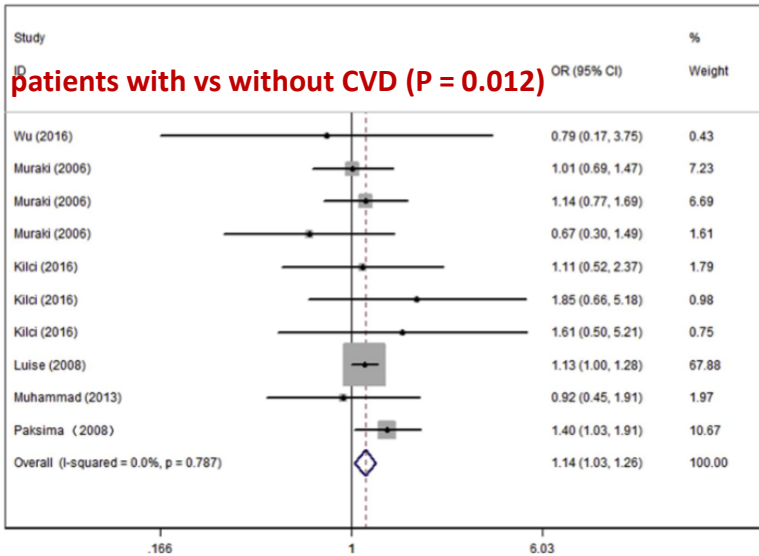
Cause-specific excess mortality after hip fracture: the Norwegian Epidemiologic Osteoporosis Studies (NOREPOS)

- Of 146,132 Norwegians with a first hip fracture, a total of 35,498 (24.3%) died within one year
- hazard specific one-year relative mortality in hip fracture patients vs. population controls ranged from 1.5 for circulatory diseases to 2.5 for diseases of the nervous system in women, and correspondingly, from 2.4 to 5.3 in men.

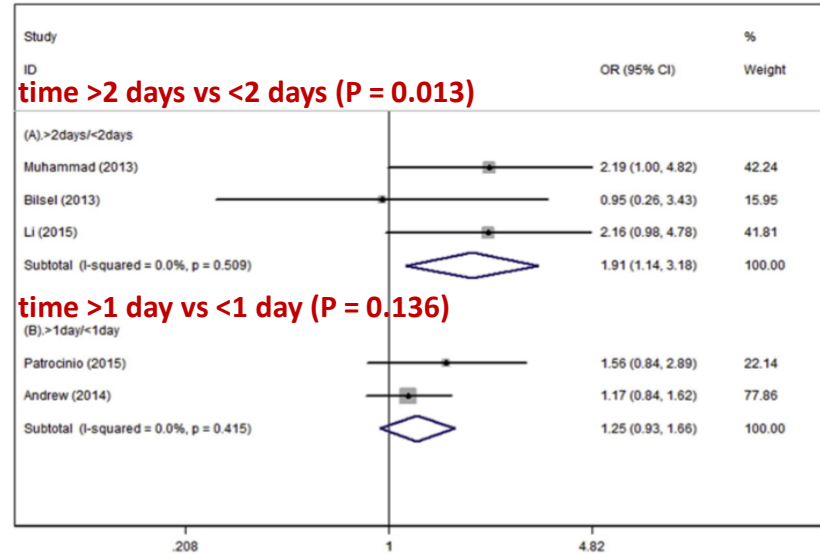
The excess CVD mortality lasts throughout the year following hip fracture



6 studies involving 14 297 pts considered the presence of cardiovascular disease



5 studies with 4770 pts examined the relationship between the time to surgery and mortality after hip fracture



Risk of post-operative cardiovascular event in elderly patients with pre-existing cardiovascular disease who are undergoing hip fracture surgery

Risk of post-operative CVD events in patients with and without pre-existing CVD in the matched cohort

	Patients with pre-existing CVD			Patients without pre-existing CVD			Crude OR (95% CI)	Adjusted OR (95% CI) ^a
	n	No. of events	Risk per 1000 persons	n	No. of events	Risk per 1000 persons		
Primary endpoint								
Post-operative cardiovascular events [†]	858	40	46.6 (33.5–62.9)	858	14	16.3 (8.9–27.2)	2.857 (1.554–5.251)	2.850 (1.138–7.139)
Secondary endpoints								
Overall cardiovascular system-related events [‡]	858	107	124.7 (102.6–146.8)	858	30	35.0 (23.7–49.5)	3.750 (2.472–5.690)	3.679 (2.115–6.399)
Stroke	858	32	37.3 (25.6–52.2)	858	8	9.3 (4.0–18.3)	4.000 (1.843–8.680)	5.618 (1.386–19.271)
Myocardial Infarction	858	6	7.0 (1.4–12.6)	858	4	4.7 (1.3–11.9)	1.500 (0.423–5.315)	-

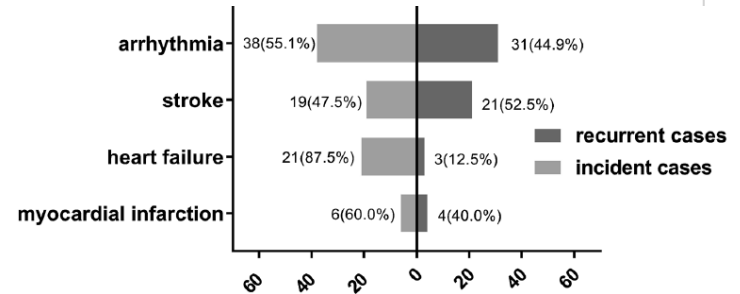
CVD, cardiovascular diseases; OR, odds ratio; CI, confidence interval

[†]Post-operative cardiovascular events, including post-operative myocardial infarction, stroke, and cardiovascular-related death

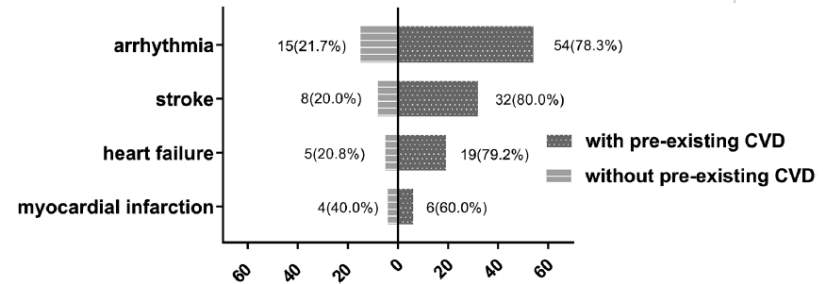
[‡]Overall cardiovascular system-related events, including post-operative pulmonary embolism, angina pectoris, myocardial infarction, heart failure, arrhythmia, stroke and cardiovascular-related death

^aAdjusted factors: age, body mass index, time from fracture to surgery, and comorbidities including type 2 diabetes, hypertension, chronic obstructive pulmonary disease, stroke sequelae, dementia, tumour, and the Charlson Comorbidity Index

Recurrent cases and new cases for post-operative arrhythmia, stroke, heart failure, and MI



Cases in pts with history of any pre-existing CVD



Pre-existing CVD was a great risk factor for developing postoperative CV events

Nearly 80% of patients who experienced post-operative CV events had at least one pre-existing CVD

Effects of Frailty on Outcomes Following Surgery Among Patients With Hip Fractures: A Systematic Review and Meta-Analysis

- (i) the study was a cohort study;
 - (ii) patients with hip fractures in adults (age>18Y);
 - (iii) patients were assessed for frailty;
 - (iv) studies must report at least one of the following outcomes: mortality or postoperative complications or 30 days readmission.
- Search: “frailty” OR “frail.”

12 retrospective cohort studies
 7 prospective cohort studies
 Total: 62,132 patients (16,789 frail)

frailty was associated with:
in-hospital mortality
30-day mortality
one-year mortality

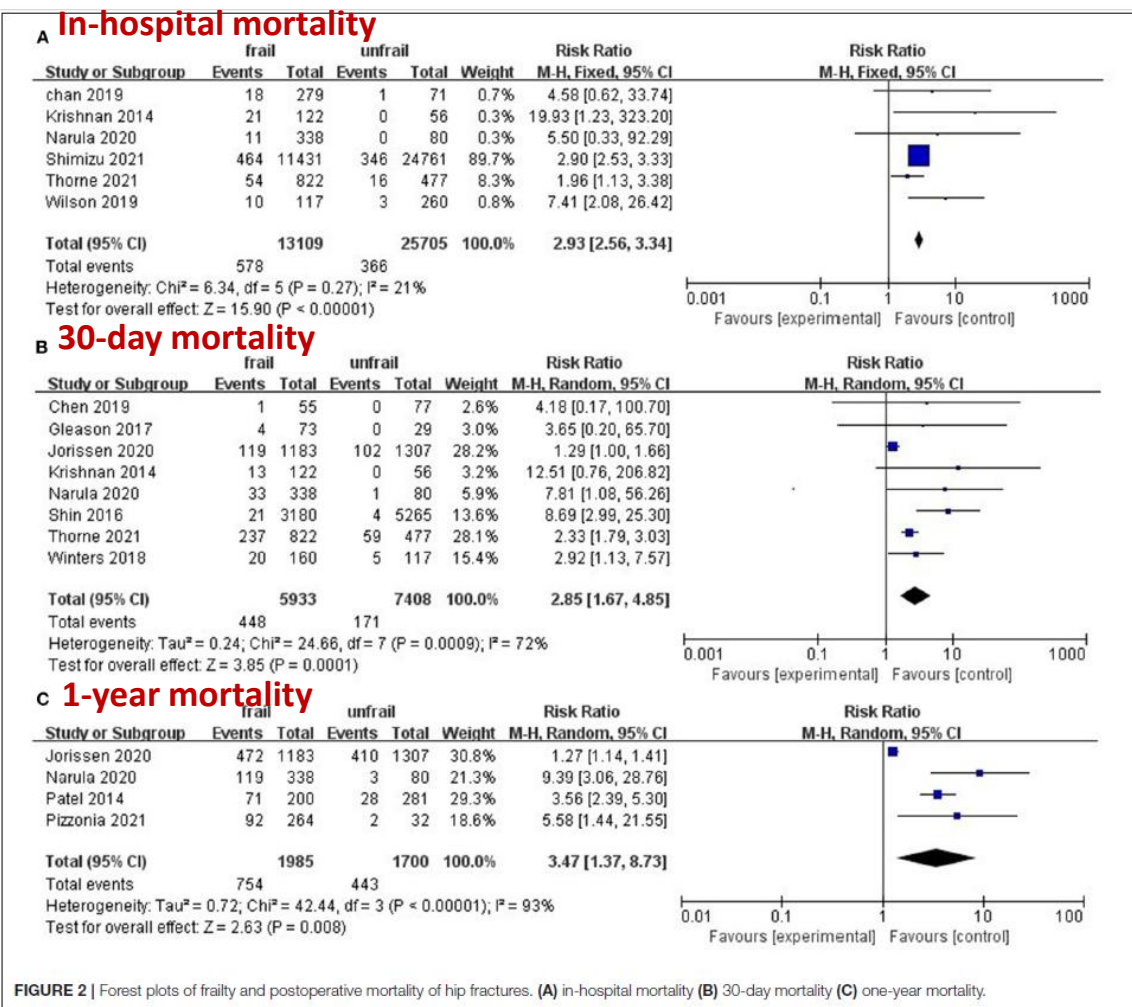


FIGURE 2 | Forest plots of frailty and postoperative mortality of hip fractures. (A) in-hospital mortality (B) 30-day mortality (C) one-year mortality.

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Box 2 Clinical consensus statement—focus on frailty in the acute phase of hip surgery

- When common tests to evaluate frailty cannot be used in hip surgery patients, advised alternatives are:
 - handgrip strength measured using a portable dynamometer,
 - muscle mass measured using the clinical CT images, and
 - a gradation of self-reported disability and vitality as measured by the Clinical Frailty Scale.
- It is advisable to screen for cognitive function, social support, mood, and nutrition using questionnaires and biomarkers such as haemoglobin and albumin and to use the Nottingham Hip Fracture Score which includes various frailty domains.
- ‘De-frailing’ multifaceted interventions focused on prehabilitation (when feasible) or early mobilization, protein-rich oral nutritional supplementation, cognitive stimulation, and polypharmacy reconciliation may be implemented before elective procedures, during the index hospitalization, or soon after surgery.

Nottingham Hip fracture Score

Seven independent predictors of mortality incorporated into a risk score:

- age (66-85 and ≥ 86 yr);
- sex (male);
- number of **co-morbidities** (≥ 2),
- admission **mini-mental test score** (≤ 6 out of 10),
- admission **haemogl concentration** (≤ 10 g dl(-1)),
- living in an **institution**,
- the presence of malignancy.

Total NHFS scores: between 0 and 14, with a median of 4.

NHFS ≤ 4 (low risk) and >4 (high risk)

Able to predict: 30 day mortality, 1-y mortality, morbidity and LOS

Development and validation of a preoperative scoring system to predict 30 day mortality in patients undergoing hip fracture surgery

M. J. Maxwell¹, C. G. Moran² and I. K. Moppett^{1*}

British Journal of Anaesthesia 106 (4): 501-4 (2011)
Advance Access publication 28 January 2011 · doi:10.1093/bja/aeq405

CLINICAL PRACTICE

Nottingham Hip Fracture Score as a predictor of one year mortality in patients undergoing surgical repair of fractured neck of femur

M. D. Wiles^{1*}, C. G. Moran², O. Sahota³ and I. K. Moppett¹

Calcified Tissue International (2020) 107:319-326
<https://doi.org/10.1007/s00223-020-00722-2>

ORIGINAL RESEARCH



The Ability of the Nottingham Hip Fracture Score to Predict Mobility, Length of Stay and Mortality in Hospital, and Discharge Destination in Patients Admitted with a Hip Fracture

Radcliffe Lisk¹ · Keefai Yeong¹ · David Fluck² · Christopher H. Fry³ · Thang S. Han⁴

Orthopedic frailty risk stratification (OFRS): a systematic review of the frailty indices predicting adverse outcomes in orthopedics

81 articles published during or prior to February 2024 assessing frailty following surgery for orthopedic pathologies

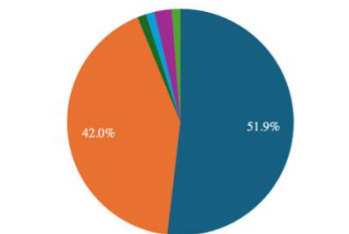


Fig. 2 Distribution of included studies based on orthopedic subcategories

Mainly trauma and arthroplasty

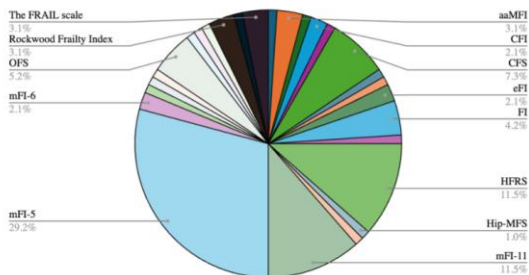
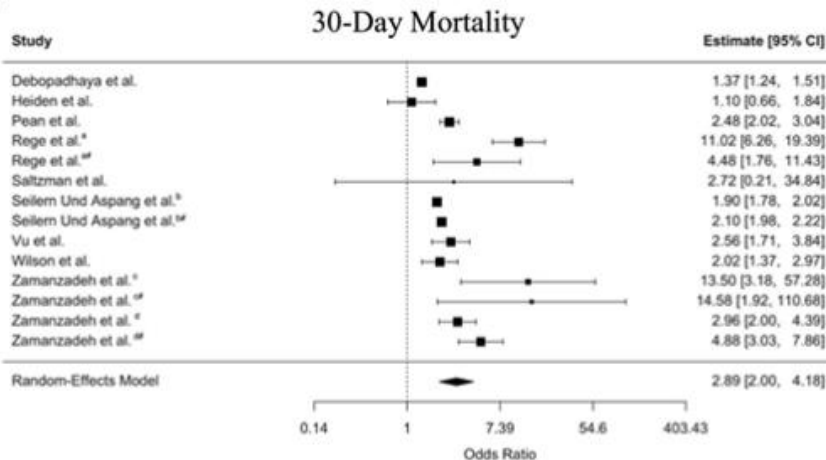


Fig. 3 Graphical representation of unique orthopedic frailty indices reported in the literature. (aaMFI = Age-Adjusted Modified Frailty Index, CFI = Chart Derived Frailty Index, CFS = Clinical Frailty Scale, eFI = Electronic Frailty Index, FI = Frailty Deficit Index, HFRS = Hospital Frailty Risk Score, mFI-11, mFI-5 = Modified 5-Item Frailty Index, mFI-6 = Six-Item Modified Frailty Index, OFS = Orthopedic Frailty Score)

Mainly modified frailty index, Fried, Roxwood, CFS

Despite heterogeneity (disparate frailty scales across many orthopedic pathologies), various frailty indices are able to predict adverse outcomes

A.



B.

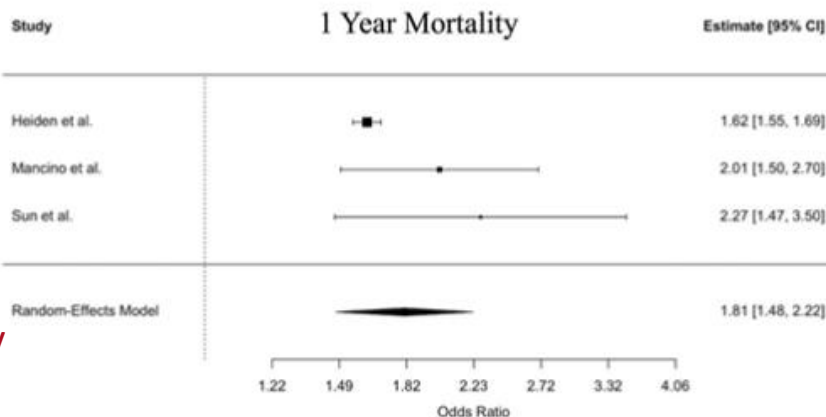


Fig. 5 Forest plots demonstrating pooled odds ratio (estimate) and 95% confidence interval (95% CI) for frailty as a predictor of 30-day mortality (A) and 1-year mortality (B). (a: Rege et al. young cohort; aa: Rege et al. old cohort; b: Seilem Und Aspang et al. mFI scoring; ba: Seilem Und Aspang et al. aaMFI scoring; c: Zamanzadeh et al. (2024) rTHA cohort; ca: Zamanzadeh et al. (2024) rTHA cohort; d: Zamanzadeh et al. (2023) mFI cohort; da: Zamanzadeh et al. (2023) aaMFI cohort)

SARCOPENIA

IMAGING: Sarcopenia, osteosarcopenia / BIOMARKERS: sarcopenia indexes



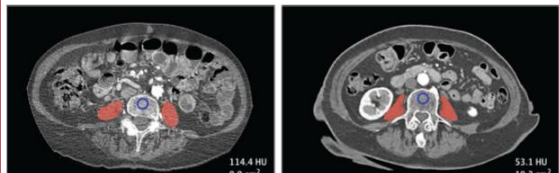
JAMA Cardiology | Original Investigation

Osteosarcopenia and Mortality in Older Adults Undergoing Transcatheter Aortic Valve Replacement

Pablo Solla-Suarez, MD, MSc; Saleena Gul Arif, MD; Fayeza Ahmad, MSc; Neelabst Rastogi, MD; Andrew Meng, MD; Joshua M. Cohen, MD; Julia Rodighiero, BSc; Nicolo Piazza, MD, PhD; Giuseppe Martucci, MD; Sandra Lauck, PhD; John G. Webb, MD; Dae H. Kim, MD, ScD; Bojan Kovacina, MD; Jonathan Afilalo, MD, MSc



C Low PMA alone D Low PMA and VBD



IEEE Open Journal of EMBS Engineering in Medicine and Biology

Ultrasound Segmentation Using Semi-Supervised Learning: Application to Point-of-Care Sarco

Hamza Rasaei, Maryia Samuel, and Hassan Rivaz

Low Muscle Mass by Preprocedural Computed Tomography Is Associated With Worse Short-Term Outcomes in Transcatheter Aortic Valve Replacement Recipients

Ian Persits, DO, Saaid Mirzai, DO, Kunaal S. Sarnaik, BS, Maximilian C. Volk, DO, James Yun, MD PhD, Serge Harb, MD, Rishi Puri, MD, PhD, Samir Kapadia, MD, Amar Krishnaswamy, MD, Po-Hao Chen, MD, MBA, Grant Reed, MD, and W. H. Wilson Tang, MD

CLINICAL RESEARCH

Transcatheter aortic valve replacement in patients with sarcopenia

Behnam Heidari, MD, MPH; Mohammed A. Al-Hijji, MD; Michael R. Garrett Welle, BS; Amir Lerman, MD;

The International Journal of Cardiovascular Imaging (2020) 36:929–938
<https://doi.org/10.1007/s10554-020-01776-x>

ORIGINAL PAPER

Importance of combined assessment of skeletal muscle mass and density by computed tomography in predicting clinical outcomes after transcatheter aortic valve replacement

Takahiro Tokuda¹, Masanori Yamamoto², Ai Kagase¹, Yutaka Koyama¹, Toshiaki Otsuka^{3,4}, Norio Tada⁵, Toru Naganuma⁶, Motoharu Araki⁷, Futoshi Yamanaka⁸, Shinichi Shirai⁹, Kazuki Mizutani¹⁰, Minoru Tabata¹¹, Hiroshi Ueno¹², Kensuke Takagi¹³, Akihiro Higashimori¹⁴, Yusuke Watanabe¹⁵, Kentaro Hayashida¹⁶ on behalf of the OCEAN-TAVI Investigators

Sarcopenia index as a predictor of clinical outcomes in older patients undergoing transcatheter aortic valve replacement

Francisco José Romeo MD^{1,2} | Juan Guido Chiabrando MD¹ | Ignacio Miguel Seropian MD¹ | Juan Valle Raleigh MD¹ | Horacio Medina de Chazal MD¹ | Cristian Maximiliano Garmendia MD¹ | Maximiliano Smetniansky MD³ | Mariela Cal MD³ | Carla Romina Agatiello MD³ | Daniel Horacio Berrocal MD, PhD³

ORIGINAL PAPER

Skeletal muscle quantity and quality evaluation in heart failure: comparing thoracic versus abdominopelvic CT approaches

Saaid Mirzai^{1,2}, Ian Persits¹, Pieter Martens³, Jerry D. Estep⁴, W. H. Wilson Tang³, Po-Hao Chen^{5,6}

Imaging for Sarcopenia Biomarkers

Importance of Psoas Muscle Area to Predict Mortality in Patients Undergoing Transcatheter Aortic Valve Replacement

Mike Saji, MD, D. Scott Lim, MD, Michael Ragosta, MD, Damien J. LaPar, MD, MSc, Emily Downs, MD, Ravi K Ghanta, MD, John A. Kern, MD, John M. Dent, MD, and Gorav Ailawadi, MD

The International Journal of Cardiovascular Imaging (2019) 35:1141–1147
<https://doi.org/10.1007/s10554-019-01582-0>

REVIEW PAPER

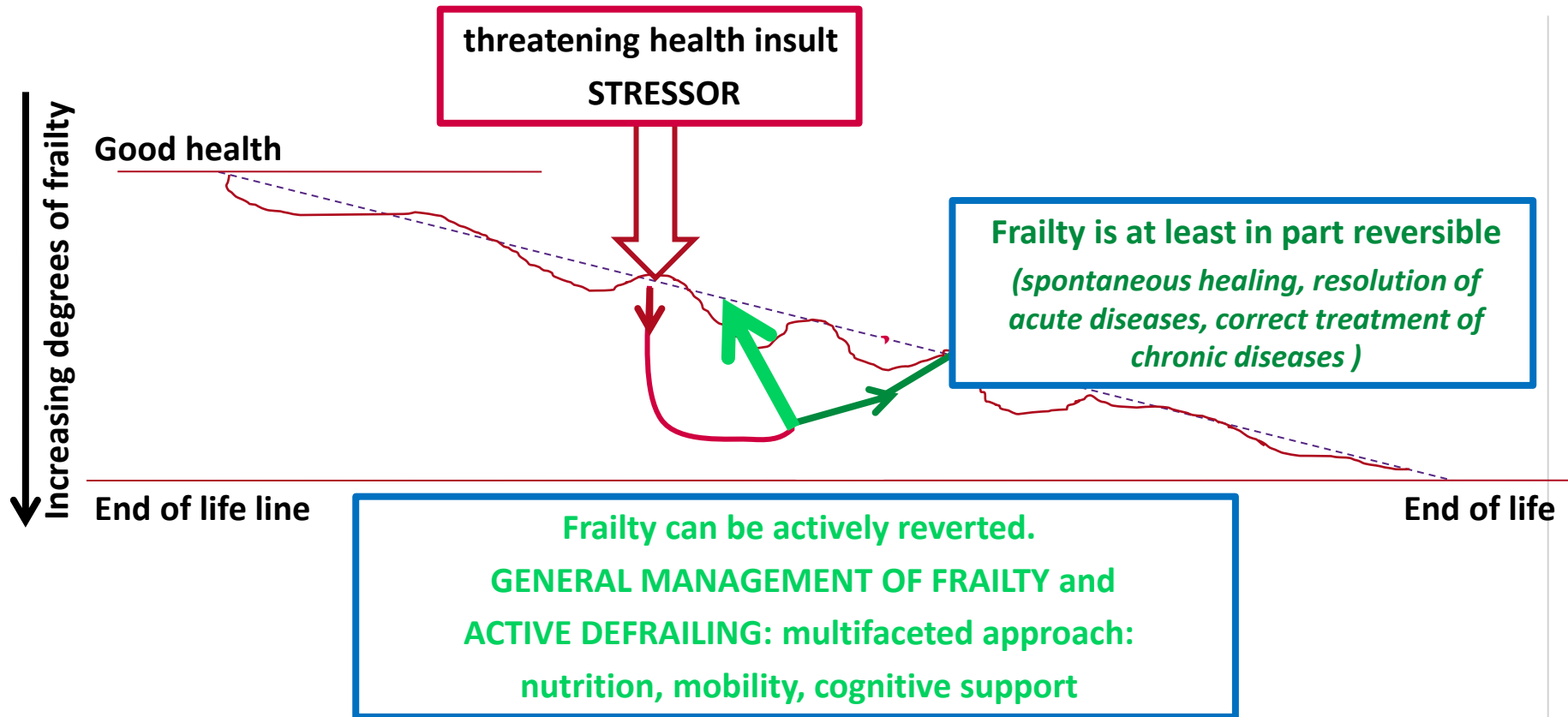
Importance of combined assessment of skeletal muscle mass and density by computed tomography in predicting clinical outcomes after transcatheter aortic valve replacement

D. Kuku¹, Marco Cejudo-Tejeda¹, Alexandre Hideo-Kajita¹, Ron Waksman¹, Hector M. Garcia-Garcia¹

Importance of Psoas Muscle Area to Predict Mortality in Patients Undergoing Transcatheter Aortic Valve Replacement

Yeong-Hau H. Lien, MD, PhD, Department of Medicine, College of Medicine, University of Arizona, Tucson

The frailty trajectory from good health to end-of-life



Cardiovascular diseases, prevention, and management of complications in older adults and frail patients treated for elective or post-traumatic hip orthopaedic interventions: a clinical consensus statement of the ESC Council for Cardiology Practice (CCP), the European Association of Preventive Cardiology (EAPC), the Association for Acute Cardiovascular Care (ACVC), the Association of Cardiovascular Nursing & Allied Professions of the ESC (ACNAP), the ESC Working Group on Aorta and Peripheral Vascular Diseases (WG APVD), and the ESC Working Group on Thrombosis (WG T)

Luigina Guasti ^{1,6†}, Stefano Fumagalli ^{2†}, Jonathan Afilalo ^{3,4,5}, Tobias Geisler⁶, Ana Abreu ⁷, Marco Ambrosetti⁸, Sofie Gevaert ⁹, Ruxandra Christodorescu¹⁰, Dimitri Richter¹¹, Victor Aboiyans ¹², Lucie Chastaing¹³, Michela Barisone¹⁴, Paolo Severgnini¹⁵, Riccardo Asteveziano ^{1,14}, and Marc Ferrini ¹⁷

Eur J Prev Cardiol 2025

Box 3 Clinical consensus statement

Main concerns in the peri-operative phase

- Conditions of the skin and musculoskeletal system before and during surgery
- Maintenance of hydration with avoidance of hypovolemia and hypotension to prevent kidney damage
- Careful monitoring of fluid intake to avoid hypervolaemia and keep a neutral fluid balance
- Avoidance of nephrotoxic drugs or combinations of drugs with high risk of nephrotoxicity
- Monitoring of body temperature with active heating of the patient when indicated
- Careful monitoring of Haemoglobin with consideration of transfusion for Haemoglobin <8 g/dL
- Optimal pain control with individualized multimodal prevention and treatment of pain
- Regular SpO₂ and respiratory rate assessments with arterial blood gas analysis when percutaneous oximetry is not possible.

Main concerns in the immediate post-operative period

- Daily assessment of caloric intake with full enteral nutrition started as soon as possible.
- Prevention and management of postoperative delirium (see [Table 1](#)).
- Use of pulmonary expansion techniques, such as respiratory physiotherapy exercises, incentive spirometry or, when indicated, non-invasive ventilation in case of high risk of pulmonary complications.
- Proper antithrombotic prophylaxis.

Box 4 Clinical consensus statement—main messages on anti-thrombotic management

- Unnecessary delay for time sensitive hip surgery should be avoided and ongoing treatments with antiplatelet agents should not delay surgery.
- Defer elective hip surgery to 1 month after elective percutaneous coronary intervention and 3 months after acute coronary syndrome to safely interrupt P2Y12 inhibitor treatment.
- Continue peri-operative single antiplatelet therapy in patients with prior percutaneous coronary intervention without excessive peri-operative bleeding risk.
- Interrupt NOAC treatment depending on NOAC type and renal function according to general guidelines.
- Interdisciplinary judgement (i.e. surgeons and cardiologist) about peri-operative interruption and post-operative continuation of antithrombotic therapy in patients at high risk of bleeding and/or high risk for thrombotic events.
- Thromboprophylaxis with NOACs or low molecular weight heparin according to risk up to 35 days.
- Careful prescription of post-operative venous thromboembolism prophylaxis, as early as possible, post-operative mobilization and short hospitalization are essential in limiting the risk.

Acute phase care challenges:

pre-existing CVD, new onset CV and non CV complications, geriatric syndromes

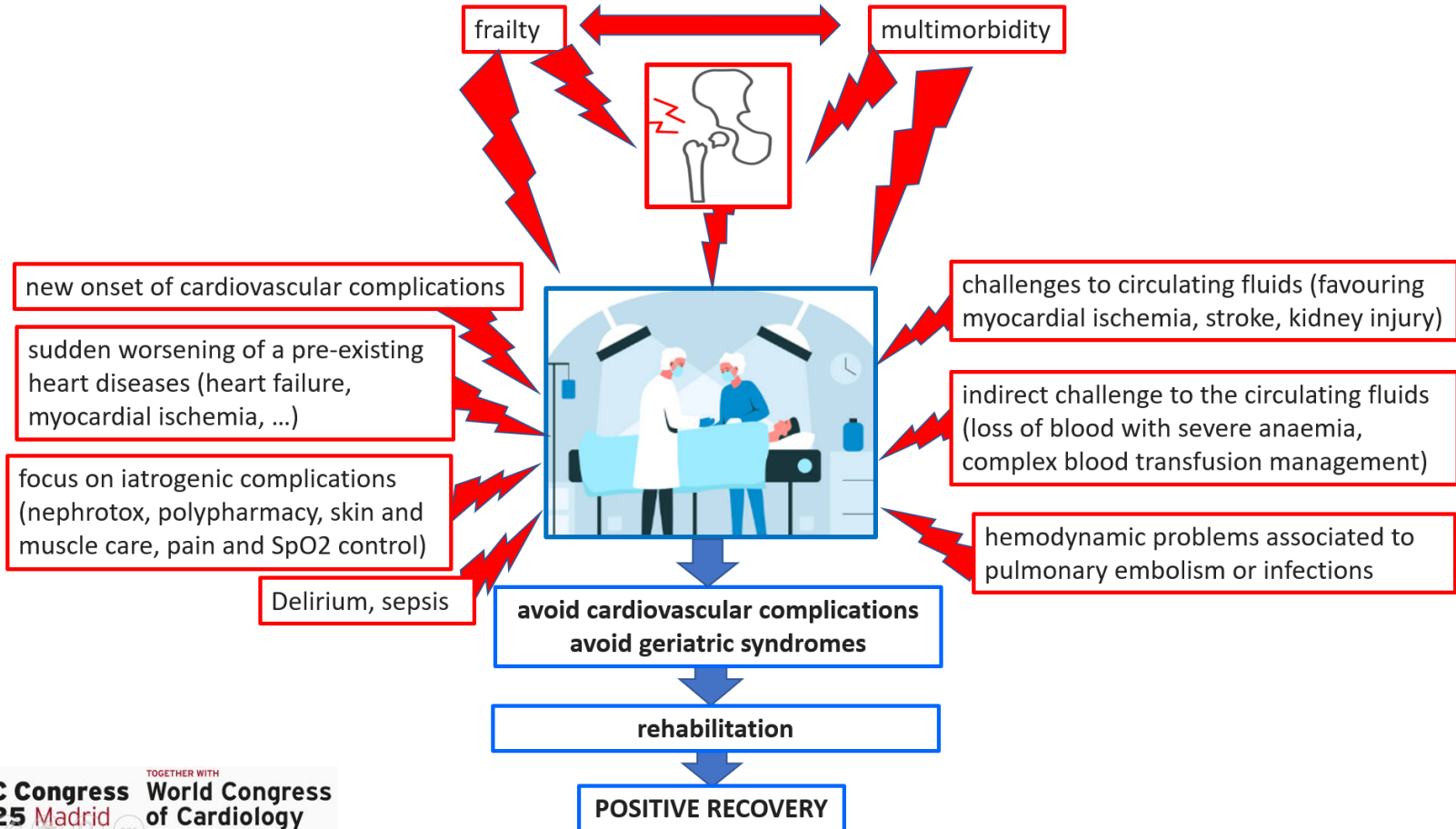


Table 2 Components of multidisciplinary rehabilitation following hip surgery in patients with frailty and/or at high risk for cardiovascular diseases or with cardiovascular diseases (adapted from Aktaa et al.¹²¹)

Component	Suggested intervention
Patient assessment	<ul style="list-style-type: none">• Cardiovascular risk or disease clinical evaluation• Multidimensional Geriatric Assessment including evaluation of comorbidities, psycho-cognitive deterioration, physical function, functional capacity, nutritional status, sarcopenia, frailty, disability, social deprivation
Physical activity counselling	<ul style="list-style-type: none">• Counselling for individual activities (and degree of supervision by the caregiver) to prevent or limit disabilities• Counselling for visual and hearing impairments, comorbidities, physical limitations, and cognitive status influencing the individual program
Exercise training prescription	<ul style="list-style-type: none">• Multi-component tailored exercise prescriptions designed on existing comorbidities, frailty, nutritional and cognitive conditions and on the physical capacity and activity limitation (mainly based on grade of recovery after hip surgery)• See Supplementary material online, Table 1: Detailed Exercise Prescription• Expected outcomes: improving physical capacity and quality of life; reducing disability, frailty level, institutionalization
Diet/nutritional counselling	<ul style="list-style-type: none">• Nutritional supplementation (high quality proteins) to be combined with strength and endurance exercise
Weight control management	<ul style="list-style-type: none">• Efforts need to be done to improve sarcopenia rather than reduce body mass index, especially in patients at higher risk of cardiac cachexia
Psychosocial management	<ul style="list-style-type: none">• Transition of care to long-term geriatric centres should be evaluated and managed individually
Lipid management	<ul style="list-style-type: none">• It is advisable to identify individual benefit from lipid lowering medication
Blood pressure monitoring	<ul style="list-style-type: none">• Decision to treat hypertension must consider the patient's clinical status, polypharmacy, and frailty.
Medication Adherence	<ul style="list-style-type: none">• Confirm adherence and adjust dosage, if necessary, of medication for cardiovascular risk factors and cardiovascular disease, pain drugs, anticoagulants and others

- management of CVD
- management of non-CVD
- management of geriatric syndromes:
focus on FRAILITY

ESC consensus- hip fractures EJPC 2025

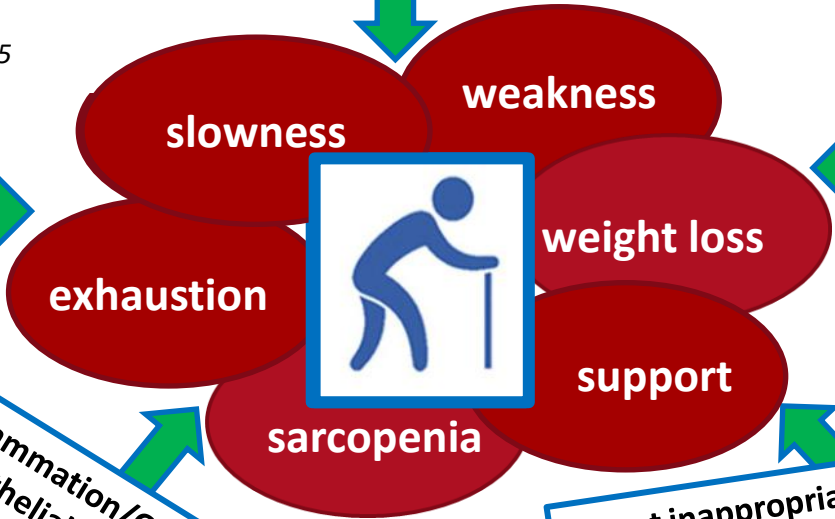
PHYSICAL ACTIVITY

Tailored exercise

identification of FRAILITY

management of FRAILITY

ESC consensus -frailty EJPC 2022



NUTRITION

- Acute supplementation
- Dental care
- Dietary counselling
- Prepared meals

COGNITIVE SUPPORT

- Avoid depression
- AVOID DELIRIUM
- ++ in the acute settings

- Inflammation/Oxidation
Endothelial dysfunction
Vascular frailty
Mitochondrial dysfunction
Protein degradation

- Target inappropriate polypharmacy
Reduce the hospitalization periods when needed
Rehabilitation/pre-habilitation
Focus on environmental aspects to reduce falls
Support self-care behaviour /sensory support
Digital health technology

ANTI-AGEING DRUGS ?

ADDITIONAL GENERAL MANAGEMENT