



## Frailty in Perioperative Medicine

**MCQs –**

**1 True or false**

- Frailty is associated with advancing age
- Frailty is synonymous with disability
- Comorbidities must be present in order for the frailty syndrome to develop
- There are two main models of frailty – phenotype and index
- People can move from more frail to less frail states

**2 True or false**

- The Clinical Frailty Score is validated in the perioperative setting
- The frailty phenotype, frailty index and comprehensive geriatric assessment are considered gold standard methods of assessing frailty
- There is no consensus on which scoring tool is best in the perioperative setting
- The timed up and go test is a highly specific frailty screening tool

**3 True or false**

- Socioeconomic deprivation is a risk factor for frailty
- Frailty is more prevalent in men
- Deficiency-level circulating cortisol is often seen in frail patients
- Frailty and sarcopenia are synonymous
- Frailty is associated with increased levels of inflammatory cytokines

**4 Which answer is most correct?**

- The frailty state is reversible in some circumstances
- It is not clear whether the frailty state is reversible but certain interventions can improve frailty scores
- The frailty state is never reversible but steps can be taken to slow its progression
- Exercise has been shown to reverse frailty

**5 Which answer is most correct?**

- Frail patients should not routinely be considered for elective surgery



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

- Frail patients necessitate a multidisciplinary approach to perioperative care
- There is no role for occupational therapy assessment preoperatively
- Pre-operative comprehensive geriatric assessment is unvalidated

---

#### Key points:

- Frailty is a loss of physiological reserve associated with ageing
  - It can be described by its phenotypic features, or by counting deficits accumulated
  - It exists on spectrum of physiological reserve from robust to frail
  - It is common in the surgical population and is associated with poor outcomes
  - Multiple scoring systems exist, each with different merits. The EFS has a high specificity and offers targets for modification. Single functional assessments are quicker but less specific
  - Frail patients should be cared for by a multidisciplinary team. The POPS service at Guys and St Thomas' Trust is one such care model.
- 

#### Introduction

As the number of older people increases the incidence of diseases amenable to definitive surgical intervention will increase. This will result in a greater number of older people undergoing surgery. Issues that become more prevalent with ageing, such as multimorbidity, functional dependence and frailty, contribute to adverse events after surgery. Older people therefore are at greater risk of poor postoperative outcome than their younger counterparts. Identifying issues such as frailty early can facilitate timely shared decision-making, resource planning and optimisation of health to improve outcome.

#### What is frailty?

The term is becoming used more often since it emerged in the 1980s[1]. Originally its definition related to a person's dependence on others for managing day-to-day tasks (activities of daily living/ADLs); a definition that would now be included with the term disability[2,3]. Frailty is indeed associated with disability but is actually a separate concept, and can exist in its absence. The latest definition from the British Geriatrics



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

Society "Fit for Frailty" best practice consensus has moved to a more complex concept[4]:

**"a distinctive health state related to the ageing process in which multiple body systems gradually lose their in-built reserves"**

Frailty should be seen as a diagnosis on a spectrum. Terms used for people with no features of frailty include fit, robust and non-frail. Those with some features may be considered to be pre-frail, and later develop a clinically observable frailty syndrome.

### **Frailty models**

Two prevailing theoretical models exist:

#### **1 Frailty phenotype model**

Proposed by Linda Fried in 2001, this theoretical model describes the characteristics of the frail state separate from comorbidity or disability[5]. Five phenotypic features were identified, frail being defined as having at least three, while those with one to two were deemed pre-frail.

Feature	Defined by
1. Shrinking	Weight loss $\geq$ 10lb in past year, or $\geq$ 5% body weight in past year
2. Weakness	Grip strength in lowest quintile, adjusted for gender and BMI
3. Poor endurance and energy	Self-reported exhaustion, identified by two questions from the CES-D scale
4. Slowness	The slowest quintile based on time to walk 15 feet, adjusting for gender/height
5. Low physical activity level	The lowest quintile of physical activity (Kcal/week) adjusting for gender.



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

## 2 Cumulative deficit model/ Frailty Index[6]

This model's development, attributed to Ken Rockwood, arose from the Canadian Study of Health and Ageing (CSHA) – a 10-year epidemiological study of over 10,000 older Canadians. The Frailty Index is obtained by counting a variety of clinical deficits from a 70-point list compiled from the CSHA database. The accumulation of these physiological deficits, each of which may be harmless in isolation, leads to frailty. A patient with at least 25% of the deficits (a frailty index of 0.25) is diagnosed with frailty. The maximum number of deficits compatible with life was 67% (frailty index 0.67).

### Appendix 1: List of variables used by the Canadian Study of Health and Aging to construct the 70-item CSHA Frailty Index

- Changes in everyday activities
- Head and neck problems
- Poor muscle tone in neck
- Bradykinesia, facial
- Problems getting dressed
- Problems with bathing
- Problems carrying out personal grooming
- Urinary incontinence
- Toileting problems
- Bulk difficulties
- Rectal problems
- Gastrointestinal problems
- Problems cooking
- Sucking problems
- Problems going out alone
- Impaired mobility
- Musculoskeletal problems
- Bradykinesia of the limbs
- Poor muscle tone in limbs
- Poor limb coordination
- Poor coordination, trunk
- Poor standing posture
- Irregular gait pattern
- Falls
- Mood problems
- Feeling sad, blue, depressed
- History of depressed mood
- Tiredness all the time
- Depression (clinical impression)
- Sleep changes
- Restlessness
- Memory changes
- Short-term memory impairment
- Long-term memory impairment
- Changes in general mental functioning
- Onset of cognitive symptoms
- Clouding or delirium
- Paranoid features
- History relevant to cognitive impairment or loss
- Family history relevant to cognitive impairment or loss
- Impaired vibration
- Tremor at rest
- Postural tremor
- Intention tremor
- History of Parkinson's disease
- Family history of degenerative disease
- Seizures, partial complex
- Seizures, generalized
- Syncope or blackouts
- Headache
- Cerebrovascular problems
- History of stroke
- History of diabetes mellitus
- Arterial hypertension
- Peripheral pulses
- Cardiac problems
- Myocardial infarction
- Arrhythmia
- Congestive heart failure
- Lung problems
- Respiratory problems
- History of thyroid disease
- Thyroid problems
- Skin problems
- Malignant disease
- Breast problems
- Abdominal problems
- Presence of snout reflex
- Presence of the palromental reflex
- Other medical history

*Frailty in relation to the accumulation of deficits. Mitnitski A et al 2007*

### Aetiology of frailty

Recent studies have provided some understanding of the aetiology of frailty, although it is still not fully understood. People with frailty have been found to have increased levels of interleukin-6, CRP, tumour necrosis factor- $\alpha$ [7], low serum albumin and alterations in the population numbers of certain T-cell subtypes[8]. Hormonal changes are also implicated including elevated cortisol, decreased vitamin D, sex steroid and IGF-1 levels[9]. These alterations in biomarkers changes are also seen in chronic disease, which may provide a pathophysiological link between comorbidity and frailty.



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

In addition chronic inflammation exacerbates sarcopenia (low muscle mass and low muscle function[10]. This deficit in muscle diminishes physical activity levels leading to a reduction in physiological reserve. Fried's theoretical cycle of frailty (Figure 1) shows how sarcopenia contributes to the development of the frailty phenotype[5].

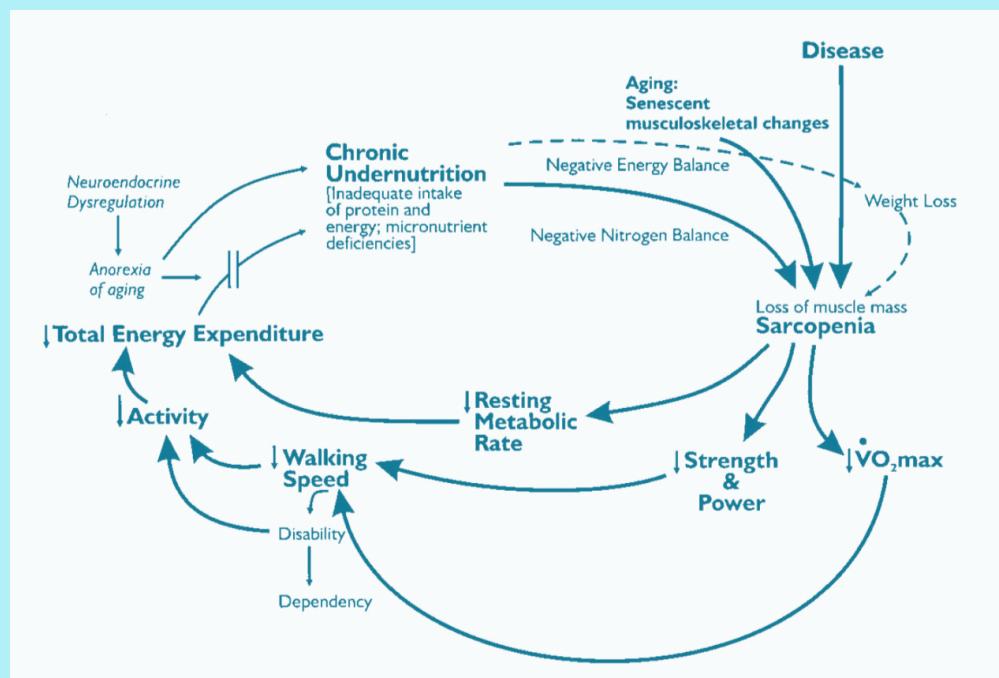


Figure 1: Frailty in older adults: evidence for a phenotype. Fried et al 2001

### Prevalence in surgical population

Approximately 10% of over-65s are frail. This increases to 25-50% of those over 85 years[11]. Prevalence increases with age and comorbidity burden, but can exist in the absence of either. Many chronologically old people are physiologically robust, and younger people can develop frailty if they have comorbidities. It is more common in women and people from lower socioeconomic groups [12,13].

In the surgical population the prevalence of frailty is variably reported - 2% in one study in urological surgery, 52% in another in vascular surgery[14,15]. This difference is partly due to the variable methods for diagnosing (see below), as well as the higher



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

incidence of associated health and social deficits with some surgical pathologies. For example, people in need of vascular surgical intervention are more likely to have associated cardiorespiratory, renal and cognitive impairment, low socioeconomic status and functional dependence [16], all of which contribute to a diagnosis of frailty.

### **Frailty and postoperative outcomes**

Frailty is associated with greater postoperative length of hospital stay, complications as well as 30 and 90-day mortality[17]. Limited data exist on discharge to care home and quality of life but it is likely that they are closely correlated. Within the hip fracture population, the requirement for assistance when walking outdoors (a surrogate marker of frailty) predicts twice the 30-day mortality risk of independent patients[18].

### **How to assess frailty**

The gold standard methods of diagnosing frailty include the above two models as well as comprehensive geriatric assessment (CGA) which is a validated, multi-domain approach to diagnosing medical and non-medical problems, including those previously undiagnosed, in the elderly population[19, 20, 21]. All of these require skilled and extensive assessments, which may not be practical in all clinical settings. Many alternative methods of measurement frailty exist including multidomain scoring systems, smaller indices [22], single domain functional measures such as grip strength [23], or biomarkers such as CT scanning, dual-energy X-ray absorptiometry, or transferrin [24]. In addition, few of these frailty tools have been compared to the gold standards. Those that have demonstrate excellent sensitivity, but poor specificity, meaning that they need to be used with caution when making diagnoses of frailty [25].

### **Frailty tools that can be used in the perioperative setting**

A wide variety of tools exist to diagnose frailty. Some of these have been applied in the perioperative setting to risk stratify against postoperative outcome, but there is no consensus on which tools should be used [26].

#### Clinical Frailty Scale (CFS) [27]

Devised from the Frailty Index (FI) for clinical use, the CFS correlates closely with the FI. Although it was originally developed for use by physicians trained in Comprehensive Geriatric Assessment, it has also been shown to predict functional decline and mortality



006

Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

7

when used by junior medical staff [28], although not validated in the perioperative setting.

#### Clinical Frailty Scale\*



**1 Very Fit** – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.



**2 Well** – 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**, but are **not regularly active** beyond routine walking.



**4 Vulnerable** – 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 Mildly Frail** – These people often have **more evident slowing**, and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.



**6 Moderately Frail** – People 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 Severely Frail** – 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 Very Severely Frail** – Completely dependent, approaching the 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 evidently frail**.

##### Scoring frailty in people with dementia

The degree of frailty 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.

\* J. Canadian Study on Health & Aging, Revised 2008.

2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-495.

© 2007-2009 Version 1.2. All rights reserved. Geriatric Medicine Research, Dalhousie University, Halifax, Canada. Permission granted to copy for research and educational purposes only.



#### Edmonton Frail Scale (EFS) [29]

This was also developed by Rockwood, and provides a more quantitative assessment of frailty that is easily reproducible at the bedside. The assessment is multidomain allowing identification of areas for more detailed assessment and modification of frailty.



006

Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

8

### The Edmonton Frail Scale

NAME : \_\_\_\_\_

d.o.b. : \_\_\_\_\_ DATE : \_\_\_\_\_

Frailty domain	Item	0 point	1 point	2 points
Cognition	Please imagine that this pre-drawn circle is a clock. I would like you to place the numbers in the correct positions then place the hands to indicate a time of 'ten after eleven'	No errors	Minor spacing errors	Other errors
General health status	In the past year, how many times have you been admitted to a hospital?	0	1-2	≥2
	In general, how would you describe your health?	'Excellent', 'Very good', 'Good'	'Fair'	'Poor'
Functional independence	With how many of the following activities do you require help? (meal preparation, shopping, transportation, telephone, housekeeping, laundry, managing money, taking medications)	0-1	2-4	5-8
Social support	When you need help, can you count on someone who is willing and able to meet your needs?	Always	Sometimes	Never
Medication use	Do you use five or more different prescription medications on a regular basis?	No	Yes	
	At times, do you forget to take your prescription medications?	No	Yes	
Nutrition	Have you recently lost weight such that your clothing has become looser?	No	Yes	
Mood	Do you often feel sad or depressed?	No	Yes	
Continence	Do you have a problem with losing control of urine when you don't want to?	No	Yes	
Functional performance	I would like you to sit in this chair with your back and arms resting. Then, when I say 'GO', please stand up and walk at a safe and comfortable pace to the mark on the floor (approximately 3 m away), return to the chair and sit down'	0-10 s	11-20 s	One of : >20 s , or patient unwilling , or requires assistance
Totals	Final score is the sum of column totals			

Scoring :

0 - 5 = Not Frail

6 - 7 = Vulnerable

8 - 9 = Mild Frailty

10-11 = Moderate Frailty

12-17 = Severe Frailty

TOTAL

/17

Administered by : \_\_\_\_\_

<https://www.nscphealth.co.uk/edmontonscale-pdf>

### Single functional assessments

The advantage of these tests is that they can be measured quickly – an advantage in some settings such as the high throughput of nurse-led pre-assessment clinics. For example:

- Gait speed: walk of short a distance over time eg. 4 metres/time. Frail = < 0.8m/s [25]



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

- Grip strength: using a dynamometer. Frail = in the lowest quintile according to age and sex [25]
- Timed up-and-go: total walk of 6 metres starting and finishing in same chair with usual mobility aid. Frail = >10 second) [30]

#### Electronic frailty Index (eFI) [31]

The eFI is an automated frailty scoring tool that uses information found in electronic patient records and has been operationalised using primary care data. In a move towards the provision of better health care for older people with frailty, the 2017/18 general practice contract will include an obligation to code for a diagnosis of frailty and provide clinical and medication reviews as well as discussing recent falls [32].

#### **How can frailty be modified?**

Frailty is usually progressive, but some patients can become less frail through modifications to aspects of frailty. It is not clear whether any of the following interventions can bring about a genuine reversal or slowing of the frailty process, or simply a modification of surrogate markers of frailty [33].

#### Exercise

Exercise in frail adults has been shown to improve quality of life, muscle function and falls risk. Multicomponent exercise three times a week for at least five months have been shown to be most effective [34]. However, the rapid pathway for a patient to urgent surgery, such as curative cancer surgery, often necessitates a more time-effective intervention. High-intensity interval training (HIT) can produce some of the largest gains in aerobic capacity over a short period of time, and has been proposed as a targeted prehabilitation intervention [35]. Four-week HIT interventions can be delivered safely in patients awaiting abdominal aortic aneurysm repair[36], and are likely to become a cornerstone of preoperative patient optimization in the future.

#### Nutrition

It is reasonable that dietary modification could help reverse or slow the progression of frailty, but evidence remains scarce. Correction of micronutrient deficiencies in vitamin B12, folate, and iron is recommended as this may help treat anaemia, which is often present in frail patients [37,38]. Current consensus states that older adults require more protein than younger adults (>1.0g/kg body weight/day) and that post-operative protein requirements of older adults is likely to be closer to 1.5g/kg/day [39]. In the hip fracture population there is low quality evidence that multinutrient oral feeds containing protein,



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

other macronutrients, and some vitamins and minerals, may reduce postoperative complication rates and mortality [40]. Vitamin D supplementation in deficient individuals may slow the progression of sarcopenia, but its overall impact on the frailty syndrome is unclear [41].

#### Drugs

Minimal data exist on drug interventions to modify frailty. Anabolic steroids, growth hormone, and anticytokine drugs may be the target of future studies [42]. In one small randomized controlled trial, ACE inhibitors were shown to improve exercise capacity to a degree reported in people undergoing six months of exercise training[43].

#### Psychosocial interventions

Social support and mental health, including cognition and mood, are often incorporated with a definition of frailty. The provision of good social support, whether via agencies or family/friends, may reduce institutionalisation following illness/surgery and aid return to independence, although there is no robust evidence that it has any impact on the frailty state.

#### **Perioperative management of frail patients**

The 2011 Royal College of Surgeons document, "The Higher Risk General Surgical Patient", recommends that people with frailty undergoing high risk surgical intervention should be managed by a multidisciplinary team [44].

A validated example of this having been delivered in clinical practice exists at Guys and St Thomas' NHS Foundation Trust [45, 46]:

#### **Key features include**

##### **1 Pre-operative assessment**

- Pre-operative comprehensive geriatric assessment to assess and optimise perioperative risks (including previously unrecognised disease). Tools that are used routinely include the EFS, gait speed and timed up-and-go scores.
- Pre-operative functional and environmental assessment by an occupational therapist, and formation of a tailored perioperative management plan that pre-empts discharge care needs
- Shared decision making (with patient, anaesthetist, surgeon) with regard to risk and benefit of surgery. The likelihood of successful post-operative recovery, return to baseline function, and post-operative dependency and institutionalisation are discussed.



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

## 2 Post-operative ward care

- Joint medical–surgical ward rounds
- Proactive approach to identifying and preventing medical postoperative complications e.g. AKI and hospital-acquired pneumonia
- Optimisation of analgesia
- Involvement of dietetics for malnourished patients
- Ward based multidisciplinary team meetings to promote rehabilitation goals and proactive discharge planning to minimise length of stay.
- Communication with relatives

## 3 Long-term health and social support

- Preoperative optimisation modifying chronic disease, not just for immediate surgical intervention
- Onward referral to appropriate medical services after hospital discharge e.g. community nursing, anticoagulation clinics, specialist clinics such as memory services
- Activation of community social care eg. reablement, intermediate care

### Conclusion

Assessment and diagnosis of frailty should be considered one of the key components of any perioperative assessment. It can help inform discussion around perioperative risks, and thus aid in shared decision-making. In addition it helps identify potentially modifiable targets for intervention in the perioperative period.

### References

- 1 Rockwood K, Fox RA, Stolee P, Robertson D, Beattie BL 1994 *Frailty in elderly people: an evolving concept*. CMAJ; 150(4): 489–495.
- 2 Woodhouse KW, Wynne H, Baillie S, James OF, Rawlins MD 1988. *Who are the frail elderly?* QJM Jul;68(255):505-6
- 3 World Health Organisation (Nov 2016) *Disability in Health* fact sheet
- 4 Fit for Frailty – consensus best practice guidance for the care of older people living in outpatient settings – a report from the British Geriatrics Society 2014
- 5 Fried et al 2001 *Frailty in older adults: evidence for a phenotype*. Journals of Gerontology Series A – Biological Sciences and Medical Sciences 56(3):M146-56.



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

- 6 Rockwood K, Mitnitski A 2007. *Frailty in Relation to the Accumulation of Deficits*. Journals of Gerontology Series A – Biological Sciences and Medical Sciences (2007) 62 (7): 722-727.
- 7 Hubbard RE, O'Mahony MS, Savva GM, Calver BL, Woodhouse KW *Inflammation and frailty measures in older people*. J Cell Mol Med. 2009 Sep; 13(9B):3103-9.
- 8 Sembal RD, Margolick JB, Leng S, Walston J, Ricks MO, Fried LP. *T cell subsets and mortality in older community-dwelling women*. Exp Gerontol. 2005;40:81-87
- 9 Puts MT, Visser M, Twisk JW, Deeg DJ, Lips P. *Endocrine and inflammatory markers as predictors of frailty*. Clin Endocrinol (Oxf) 2005;63:403-411.
- 10 Cruz-Jentoft AJ et al (European Working Group on Sarcopenia in Older People). *Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People*. Age and Ageing 2010 Jul;39(4):412-23
- 11 Fit for Frailty – consensus best practice guidance for the care of older people living in outpatient settings – a report from the British Geriatrics Society 2014
- 12 Buckinx F, Rolland Y, Reginster JY, Ricour C, Petermans J, Bruyère O. *Burden of frailty in the elderly population: perspectives for a public health challenge*. Arch Public Health 2015; 73(1): 19
- 13 Clegg A Prof, Young J, Iliffe S, Olde Rikkert M Rockwood K. *Frailty in elderly people*. The Lancet Volume 381, No. 9868 p752–762, 2 Mar 2013
- 14 Partridge JS, Fuller M, Harari D, Taylor PR, Martin FC, Dhesi JK. *Frailty and poor functional status are common in arterial vascular surgical patients and affect postoperative outcomes*. Int J Surg 2015 Jun;18:57-63.
- 15 Pearl JA, Patil D, Filson CP, Arya S, Alemozaaffar M, Master VA, Ogan K *Patient Frailty and Discharge Disposition Following Radical Cystectomy*. Clin Genitourin Cancer 2017 Jan 5. pii: S1558-7673(16)30359-7.
- 16 Pand RL, Creager MA. *Socioeconomic Inequality and Peripheral Artery Disease Prevalence in US Adults*. Circ Cardiovasc Qual Outcomes 2014 Jul; 7(4): 532–539
- 17 Lin et al. 2016; *Frailty and post-operative outcomes in older surgical patients: a systematic review* BMC Geriatrics 16:157
- 18 NHFD report 2013 – appendices
- 19 Ellis G, Langhorne P. *Comprehensive geriatric assessment for older hospital patients*. Br Med Bull. 2005 Jan 31;71:45-59. Print 2004
- 20 Partridge, J. S. L., Harari, D., Martin, F. C. and Dhesi, J. K. (2014). *The impact of pre-operative comprehensive geriatric assessment on postoperative outcomes in older patients undergoing scheduled surgery: a systematic review*. Anaesthesia, 69: 8-16. doi:10.1111/anae.12494



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

- 21 Martin FC (2010). British Geriatrics Society website. Accessed 1<sup>st</sup> March 2017. [<http://www.bgs.org.uk/good-practice-guides/resources/goodpractice/gpgcassessment>]
- 22 Faiz Gani, MBBS Joseph K. Canner, Pawlik TM (2017). *Use of the Modified Frailty Index in the American College of Surgeons National Surgical Improvement Program Database Highlighting the Problem of Missing Data*. JAMA Surg. 2017;152(2):205-207. doi:10.1001/jamasurg.2016.3479
- 23 Chainani V, Shaharyar S, Dave K, Choksi V, Ravindranathan S, Hanno R, Jamal O, Abdo A, Abi Rafeh N (2016). *Objective measures of the frailty syndrome (hand grip strength and gait speed) and cardiovascular mortality: A systematic review*. Int J Cardiol 2016 Jul 15;215:487-93. doi: 10.1016/j.ijcard.2016.04.068. Epub 2016 Apr 14.
- 24 Riccardo Calvani R et al (2015). *Biomarkers for physical frailty and sarcopenia: state of the science and future developments*. J Cachexia Sarcopenia Muscle 2015 Dec; 6(4): 278–286.
- 25 Clegg A, Rogers L, Young J. *Diagnostic test accuracy of simple instruments for identifying frailty in community-dwelling older people: a systematic review*. Age Ageing (2015) 44 (1): 148-152.
- 26 Buigues C, Juarros-Folgado P, Fernández-Garrido J, Navarro-Martínez R, Cauli O. *Frailty syndrome and pre-operative risk evaluation: A systematic review*. Arch Gerontol Geriatr 2015 Nov-Dec;61(3):309-21
- 27 Rockwood K et al (2005). *A global clinical measure of fitness and frailty in elderly people*. CMAJ 173(5); 489-95
- 28 Gregorevic KJ, Hubbard RE, Katz B, Lim WK *The clinical frailty scale predicts functional decline and mortality when used by junior medical staff: a prospective cohort study* BMC Geriatrics (2016) 16:117
- 29 Rolfsen DB, Majumdar SR, Tsuyuki RT, Tahir A, Rockwood K. *Validity and reliability of the Edmonton Frail Scale*. Age Ageing (2006) 35 (5): 526-529.
- 30 Savva GM, Donoghue OA Horgan F, O'Regan C, Cronin H, Kenny RA. *Using timed up-and-go to identify frail members of the older population*. J Gerontol A Biol Sci Med Sci. 2013 Apr;68(4):441-6.
- 31 Clegg A et al (2016). *Development and validation of an electronic frailty index using routine primary care electronic health record data*. Age Ageing (2016) 45 (3): 353-360.
- 32 NHS England Medical Directorate letter to directors of commissioning. NHS England website. Accessed 23<sup>rd</sup> April 2017. [<https://www.england.nhs.uk/wp-content/uploads/2017/02/gp-contract-17-18-letter-to-service.pdf>]



Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

- 33 Ian D Cameron ID et al (2013). *A multifactorial interdisciplinary intervention reduces frailty in older people: randomized trial* BMC Medicine 2013 11:65
- 34 Theou. J 2011 *The Effectiveness of Exercise Interventions for the Management of Frailty: A Systematic Review*. Aging Research
- 35 Weston et al. 2016 *High-intensity interval training (HIT) for effective and time-efficient pre-surgical exercise interventions* Perioperative Medicine 5:2
- 36 Weston et al. *Patients awaiting surgical repair for large abdominal aortic aneurysms are able to exercise at moderate to hard intensities with a low risk of adverse events*. Frontiers in Physiology 7: 684
- 37 Munoz et al *International consensus statement on the peri-operative management of anaemia and iron deficiency*. Anaesthesia 2016 72:2
- 38 Goodnough LT, Maniatis A, Earnshaw P, Benoni G, Beris P, Bisbe E, et al. *Detection, evaluation, and management of preoperative anaemia in the elective orthopaedic surgical patient: NATA guidelines*. Br J Anaesth. 2011 Jan; 106(1):13-22
- 39 Bauer et al *Evidence-Based Recommendations for Optimal Dietary Protein Intake in Older People: A Position Paper From the PROT-AGE Study Group* JAMDA Aug 2013 14(8):542-59
- 40 Avenell A, Handoll HHG. *Nutritional supplementation for hip fracture aftercare in older people*. Cochrane Database of Systematic Reviews 2010, Issue 1. Art. No.: CD001880. DOI: 10.1002/14651858.CD001880.pub5.
- 41 Arik G, Ulger Z (2016). Vitamin D in sarcopenia: *Understanding its role in pathogenesis, prevention and treatment*. European Geriatric Medicine 7:3 (207–213)
- 42 Hubbard R Pierce A (2002). *Anabolic agents in frail elderly patients*. May 2002, Issue 2 pp. 145-158
- 43 Sumukadas D, Witham MD, Struthers AD, McMurdo ME. *Effect of perindopril on physical function in elderly people with functional impairment: a randomized controlled trial*. CMAJ 2007 Oct 9;177(8):867-74.
- 44 The Higher Risk General Surgical Patient: Towards improved care for a forgotten group – report from The Royal College of Surgeons of England / Department of Health 2011
- 45 Dhesi JK (2013). Setting up a pro-active service to make surgery safer for older people – report from The Health Foundation.
- 46 Partridge JS, Harari D, Martin FC, Peacock JL, Bell R, Mohammed A, Dhesi JK. *Randomized clinical trial of comprehensive geriatric assessment and optimization in vascular surgery*. Br J Surg 2017 May;104(6):679-687



006

Dr Andrew Rogerson

Dr Sara Churchill

Dr Philip Braude

-

02 June 2017

15

---

Trainees with an Interest in Perioperative Medicine [TriPom]

An educational collaborative run by and for trainees and all other professionals who are involved with the surgical patient

[www.tripom.org](http://www.tripom.org) . @triperioperati1