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
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...
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.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Defined by</th>
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<tbody>
<tr>
<td>1. Shrinking</td>
<td>Weight loss &gt;/= 10lb in past year, or &gt;/= 5% body weight in past year</td>
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<tr>
<td>2. Weakness</td>
<td>Grip strength in lowest quintile, adjusted for gender and BMI</td>
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<td>3. Poor endurance and energy</td>
<td>Self-reported exhaustion, identified by two questions from the CES-D scale</td>
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<td>4. Slowness</td>
<td>The slowest quintile based on time to walk 15 feet, adjusting for gender/height</td>
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<tr>
<td>5. Low physical activity level</td>
<td>The lowest quintile of physical activity (Kcal/week) adjusting for gender.</td>
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2 Cumulative deficit model/ Frailty Index[6]
This model’s development, attributed to Ken Rockwood, arose from the Canadian Study of Health and Ageing (CHSA) – 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).

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

**Clinical Frailty Scale**

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<th>Score</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Very Fit – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.</td>
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<tr>
<td>2</td>
<td>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.</td>
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<tr>
<td>3</td>
<td>Managing Well – People whose medical problems are well controlled, but are not regularly active beyond routine walking.</td>
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<td>4</td>
<td>Vulnerable – While not dependent on others for daily help, often symptoms limit activities. A common complaint is being “sloved up”, and/or being tired during the day.</td>
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<td>5</td>
<td>Mildly Frail – These people often have more evident slowing, and need help in high order ADLs (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.</td>
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<td>6</td>
<td>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, standing) with dressing.</td>
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<tr>
<td>7</td>
<td>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).</td>
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<td>8</td>
<td>Very Severely Frail – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.</td>
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<td>9</td>
<td>Terminally Ill – Approaching the end of life. This category applies to people with a life expectancy &lt;6 months, who are not otherwise evidently frail.</td>
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**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.
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]
• 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,
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.
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.

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