CHAPTER – 12

Frailty and Orthopaedic Surgery

Background:

While frailty is a multidimensional concept, as reflected in the frailty index approach to measurement, clinical indicators, or phenotypic markers, such as reduced muscle strength, unintended weight loss, low physical activity, fatigue, and impairment of physical function, are frequently used to operationalize it.[1] Furthermore, frail elderly individuals have poorer bone mineral density and lean body mass than non-frail elderly patients. These and other mechanisms can lead to weakness, unsteady walking, and poor balance, making patients more vulnerable to falls, fragility fractures, and death.

Over the last fifteen years, best practise for the management of older and frail orthopaedic patients has vastly improved. The ageing population has resulted in increasingly complex comorbidities and weakness among orthopaedic patients. Prior to surgery, initiatives such as a full geriatric assessment and surgery within 36 hours of trauma have improved treatment and reduced mortality. There has been a growing awareness of poor outcomes in various orthopaedic trauma patient cohorts over the last decade. [2, 3] As a result, authorities have increasingly broadened their guidelines to incorporate more fracture patterns, demographic considerations, and treatment recommendations (Table 1).

Table 1: Comparison of the Best Practice Tariff Criteria, National Institute of Health and Care Excellence (NICE) Guidelines and the Blue Book for the management of hip fractures [4]

	BPT 2020	BOAST 2019	NICE	Blue Book
Inclusion Criteria	Hip fracture or femoral fracture in aged 60 + +	Sustaining a fragility fracture OR Major trauma with CFS of 5 +	Hip fracture in adults (aged 18 +).	All fragility fractures with Some recommen -dations for hip fractures only (∗= hip fracture specific)
Time to surgery	Within 36hrs of arrival in the emergency department.	Within 36 hours of admission.	Day of, or the day after admission.	Within 48 hours of admission (if medically fit) ∗.
Orthogeriatric input	Geriatrician assessment in preoperative period (within 72hrs of admission). Admitted under joint care of consultant geriatrician and consultant orthopaedic surgeon. Postoperative geriatrician-directed Multiprofessional rehabilitation team.	Comprehensive Geriatric Assessment within 72 hours of injury.	From admission, patients should be offered orthogeriatric assessment, optimisation for fitness for surgery, orthogeriatric and multidisciplinary review.	Should be managed on an orthopaedic ward with routine access to acute orthogeriatric medical support ∗.
Physiotherapy input	Assessed by physiotherapist the day of or day following surgery.	Should be seen by physiotherapist the day after surgery.	Offer appropriate mobilisation strategies e.g. physiotherapist assessment.	
Fracture/falls prevention	Fracture prevention assessments (falls and bone health).	Bone health review. Multifactorial falls risk assessment, referred to	Liaison with appropriate services e.g. falls prevention.	Offered MDT assessment and intervention to prevent future falls. Assessed for need for antiresorptive therapy

		falls prevention services if indicated.		to prevent future osteoporotic fractures
Other guidelines	Admitted using an assessment protocol agreed by geriatric medicine, orthopaedic surgery and anaesthesia AMTS before surgery, with score recorded in the NHFD. Delirium assessment using the 4AT screening tool during admission. Nutritional assessment during admission.	Delirium assessment. Nutrition assessment.		Should be admitted to an acute orthopaedic ward within 4 hours of presentation ∗ . Should be assessed and cared for to minimise risk of developing a pressure ulcer.

BPT: Best Practice Tariff, BOAST: British Orthopaedic Association Standards for Trauma and Orthopaedics, NICE: National Institute of Health and Care, CFS: Clinical Frailty Scale, Excellence, MDT: Multidisciplinary Team, AMTS: Abbreviated Mental Test Score, NHFD: National Hip Fracture Database, 4AT: rapid assessment test for delirium.

Table source: Rogers MM, Brown R, Stanger MS. Frailty in orthopaedics: is age relevant?. Injury. 2020 Jul 15.

Frailty and orthopaedics:

Frailty has been linked to a higher rate of perioperative complications in older adults undergoing elective and emergency procedures, as well as a higher rate of mortality in frail patients undergoing surgery. [5, 6] Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA) procedures are linked to an increased risk of morbidity and mortality in the elderly. [7, 8] The need for orthopaedic surgical operations is rising as a result of the growing ageing population.

According to a recent study, demand for THA would rise by 174% to 572,000 treatments per year by 2030, while demand for TKA will rise by 673% to 3.48 million procedures per year. [9] The rising number of orthopaedic procedures performed on the elderly, the high incidence of frailty in the surgical population, and the increased risk of morbidity and death in frail older

adult surgical patients all point to the significance of a greater focus on frailty in the orthopaedic field.

Diagnosis and screening of frailty prior to orthopaedic procedures:

Researchers have developed the Frailty Index (FI), which consists of 44 elements, since the establishment of the Frailty Phenotype. For fragile patients undergoing major elective orthopaedic procedures such as total hip and knee replacement and lumbar, sacral, or cervical laminectomy, the FI has been demonstrated to be a beneficial metric. The FI was changed after its initial development to become the Modified Frailty Index (mFI). [10] The mFI consists of only 11 items plus information about functional status from the medical record of the patients (Figure 1). It helps to stratify patients into risk categories and predict post-operative outcomes, is an even simpler measure of frailty.

The mFI has also been shown to be an excellent risk assessment tool for both THA and TKA orthopaedic operations, as well as being easy to deploy. [11, 12] It has been demonstrated to be a better predictor of readmission, post-operative complications, re-operation, and post-operative death. The mFI has been reduced to a 5-factor mFI over the last few years (mFI-5).[13] A recent study comparing the mFI-5 to the original 11-factor mFI found it to be an equally credible predictor of frailty in all surgical subspecialties, with a correlation coefficient of above 0.9 in all cardiac and vascular surgery. [13, 14]

The 5-mFI has been demonstrated to be a powerful predictor of frailty, postoperative morbidity, and mortality in a range of operations, including primary hip and knee arthroplasty, kyphoplasty vertebral augmentation, posterior lumbar fusion, and distal radius fracture repair, in several recent investigations. Finally, while the Frailty Phenotype, FI, and 5 factor mFI are all effective for assessing and screening for frailty in patients undergoing major elective orthopaedic surgery, their levels of complicity differ. [13] The mFI-5 has the

advantage of being the most therapeutically helpful due to its simplicity (just 5 variables to measure and no need for specialist equipment).

Figure 1: Modified frailty index [15]

The 11-Item Modified Frailty Index[a]

Variable, if Present in Patient History	Modified Frailty Index Variable
Diabetes mellitus—insulin and noninsulin dependent	1
Congestive heart failure	2
Hypertension requiring medication	3
History of myocardial infarction	4
Previous percutaneous coronary intervention or angina	5
History of transient ischemic attack or cerebrovascular accident without neurological deficit	6
Cerebrovascular accident with neurological deficit	7
Impaired sensorium	8
History of chronic obstructive pulmonary disease or pneumonia	9
History of peripheral vascular disease or rest pain	10
Functional health status before surgery—partially or totally dependent for activities of daily living	11

[a]*Scores are calculated by adding 1 point for each variable present and then dividing this number by 11.*

Image source: Boissonneault A, Mener A, Schwartz A, Wilson J, Staley C, Schenker M. Impact of frailty on 30-day morbidity and mortality of patients with intertrochanteric femur fractures. Orthopedics. 2019 Nov 1;42(6):344-8.

Figure 2: The 5 item modified Frailty Index [16]

Dis RF (Distal Radius Fracture)

+1 Diabetes mellitus
+1 Increased blood pressure requiring medication
+1 Status (nonindependent functional status)
+1 Respiratory pathology (history of COPD or pneumonia)
+1 Failure of heart (congestive heart failure within 30 days of surgery)

Image source: Wilson JM, Holzgrefe RE, Staley CA, Schenker ML, Meals CG. Use of a 5-item modified frailty index for risk stratification in patients undergoing surgical management of distal radius fractures. J Hand Surg. 2018;43(8):701-9.

Orthopaedic implications of frailty:

Frailty has been linked to a high rate of postoperative death in previous studies. In patients undergoing surgery for pelvis and lower extremity fractures, adult spinal deformity, femoral neck fracture, primary hip arthroplasty, and primary knee arthroplasty, frailty is linked to postoperative mortality. Higher mFI scores are linked to a higher risk of post-operative death and have been proven to be a better predictor of post-operative mortality than age, obesity class, or ASA class. [17] Various studies have found a link between spine surgery, orthopaedic trauma, THA, TKA, and HA and increased post-operative mortality. In addition, fragile patients undergoing orthopaedic surgery have a higher risk of post-operative complications, duration of stay, and readmission. [18, 19]

As seen in Table 2, fragility is related with a considerable number of postoperative problems. Patients undergoing spine surgery, orthopaedic trauma, THA, TKA, and HA have a higher risk of Clavien-Dindo Class IV complications and hospital acquired diseases (surgical-site infections, pneumonia, venous thromboembolism, and urinary tract infections) when their mFI score is higher. [9]

Table 2: Percent Increase in 30-Day Mortality, Re-Operation, Readmission, Clavien-Dindo Class IV Complications and Any Complications with Increase in mFI Score by Type of Orthopedic Surgery [9]

Orthopedic Surgery Type	30-Day Mortality (% increase)	Reoperation (% increase)	Readmission (% increase)	Clavien-Dindo Class IV Complications (% increase)	Any Complications (% increase)
Spine	9.7%	10%	N/A	N/A	25%
Orthopedic Trauma	10.5%	1.3%	13.3%	9.6%	8.5%
THA	4.08%	3.19%	11.28%	N/A	14.8%
TKA	1.49%	N/A	9.45%	N/A	11.27%
HA	11%	N/A	N/A	4.9%	N/A

THA = total hip arthroplasty; TKA = total knee arthroplasty, HA = hemiarthroplasty, N/A = not assessed; mFI = modified frailty index

Source: Mamtora PH, Fortier MA, Barnett SR, Schmid LN, Kain ZN. Peri-operative management of frailty in the orthopedic patient. J Orthop. 2020;22:304-7.

Management of frail orthopaedic patient:

Excellent pain control, a decent sleep environment, limiting tethers, cognitive reorientation using clocks, clear communication, early mobilisation, and adequate diet have all been documented to help this group of patients improve their outcomes. It's critical to recognise and treat triggering conditions like sepsis, dehydration, electrolyte imbalance, and substance withdrawal. [17] Fast-track surgery is recommended by the European Society of Anesthesiology to prevent post-operative delirium in high-risk patients, such as the elderly. [20] Avoiding possibly inappropriate drugs such as benzodiazepines for pre-medication and monitoring anaesthesia depth to minimise excessive depth are two specific recommendations for anaesthesia management.

Referring frail patients for formal physical therapy exams, procuring assistive devices, and preparing for in-hospital and post-discharge rehabilitative therapy are all examples of functional status optimization techniques for frail patients. Pre-operative exercise programmes to promote strength and mobility, also known as pre-habilitation, have demonstrated considerable improvement in postoperative outcomes, such as decreased risk of discharge to a rehabilitation facility, improved strength, and functional capacity.

Antibiotics and routine infection control protocols should be provided and followed to prevent common post-operative infections such as respiratory, wound, and urinary tract infections. Frail patients are also more susceptible to opportunistic infections like MRSA (methicillin-resistant staph aureus) or Clostridium difficile, as well as iatrogenic disorders caused by excessive medicine, which are common in hospitals. [21] Polypharmacy and changed pharmacodynamics and kinetics can cause systemic adverse effects such as nausea, fatigue,

disorientation, anorexia, dizziness, constipation, and electrolyte imbalance, even when medicines are given appropriately. As a result, it is critical to evaluate and rationalise each medication's drug chart on a frequent basis. Regular monitoring of urea and electrolytes, weight and blood pressure, and drug charts should be monitored to avoid problems with fluid and electrolyte imbalance. [21]

Summary:

The demand for surgical care in older and frail patients will continue to rise as the global population ages. As a result, doctors and researchers must customise the perioperative pathway for these patients since they face distinct problems. Because there is currently no proof that frailty can be slowed or reversed, it is critical for anesthesiologists and surgeons to take prophylactic measures to halt the disease's progression. Preoperative supervised exercise programmes, early detection of frailty, prophylactic antibiotics, regular drug record review, regular monitoring of urea and creatinine, and implementing postoperative delirium prevention measures are among the preventive strategies.

Finally, more studies are needed to find innovative ways for preventing and reducing unfavourable surgical outcomes in frail patients, as well as to assess whether pre-operative optimization can effectively ameliorate postoperative outcomes through large-scale randomised controlled trials.

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