



# Orthogeriatrics: a vital requirement for improving fragility fracture patient care internationally with particular reference to Turkey

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## Abstract

**Purpose** Orthogeriatrics is a team approach that aims to provide adequate and timely intervention for individuals suffering from fragility fractures, particularly hip fractures. These patients are mostly the frailest older adults. The aim of orthogeriatrics is to re-gain functionality as early as possible and to decrease disability and mortality. Some developed countries have established orthogeriatric services, while many others, including Turkey, have so far not. Here, to identify areas for improvement, we outline the status of the orthogeriatrics in older adults in Turkey.

**Methods** We present clear calls for action, emphasizing possible and noteworthy areas for improvement.

**Results** Our proposals include the need for an easily applied, short version of comprehensive geriatric assessment; appropriate laboratory testing on admission; paracetamol with a special emphasis in its dosings and clues for state-of-the-art analgesic management; the essential need to introduce oral nutritional supplementation, irrespective of nutritional status; the need for vitamin D commencement, in almost all patients; and starting osteoporosis treatment in fracture hospitalization, whenever appropriate. Last but not least, the ever-increasing prerequisite to establish “fracture liaison services” is stipulated.

**Conclusion** We suggest that our recommendations offer great potential in Turkey, for the improvement of frail fracture patients’ care. We call the other countries that do not have established orthogeriatric lines to model our approach to improve the management of fracture patients globally.

**Keywords** Orthogeriatrics · Improve · Care · Fragility fracture · Turkey

## Abbreviations

<b>ACS</b>	Acute coronary syndromes	<b>HbA1C</b>	Hemoglobin A1C
<b>BCIS</b>	Bone cement implantation syndrome	<b>INR</b>	International normalized ratio
<b>CGA</b>	Comprehensive geriatric assessment	<b>IU</b>	International unit
<b>CKD</b>	Chronic kidney disease	<b>IV</b>	Intravenous
<b>COPD</b>	Chronic obstructive pulmonary disease	<b>LMWH</b>	Low-molecular-weight heparin
<b>CRP</b>	C-reactive protein	<b>MMSE</b>	Mini-Mental State Exam
<b>ECG</b>	Electrocardiogram	<b>MNA</b>	Mini nutritional assessment
<b>FFFAP</b>	Falls and Fragility Fracture Audit Programme	<b>NHFD</b>	National Hip Fracture Database
<b>FIC</b>	Fascia iliaca compartment	<b>NHS</b>	National Health Service
<b>FLS</b>	Fracture Liaison Service	<b>NICE</b>	National Institute for Health and Care Excellence
		<b>NOACs</b>	Non-vitamin K oral anticoagulants
		<b>NRS</b>	Nutritional risk screening
		<b>NSAIDs</b>	Non-steroidal anti-inflammatory drugs
		<b>ONS</b>	Oral nutritional supplements
		<b>OP</b>	Osteoporosis
		<b>O2</b>	Oxygen
		<b>PO</b>	Per oral
		<b>Pro-BNP</b>	Pro-brain natriuretic peptide
		<b>RCP</b>	Royal College of Physicians
		<b>REFRA-FLS</b>	Registry of Fractures-FLS

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<b>TIME</b>	Turkish inappropriate medication use
<b>VRS</b>	Verbal rating scale
<b>WHO</b>	World Health Organization
<b>5-HT3</b>	5-Hydroxytryptamine 3

## Introduction

A significant global increase in hip and other fragility fractures is imminent, constituting a substantial burden to societies and health systems. Incidences of hip fracture are projected to increase by 310% in men and 240% in women by 2050 [1]. The decrease in intrinsic capacity is expected to increase dependency rates [2]. Orthogeriatrics is a team approach, the objective of which is to provide adequate and timely intervention for individuals suffering from fragility fractures, particularly hip fractures. Some developed countries have established orthogeriatric services, while many others, including Turkey, have so far not. In this article, our aim is to outline the status of orthogeriatrics in older adults in Turkey in order to identify areas for improvement and thereby represent a practical model for those regions where orthogeriatrics is not developed. We present clear calls for action, emphasizing possible and noteworthy areas for improvement.

## What is orthogeriatrics?

Orthogeriatrics is a multidisciplinary team approach, the aim of which is to provide adequate and timely intervention opportunities for fragility fracture patients who are mostly frail and very complex. This approach could implement optimal treatment, rehabilitation, and secondary prevention of further falls and fractures [3, 4]. The aim is to re-gain the functionality and quality of life to pre-fracture levels if possible, thereby decreasing disability and mortality [5].

To date, the collaboration of orthopedics and geriatrics has been implemented in the Nordic countries (i.e., Norway, Denmark, Finland, Sweden), Scotland, Australia, New Zealand, the USA, Canada, Germany, Spain, the UK, the Netherlands, Italy, Brazil, China, North Africa, Colombia, Israel, Singapore, India, Korea, Switzerland, and Ireland. Some other countries (Hong Kong, Malaysia, Lebanon, Iran, France, Mexico, Japan) including Turkey have also made some endeavors in this field [4, 5]. It is estimated that the number of hip fractures could increase twofold by 2025 and more than threefold by 2050 [6]. While hip fracture audits are relatively established in many regions of the world, other fragility fractures are also supervised, albeit less commonly. This is mainly due to the difficulty of detecting cases that do not require frequent hospitalization. Fracture registry systems have been developed to investigate vertebral fractures

in the UK, fractures (fragility and non-fragility) in Sweden, and periprosthetic and peri-implant fractures in Germany [4]. There are many missed opportunities, particularly in the developing countries and even in some developed countries.

In a systematic review, the highest incidence rates of hip fracture were observed in Denmark (574/100.000), Norway (563/100.000), and Sweden (539/100.000) [7]. The orthogeriatric approach is proven to be cost-effective, resulting in a better mobility status, functionality, quality of life, lower fear of falling, and consequent hospital admissions [8, 9]. The length of hospitalization and mortality are also decreased [10]. In a study, the risk ratio for the prevention of falls was 1.15 with orthogeriatric care, when compared with ordinary orthopedic care [11]. In another study, a reduction in recurrent falls was reported in the enhanced interdisciplinary inpatient rehabilitation and care model group [4]. By contrast, evidence for the effect of orthogeriatric care on fall prevention, falls, and subsequent fracture rates is still insufficient and inconclusive. In this regard, more studies are needed to determine whether orthogeriatric approach may reduce falls and secondary fractures [12].

This interdisciplinary team includes an orthopedist, geriatrician, anesthetist, nurse, physiotherapist, dietician, social worker, occupational therapist, and clinical pharmacist [5]. The geriatrician acts to decrease and manage perioperative comorbidities and complications; handle drug therapy, coping with inappropriate medication use/polypharmacy; assess falls; and manage osteoporosis (OP) [5]. As individuals who suffer from hip fractures are mostly elderly and have potential cognitive impairments and a very high fall risk, inpatient services should be organized to counteract delirium and falls and to encourage mobilization [5].

Different orthogeriatric models have been acknowledged to improve outcomes for hip fracture patients [12]. In Model 1, patients are admitted to an orthopedic unit. Orthopedic surgeons have overall responsibility, while the geriatricians are consultants. In Model 2, patients are admitted to a geriatric unit. Geriatricians have overall responsibility, while the orthopedic surgeons are consultants. In Model 3, patients are admitted to an integrated unit with shared care. Both the orthopedic surgeons and geriatricians share responsibility. A meta-analysis has identified a significant decrease in long-term mortality, in-hospital mortality, time to surgery, lower postop delirium, and improved function with Model 1 [12]. In another study examining the effects of a dedicated geriatric unit on the mortality in older adults with hip fractures, both mortality and re-hospitalization risks were shown to be significantly decreased compared to the orthopedic cohort, even after adjustment for age, gender, and comorbidities [13]. A recent meta-analysis identified that older adults with hip fractures, admitted early into a dedicated orthogeriatric ward, had reduced long-term mortality [14]. Although there are only limited studies to provide a better

overview, the geriatric orthopedic co-management model (Model 3) is regarded as the latest trend [5, 10].

## Components of orthogeriatric care

### 1) Preoperative care

#### i. Hospitalization and radiological examinations

Clinicians should evaluate the fall event; functionality before the event; consciousness level; possible head trauma and other fractures sites; the possibility of concurrent infection; stroke; anemia; arrhythmia; heart/respiratory failure; dehydration; malnutrition; polypharmacy; and alcohol consumption [5]. In Turkey, orthopedic surgeons commonly focus on the trauma and other possible sites of fracture, stroke, and other systemic problems. Yet, fall assessment, malnutrition, polypharmacy, and alcohol consumption are not evaluated regularly.

#### ii. Blood and urine analysis and electrocardiogram

Clinicians should request comprehensive routine blood tests [hemogram; C-reactive protein (CRP); kidney, liver, and thyroid function tests; electrolytes; 25-hydroxy vitamin D level, B12, and folic acid]. Close electrolyte monitoring should be performed in malnourished patients in terms of the risk of refeeding syndrome. Also, the following tests should be requested in the specified situations: hemoglobin A1C (HbA1C) in diabetic patients, pro-brain natriuretic peptide (Pro-BNP) in suspected heart failure, troponin in acute coronary syndrome, and international normalized ratio (INR) in those using warfarin. Spot urine analysis should be performed in all patients, and if a urinary infection is suspected, a urine culture should be obtained [5]. Electrocardiogram (ECG) must be performed on hospital admission [5]. According to our observations from the 2 centers in our country where the orthogeriatric approach is applied, while these are commonly utilized in Turkey, spot urine analysis is commonly overlooked with a subsequent failure to perform a culture test when required.

#### iii. Preoperative evaluation

Preoperative evaluation by a geriatrician is preferred. However, if the geriatrician is not available, the operation should not be delayed [5]. An early operation, within 1–2 days with subsequent mobilization, reduces mortality in hip fracture patients [4, 15]. Norwegian guidelines recommend operation within the first 48 h and the National Institute for Health

and Care Excellence (NICE) guidelines for the English and Welsh National Health Service (NHS), within 36 h. To ensure optimal conditions, the operation should not be postponed [4]. In Turkey, the number of geriatricians is limited; however, internal medicine specialists are widely available. Even so, their education on the geriatrics approach is limited. Also, in locations where geriatricians are available, orthopedic surgeons do not commonly seek geriatric evaluation, and the focus is mostly on prompt surgery and immediate surgery success. We suggest that orthopedic surgeons request comprehensive evaluations for each inpatient presenting with hip fractures, if these are available, from a geriatrician or otherwise from an internal medicine specialist. Comprehensive geriatric assessment (CGA) has an important role in reducing the risk of complications and post-discharge mortality in older adults with hip fracture [4]. Comprehensive geriatric assessment should include brief assessments of the following: pain [with verbal rating scale (VRS)]; malnutrition [with nutritional risk screening (NRS)-2002 score]; delirium (with 4AT test); cognition [with Mini-Mental State Exam (MMSE)]; urinary incontinence; falls; and sleep disorders [4, 5].

#### iv. Pain management

The patient should be managed to be painless or with mild pain at rest and mild/moderate pain upon moving. Clinicians should be attentive in the management of cognitively severely impaired individuals and those unable to speak. In these patients, increased respiratory rate, restlessness, resistance to posture changes, painful facial expressions, crying, and delirium constitute the pain indicators [5]. The basic principle is to treat pain with paracetamol and nerve blockade and to supplement with opioids only if necessary [4, 5]. Surgery may be the best analgesic method, as it relieves pain [5].

#### Analgesics

- **Paracetamol**  
Paracetamol is the gold-standard analgesic medication in this scenario. The recommended dose is 4 × 1 g per oral (po)/intravenous (iv), while the first dose should be 2 g if the bodyweight is > 60 kg. If the bodyweight is < 60 kg, the loading dose should be 1.5 g routinely followed by 3 × 1 g po/iv. Of note, paracetamol should be used cautiously in case of hepatic failure. The dose should be reduced after 14 days in individuals older than 80 years and who have very low body weight [5].
- **Opioids**  
This is not the first choice, given their frequent hazardous adverse effects. Side effects are common, serious, and wide-range, i.e., respiratory depression, urinary

retention, nausea, constipation, fall tendency, and delirium [5]. If required, clinicians should commence morphine in the lowest effective dosage. Morphine should be used with caution in renal failure. In this context, oxycodone may be an alternative. If adverse effects appear, switching to an alternative is performed because side effect profiles vary between opioids. Naloxone should be considered in titrated doses in case of overdose [5]. Meperidine is unacceptable due to neurotoxicity and delirium risks, especially in chronic renal failure, which is very prevalent among fragility fracture patients [16]. Tramadol can cause severe problems like convulsions, serotonergic syndrome, and hypoglycemia. Accordingly, clinicians should avoid tramadol, which only may be given in titrated doses [5, 17]. Oxycodone, hydromorphone, morphine, fentanyl, and buprenorphine may be alternatives [16].

- **Non-steroidal anti-inflammatory drugs (NSAIDs)**

These are potent analgesics; however, they are not recommended in standard therapy in these patients, considering prevalent renal failure, hypovolemia, gastrointestinal bleeding risk, heart failure, hypertension, and cardiovascular diseases [5]. They have the potential to delay fracture healing [18] and are rarely suggested for older adults, being only a cautious alternative if pain management is inadequate and others are not tolerated [5].

In Turkey, paracetamol is not commonly used for pain management due to its underappreciated analgesic effect in higher doses. The alcohol consumption rate is low between the ages of 18 and 60 in our country (7.8%) [19]. Also, between the ages of 65 and 74, the rate for men is 11.2% and 1.3% for women, while the rate is 4.4% for men and 0.5% for women aged 75 and over [20]. Furthermore, according to the “Global Alcohol and Health Report” published by the World Health Organization (WHO) in 2014, the consumption of alcohol in Turkey is lower than in many other countries [21]. In this context, alcohol consumption is usually not a major problem among older Turkish adults. Paracetamol is generally well-tolerated if there is no factor contributing to paracetamol toxicity, such as liver failure (related with, e.g., hepatitis B, C, and chronic liver disease), drug use causing hepatotoxicity; or advanced age, and very low weight [22]. Yet, NSAIDs are used liberally with consequential adverse events, some of which are recognized, e.g., renal failure and gastrointestinal bleeding, but some are not recognized, i.e., cardiovascular events.

- **Peripheral nerve blockade**

Local nerve block is increasingly being used for the management of pain. NICE guidelines report that nerve block

should be used whenever possible to limit the use of systemic analgesics. Both femoral nerve and fascia iliaca compartment (FIC) blocks are shown to be efficacious in hip fractures. These are recommended in cases of severe pain as they reduce the use and side effects of opioids preoperatively [4, 5, 23, 24].

#### **v. Antithrombotic therapy**

Non-vitamin K oral anticoagulants (NOACs) do not increase perioperative bleeding and mortality [25]. They should be ceased 24–48 h before spinal anesthesia. The international normalized ratio (INR) should be < 1.5 in warfarin users, prior to spinal intervention [4]. Clopidogrel, ticagrelor, and prasugrel users cannot be given spinal anesthesia, but aspirin and dipyridamole are safe [5].

Low-molecular-weight heparin (LMWH) (subcutaneous) once a day and generally thigh-length vs. knee-length anti-embolic stockings are recommended for deep vein thrombosis prophylaxis during hospitalization [4]. The American Association of Clinical Pharmacy guidelines recommend LMWH use, lasting for 10–14 days, up to 35 days [26].

In Turkey, antithrombotic pharmacologic therapy is mostly managed in line with guidelines. Knee-high anti-embolic stockings are commonly employed as there are compliance problems with thigh-high stockings.

#### **vi. Anesthesia**

The routine method is spinal anesthesia with bupivacaine; however, general anesthesia may be preferred in line with the patient or surgeon’s preference or if contraindications for spinal anesthesia, i.e., a risk of bleeding, the use of dual anticoagulants, previous dorsal surgery, or local pathology are present [4].

Spinal anesthesia is generally preferred in Turkey, if available. If it is not, general anesthesia is used.

#### **vii. Other essentials in the preoperative period**

Vital functions should be monitored four times a day and, in high-risk patients, peripheral oxygen saturation two times a day. Fluid balance should be followed by using a urinary catheter on postoperative day one. Constipation is common, and prophylactic laxatives should be given if needed. Urinary incontinence medications should be discontinued until mobilization. Upon the removal of the bladder catheter, residual urine should be assessed via bladder scanning. Medications should be managed, taking into consideration polypharmacy, fall risk (especially for antihypertensives, alpha-blockers, and opioids), and delirium risk (especially

anticholinergics, sedatives) [5]. Neuroleptics via extrapyramidal side effects, benzodiazepines via sedation and balance disorders, and Z-type hypnotics via sedation and ataxia are not advised in most patients due to high fall risk [16].

In Turkey, most of the above measures are taken; however, constipation is commonly overlooked with a failure to commence routine laxatives in these risky individuals. Urinary catheters are used for longer periods with subsequent development of related complications. While this may be needed in sacral pressure sore cases, it is not removed in many cases without a valid indication. Residual urine screening following catheter removal is usually not performed; catheters are sometimes only removed just prior to discharge. Medications are not commonly managed because they are mostly related to various accompanying chronic internal diseases and geriatric syndromes. Surgeons do not consider medicines due to their limited experience in these conditions and focus mainly on immediate surgery and discharge. In our country, clinicians have Turkish inappropriate medication use (TIME) criteria specifically developed for use in Eastern Europe [16]. This has been validated by an international expert group and can be used through Europe [27]. A mobile application (TIME application) has been released very recently ([www.timecriteria.com](http://www.timecriteria.com)). Using this application, surgeons have the opportunity to screen for inappropriate medication use.

Malnutrition screening is one of the most important actions. Individuals should be served energy and protein-rich meals [5]. It should be noted that in hip fracture patients, oral nutritional supplements (ONS) should be started regardless of malnutrition risk/malnutrition status [16]. Preoperative fasting should be kept to a minimum if possible. Preoperative ONS may be considered in patients with a waiting period > 4–6 h. In the preoperative period, patients should stop solid foods only 6 h and clear liquids 2 h beforehand [4]. Clinicians should review risk factors for delirium. All patients should be screened daily and assessed with standardized tools to avoid delirium being missed. The 4AT, a simple scoring with good reliability, is a useful tool for recognizing and screening delirium ([www.the4AT.com](http://www.the4AT.com)). It does not require special training and has been validated in hip fracture patients [28]. While neuroleptic prophylaxis is not recommended, haloperidol (0.25–2 mg oral or intramuscular) can be used in the presence of hazardous agitation in a hyperactive delirium state. It should be commenced with a low dose, and the daily dose should not exceed 5 mg. Lower doses should be used for patients with dementia and frailty [4, 5]. If there is no efficacy after 2–4 doses, olanzapine (2.5–10 mg oral) and risperidone (0.5–2 mg oral) can be given. All these drugs are contraindicated in the presence of QT prolongation [4, 5]. Because of extrapyramidal side effects, haloperidol is contraindicated in Parkinson's disease, Lewy body disease,

and other Parkinsonism disorders [5, 16]. In such diseases, instead of haloperidol, quetiapine (12.5–50 mg) may be an alternative. Likewise, hypoactive delirium should not be overlooked. Neuroleptics are not used in hypoactive delirium [5]. Sleep problems are common for a variety of reasons. In this case, besides non-pharmacological approaches, melatonin is the supplement of choice. Pressure sores may develop in risky individuals, and measures for prevention/treatment should be commenced [5]. Each and every patient should be provided with a special pressure-relieving mattress, accompanied by position changes at regular intervals, while the operated leg is kept in 30 degrees of abduction [29].

Nutritional screenings are conducted before surgeries as a public health policy in Turkey, as recommended by the Ministry of Health. Even so, there is still a failure to implement a nutritional plan even when a nutritional problem is detected. While there are some attempts to limit the preoperative fasting state, many centers implement an overnight fasting order the day before the surgery. Oral supplements are rarely used and then only in the limited number of centers that are endeavoring to integrate orthogeriatric practice. A common pitfall is sleep problems, for which attempts are often made to solve them with benzodiazepines or neuroleptics, the use of which invites additional problems. Pressure-relieving mattresses are uniformly applied throughout the country, but nursing care with position changes is dependent on the center with widespread practical differences.

Another issue is the management of cardiovascular problems. Troponin monitoring may be complex in patients at high risk of acute coronary syndromes (ACS) because troponin may be elevated in falls owing to muscle injury. Therefore, close ECG monitoring and troponin follow-ups are recommended in case of ACS suspicion [5]. Postoperative atrial fibrillation is common, and beta-blockers should be continued during hospitalization. Respiratory problems should be assessed, as should vigilance for and the treatment of postoperative mucus plugs [5]. Chronic obstructive pulmonary disease (COPD) exacerbations are common [5]. Blood loss by surgery and transfusion need should be considered with a hemoglobin target of 9–10 g/dl in cardiac disease and cerebral and pulmonary dysfunction [5]. Hypoxia should be assessed, and oxygen (O<sub>2</sub>) supplementation should be provided if saturation is below 95% [4]. Of note, prophylactic O<sub>2</sub> is not recommended [5]. First-generation cephalosporin group antibiotic, which is preferably iv cefazolin, should be commenced for surgical prophylaxis [30, 31]. Clindamycin and vancomycin can be alternatives if there is a beta-lactam allergy [31]. Clinicians can use a validated hip fracture risk stratification tool, such as the Nottingham Hip Fracture Score, to predict the risk of 30-day mortality (Table 1) [32].

**Table 1** The Nottingham hip fracture score [32]

Variable	Points	Total score	Predicted 30-day post-operative mortality (%)
Age 66–85 years	3	0	0.4
Age 86 years or older	4	1	0.6
Male	1	2	1.0
Hb less than or equal to 10 g dl on admission to hospital	1	3	1.7
Abbreviated mental test score $\leq$ 6/10 at hospital admission	1	4	2.9
Living in an institution	1	5	4.7
More than one comorbidity*	1	6	7.6
Active malignancy within last 20 years	1	7	12.3
<b>Total score</b>		8	<b>18.2</b>
		9	<b>27.0</b>
		19	<b>38.0</b>

A score out of ten is calculated by adding the scores for the eight criteria in the left column. The total score is used to estimate a patient's mortality risk within 30 days after hip fracture surgery (right column). Comorbidities (\*) include myocardial infarction, angina, atrial fibrillation, valvular heart disease, hypertension, cerebrovascular accident, transient ischemic attack, asthma, chronic obstructive pulmonary disease, and renal dysfunction

In Turkey, cardiovascular and respiratory problems are recognized and commonly consulted with the corresponding specialists. However, hip fracture risk stratification tools are not commonly introduced.

**Areas for improvement** Countries should review the components of orthogeriatric care to improve the management of fragility hip fractures and decrease the burden of fracture-related impaired functionality, quality of life, hospitalizations, mortality, and cost. We outlined the review results for Turkey above and clear and simple actions for improvement below, as a model.

**Box 1** Areas for improvement in the preoperative care of fragility fracture patients.

Assessment of fall events, malnutrition, polypharmacy, and alcohol consumption to be evaluated regularly
Spot urine analysis and urine culture in case of urinary infection suspicion to be ordered on hospital admission
Geriatric approach and education to be introduced widely
Preoperative FIC blockade to be considered in practice
Paracetamol to be considered a gold-standard pharmacological agent for pain, used in its sufficient dose
NSAIDs and opiates to be avoided if possible
Preferably apply thigh-length anti-embolic stockings
Spinal anesthesia to be widely introduced when appropriate
Urinary catheters limited to postoperative day one unless there is a high risk for sacral pressure sore
Medications to be managed with a holistic approach; TIME criteria application can be useful
ONS to be started regardless of malnutrition risk/malnutrition status
Manage sleep problems by non-pharmacological approaches and melatonin
Early operation attempts, within 1–2 days, to be improved
Hip fracture risk stratification tools to be introduced

*FIC*, fascia iliaca compartment; *LMWH*, low-molecular-weight heparin; *NSAIDs*, non-steroidal anti-inflammatory drugs; *ONS*, oral nutritional supplementation; *OP*, osteoporosis; *TIME*, Turkish inappropriate medication use in elderly.

## 2) Postoperative care

Following surgery, adequate fluid and nutrient intake, physiological defecation, micturition, and pain control should be ensured. Early mobilization should be attempted, and delirium should be closely monitored [5]. Orthostatic hypotension is common in this setting. It is very common among older adults. Also, prolonged immobilization, anesthetics used within the surgery, and anticholinergics promote orthostatism. Accordingly, orthostatism should be assessed after gaining the ability to stand still for 3 min [5]. Postoperative nausea is common. Metoclopramide and trimethobenzamide should be avoided due to their extrapyramidal side effects; domperidone should be avoided due to adverse cardiac events [16, 33]. Serotonin 5-HT<sub>3</sub> (5-hydroxytryptamine 3) receptor antagonists are the drug of choice [5].

Optimal protein intake is essential for wound healing and muscle strengthening to help counteract falls in the follow-up. The ideal amount is 1.0–1.5 g/day in older adults unless they are in the pre-dialysis period. During periods of acute stress, a protein supply of up to 2 g/day may be considered, if there is no severe kidney failure [16]. The PROT-AGE working group reported the required protein intake for older adults with chronic kidney disease (CKD), based on ideal body weight. In severe CKD (GFR, < 30 ml/min/1.73 m<sup>2</sup>), protein intake should be limited to 0.8 g/kg/day; in moderate CKD (GFR, 30–60 ml/min/1.73 m<sup>2</sup>), protein intake should be > 0.8 g/kg/day, but GFR should be checked twice a year; in mild CKD (GFR, > 60 ml/min/1.73 m<sup>2</sup>), protein intake may be increased according to the patient's needs. Protein intake > 1.2 g/kg/day (> 1.5 g/kg/day, if achievable) is recommended for hemodialysis or peritoneal dialysis patients

[34]. Optimal protein intake prevents bone loss after orthopedic surgery, increases muscle strength, reduces complications, and shortens hospitalization and rehabilitation [35]. Optimal energy is needed for protein to be used in recovery rather than as a source of energy. A caloric intake of 30 kcal/kg/day forms the basis to start in most cases and can be modified in the follow-ups by nutritional assessments [16, 36]. Calcium and vitamin D are vital for bone health and repair. Most fragility fracture patients lack adequate calcium and vitamin D intake. Vitamin D measurement is costly and may not be available in most locations. Therefore, commencing vitamin D treatment as cholecalciferol is recommended. The optimal intake is 800–1000 IU/d but can be given up to the upper tolerable limit of vitamin D, i.e., 4,000 IU/day [4, 16, 37]. However, in a 12-month double-blind, randomized controlled trial, the effects of various daily vitamin D doses on falls were examined in postmenopausal women (age range, 57–90 years) with baseline serum 25 (OH) D vitamin levels of 20 ng/ml or less. Participants were asked to maintain a 1200–1400 mg/day of calcium intake, and if they could not increase dietary calcium to those levels, a calcium supplement (mean, 580 mg) was given. The fall rates at high doses such as 4,000 and 4,800 IU/day of vitamin D were significantly higher than at doses of 1,600–3,200 IU/day. In this regard, in older women, especially those with a history of falls, the safe upper limit for vitamin D supplementation may be narrower than previously described [38, 39]. Elementary calcium is required at 1000–1200 mg/day dose and is preferably taken with regular meals [4, 40]. However, if the diet is insufficient, the advice is for it to be supplemented at about 500 mg/day [40].

Osteoporosis treatment should be started during hospitalization for fracture, given the reports appraising beneficial and non-hazardous osteoporosis medications when commenced in this state. Studies have shown that the early administration of bisphosphonates within the first 2 weeks after fracture does not delay fracture healing [4, 5, 41–44]. In cases where vitamin D is sufficient, and there is no other contraindication, oral bisphosphonates, zoledronic acid, and denosumab within the first 2 weeks and teriparatide within the first week after the fracture, during the hospitalization, can be started [4, 5].

Bone cement implantation syndrome (BCIS) is a rare complication that may cause 0.5% of cardiopulmonary arrest in surgeries integrating instruments and/or femoral cement fixation [4]. This should be considered during the postoperative period.

In postoperative management, the overall aim is to limit the length of hospital stay to a short a time as possible, to limit in-hospital complications [5]. Moreover, to achieve the

best results in the long-term, clinicians are expected to introduce optimal care measures in this period.

In this country, delirium is generally unrecognized by non-geriatricians/non-psychiatrists, as well as orthopedics staff. Postoperative orthostatism is seldomly considered and assessed. When nausea is encountered, mostly metoclopramide/trimethobenzamide is introduced. Nutritional needs are, unfortunately, seldom considered, which generally results in a lack of optimum protein, calcium, and vitamin D intake. Many fracture patients suffer from vitamin D deficiency, and treatment to combat osteoporosis is commonly disregarded. Orthopedics focuses on early discharge to limit in-hospital complications while on occasions missing optimal care opportunities for best functional outcomes.

Fracture liaison services (FLSs) are established to commence necessary osteoporosis treatment and the best possible care to prevent falls and subsequent fractures in those suffering from a fragility fracture [45]. The main elements involve identifying those patients, individualized assessment, treatment planning, maintenance, and follow-ups tailored to the needs of an individual case [46, 47]. Its scope is obviously the acutely hospitalized fragility fracture patients. It is beneficial and cost-effective. By managing falls and osteoporosis, these services are invaluable for reducing repeated fractures [48, 49]. A hip fracture audit is relatively established in some regions in the world, but an audit of other fragility fractures is less common. It is difficult to detect fractures that do not require hospital admission/hospitalization. Consequently, many vertebral fractures go clinically undetected [50, 51]. Further audit research is now focusing on FLS databases; for example, there is one in England under the auspices of the Royal College of Physicians (RCP), as part of the same Falls and Fragility Fracture Audit Programme (FFFAP), together with the National Hip Fracture Database (NHFD) [52], and also in Canada with 45 FLSs, in 2018 [53]. Spain is currently piloting a fragility fracture and FLS audit, the Spanish Registry of Fractures-FLS (REFRA-FLS), with the participation of over a dozen hospitals [54].

In our country, FLSs are currently limited and are only available in Cerrahpaşa Medical Faculty Hospital, Fatih Sultan Mehmet Training and Research Hospital, Ankara City Hospital, and Medicana International Ankara Hospital (<https://www.capturethefracture.org/index.php/map-of-best-practice>).

The first comprehensive orthogeriatric care concept to operate in Turkey was at Istanbul University Istanbul Medical School, followed by Istanbul Prof. Dr. Cemil Taşçıoğlu City Hospital. As comprehensive orthogeriatric care has only been applied in two centers, our data illustrate only a 2-center approach. In this regard, orthogeriatrics in

Turkey has several more steps to climb to achieve optimum application.

**Box 2** Areas for improvement in the postoperative care of fragility fracture patients.

Delirium to be considered and recognized

Orthostatic hypotension to be assessed after gaining the ability to stand still for 3 min

Nausea, if encountered, to be managed by 5-HT<sub>3</sub> receptor antagonists; metoclopramide/trimethobenzamide to be avoided

Protein intake (1.0–1.5 g/kg/d unless in pre-dialytic state), energy (30 kcal/d), calcium (1000–1200 mg/d), and vitamin D intake (1000 IU/d) be provided in osteoporotic older patients

Anti-osteoporotic medications to be commenced during fracture hospitalization, if appropriate

Fracture liaison services to be established in more centers

Orthogeriatric models to be widely implemented

*d*, day; 5-HT<sub>3</sub>, 5-hydroxytryptamine 3.

## Conclusion

We have outlined the orthogeriatric care concept and presented the current, commonly applied management protocol in Turkey. In so doing, we have identified several, nonetheless very valuable, areas for improvement. This study represents a practical model for countries where orthogeriatrics remains undeveloped. We have presented clear calls for action, emphasizing areas requiring significant improvement. We suggest that our recommendations offer great potential for the improvement of fragility fracture patient care in Turkey. Also, we call on other countries to model our approach to improve the management of fracture patients globally.

**Author contribution** Bahat G, Catikkas NM, Karan MA, and Reginster JY contributed to the study. Bahat G and Catikkas NM contributed to the study design. Bahat G and Catikkas NM did literature review. Bahat G, Karan MA, and Reginster JY did the critical review. All co-authors read and approved the final version of the manuscript.

**Availability of data and material** The data is available from the authors upon reasonable request.

**Code availability** N/A.

## Declarations

**Conflicts of interest** Gulistan Bahat has received a speaker honorarium from the companies LILLY and AMGEN. Nezahat Muge Catikkas has no conflicts of interest to declare that are relevant to the content of this article. Mehmet Akif Karan has no conflicts of interest to declare that are relevant to the content of this article. Jean Yves Reginster has received consulting fees or paid advisory boards from these companies: IBSA-Genevriev, Mylan, Radius Health, Pierre Fabre, Faes Farma, Rejuvenate Biomed, Samumed, Teva, Theramex, Pfizer, and Mithra Pharmaceuticals. He has received lecture fees when speaking at the invitation of sponsors from these companies: IBSA-Genevriev, Mylan, CNIEL, Dairy

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