ABSTRACT: With the increasing life expectancy, osteoporosis is becoming a major worldwide health problem. Osteoporotic fragility fractures affect the quality of life and are associated with premature mortality. The magnitude of the disease may become larger in developing countries, particularly in the Middle East where the prevalence of low bone mass is higher than in Western countries. Besides two small studies, there is no serious fragility fracture registry in Lebanon.

The British Orthopedic Association published guidelines on the care of fragility fractures in 2007. Inspired by this effort, and taking into consideration the Lebanese socio-medico-economical particularities, we will detail the multidisciplinary management of a fragility fracture, as listed in the international standards, from its presentation to the Emergency Department, through its peri-operative care, and we will pay particular attention to the different aspects of secondary prevention. We hope that this paper will contribute to the upgrading of care of fragility fractures in Lebanon in order to meet the international standards of care, thus setting the example to other countries and healthcare systems in the Middle East region.

INTRODUCTION

With the increasing life expectancy, osteoporosis is becoming a major health problem worldwide. More than 40% of postmenopausal women with osteoporosis are expected to experience at least one fragility fracture [1]. With each osteoporotic fracture, the risk of future fracture increases [2]. These fractures affect the quality of life and are associated with premature mortality. Nearly one in four men older than 60 will have a fragility fracture [3]. Unfortunately, patients with osteoporosis continue to be undertreated [4].

RESUME: Avec l’amélioration de l’espérance de vie, l’ostéoporose est devenue un problème majeur de santé publique. Les fractures ostéoporotiques affectent la qualité de vie et entraînent une mortalité précoce. L’ampleur de cette maladie risque d’empirer dans les pays en voie de développement, notamment au Moyen-Orient, où la prévalence de faible masse osseuse est plus élevée que dans les pays occidentaux. Mis à part deux études, un registre complet pour les fractures de fragilité n’existe pas au Liban.


The magnitude of the disease may become larger in developing countries, particularly in the Middle East where the prevalence of low bone mass is higher than in Western countries [5]. Three Lebanese studies have shown that the mean BMD for the Lebanese female is lower than that of the European woman [5]. Another Lebanese study [6] showed that hip fractures occur at a younger age in Lebanon (between 65 and 75) compared to Western population (above 75), and that 60% of patients with hip fractures have osteopenia rather than osteoporosis. Besides two small studies [7], there is no fragility fracture registry in Lebanon.

The British Orthopedic Association published, in the form of the Blue Book, guidelines on the care of fragility fractures in 2007. Inspired by this effort, and taking into consideration Lebanese socio-medico-economical particularities, we will try to establish some guidelines to initiate a national multidisciplinary approach for this disease.

We hope that this paper will contribute to the upgrading of care of fragility fractures in Lebanon in order to meet the international standards of care.
I. IMPROVING FRACTURE CARE THROUGH MULTIDISCIPLINARY TEAMWORK [8]

Hip fractures are associated with greater mortality and morbidity than other sites [9].

1. Most hip fractures present to the emergency department (ED), and the following check list should be completed in the ED:
   - Diagnosis: Focus on the patient’s symptoms and on the physical examination. Order antero-posterior and lateral hip X-rays. This will show the fracture in 99% of cases, with MRI or CT scan being useful in the remaining 1%.
   - Assure admission to the orthopedic department within four hours.
   - Use a pressure relieving mattress and appropriate pain killers.
   - Order appropriate routine blood workup, chest X-rays, EKG, etc.
   - Assess patient for other injuries (abdomen, head, etc.).
   - Adopt a full clinical evaluation: causes of fall, comorbidities, previous level of mobility, social support, and mental status on admission.

2. Pre-operative assessment
Patients often present with multiple comorbidities. Not uncommonly, patients may be taking warfarin or clopidogrel. Unlike elective surgery where these medications are stopped four to seven days before the intervention, in hip fractures an urgent intervention is needed within two days in order to reduce the risk of complications. Another concern is the choice of anesthetic technique. A Cochrane review [10] concluded that spinal or regional anesthesia may reduce postoperative confusion, but no conclusions could be drawn on mortality. We emphasize the importance of team work and the constant communication between the surgeon and other specialists as needed to ensure a safe surgery.

3. Surgical care of the fragility fracture
Osteoporosis makes fractures more likely to occur, and more likely to be comminuted. It slows bone healing.

a. Surgical care for hip fracture
   - All patients with hip fracture who are stable should be operated as soon as feasible (preferably within two days of presentation) [8].
   - Undisplaced intracapsular fractures (Garden I-II): Internal fixation using three screws is recommended. This procedure needs to be done within six hours of presentation [11], to avoid the risk of avascular necrosis.
   - Displaced intracapsular fractures (Garden III-IV): With internal fixation the risk of re-operation is 20-36%, due to non-union and avascular necrosis [12]. With arthroplasty, the re-intervention rate is 6-18%, but there is an increased risk of hematoma, wound infection, dislocation and probably a higher mortality [12]. Scientific evidence shows that a maximum time interval to surgery of 48 hours should not be exceeded [13]. Total endoprosthesis (TEP) delivered better results after three years and in the longer term with respect to pain and function [14]. The revision rate is 6% after 13 years compared with 33% for osteosynthesis and 24% for hemi-prosthesis [14]. Duration of surgery, blood loss, and the risk of early postoperative dislocation are lower if merely the head is replaced [15]. The failure rate for hemiarthroplasty (loosening of the prosthesis and degeneration of the acetabulum) is lower after the 75th year of life [12]. When osteoarthritis related changes are present, a hemiprosthesis is contraindicated [11]. The use of bone cement is partly determined by the bone quality that becomes apparent during the operation. The risk associated with cement use – fat embolism and right heart strain [16] – have to be considered, particularly in patients with reduced physiological resources. Modern cementing techniques are obligatory (preservation of the region of subchondral sclerosis, cement plug restrictors, pressure flush, retrograde filling, vacuum technique) [12]. Currently, 65% of hip prostheses are implanted cement-free [17].

   - Intertrochanteric fractures: The sliding hip screw is the gold standard for stable fractures [8]. For unstable fractures, intramedullary nails are a good choice. There is insufficient evidence from randomized trials to determine whether replacement arthroplasty has any advantage over internal fixation for unstable hip fractures [18].

   - Subtrochanteric fractures: Long intramedullary nails are frequently used with good result [8] and prosthesis might be a treatment of choice allowing the patient to get out of bed with full weight bearing more rapidly.

b. Surgical care for non-hip fractures
Vertebral fragility fracture account for one third of fragility fractures [19].

   - Vertebral compression fractures: Vertebroplasty or balloon kyphoplasty have been used. These procedures relieve pain in the short term, although in some countries these procedures are no longer routinely recommended because two sham-control trials published in the New England Journal of Medicine could not prove that these procedures were helpful in the long-term. No difference in pain relief and correction between those two procedures has yet been demonstrated [20-21]. Those procedures frequently require admission to a hospital. On the contrary, a patient can be managed at home with intra-nasal calcitonin, bracing and adequate pain killers [22] and bed rest. Restoring the spinal curvature might improve the outcome of the procedures.

   - Distal radius fractures: The options for management include: closed reduction and cast, intrafocal pinning (kapandji), or open reduction internal fixation using the locking plates. The decision should take into
account the patient’s functional requirements and general medical condition.

c. **Outpatient care**

Many fragility fractures (Colles, vertebral compression) do not require admission to the hospital. Patients or their caregivers should have contact with a Fracture Liaison Service [8]. This service is accomplished by a specialized nurse ‘the fragility fracture nurse’ whose role is to make sure that the non-hip fragility fracture patients receive the appropriate secondary prevention measures for osteoporosis.

4. **Postoperative care**

- **Analgesia** is essential for early rehabilitation. Many hospitals in Western countries have a dedicated pain team led by a senior nurse and supported by an anesthetist.
- **Wound care**: Wound hematoma is common. Small ones are left alone to resolve, larger collections require surgical drainage. Deep wound infection, below the deep fascia is rare but devastating. Superficial infections can be managed by antibiotics, deeper infections require surgery.
- **Pressure care area**: One third of hip fracture patients will develop pressure sores, most of which could be prevented by good care i.e. use of pressure relieving mattresses, regular repositioning, addressing incontinence and malnutrition [23].
- **Thromboprophylaxis**: Controversy over thromboprophylaxis continues. It is very well established that early surgery, immediate postoperative mobilization and avoiding prolonged surgery and over transfusion, will help to reduce the incidence of clinical thrombosis [8]. Despite the lack of evidence, the NICE guidance strongly advocates chemoprophylaxis (low-molecular weight heparin) for four weeks after surgery [24]. It is not established whether the delayed initiation of chemoprophylaxis, until after surgery to avoid postoperative bleeding and wound healing complications, remains effective. The use of a protocol to prevent thromboembolism should be an issue that must be agreed by the surgical, medical and anesthetic actors [24], and should not further delay surgery in particularly vulnerable patients [25].
- **Nutrition**: Hip fracture patients achieve only half of their needed daily calories, protein and other requirements [26]. Oral multinutrient feeds, and supplementary proteins may reduce the risk of death, infection and the days in hospital [27]. Part of nursing care should include assessment of nutritional intake, and referral on dietician if needed.
- **Early rehabilitation**: The current implants and techniques, allow an immediate postoperative rehabilitation [8].

5. **Model of ortho-geriatric care**

In the U.K., the complexity of the medical situation for fragility fracture patients has led to the establishment of a multidisciplinary approach of these patients since the 1960s [8]. The two primary actors are the orthopedic surgeon and the geriatrician. Good multidisciplinary work depends on good information sharing. A solution is the hip fracture nurse, a senior nurse who assumes a liaison role, will coordinate initial assessment, order a specific preoperative checklist, supervise postoperative care, rehabilitation, discharge planning, and secondary prevention and follow-up. One last role is to coordinate data collection, for a National Hip Fracture Database.

II. **SECONDARY PREVENTION**

1. **The importance of secondary prevention**

Fifty to 70% of patients presenting a hip fragility fracture have had a prior fracture (vertebral compression, wrist, etc.) [28]. Furthermore, two meta-analyses, have concluded that a prior fracture doubles the risk of a future fracture [29]. Studies from UK, Canada, France and many other Western countries suggest that there is a huge management gap in the secondary prevention of fragility fractures [30-31]. Fewer than 30% of patients with fragility fracture will have an osteoporosis risk assessment and treatment, and only 15% will receive an education for reducing their fall risk.

2. **Intervention strategies**

a. **Non pharmacological intervention**

- **Reducing fall risk**: Thirty percent of those aged 65 or more who live in the community fall each year, increasing to 45% in those aged 80 or above [32]. Recurrent falls are associated with increased rates of hospitalization and mortality [33]. A meta-analysis of fall-prevention trials, found that multifactor fall-risk assessment and management programs are the most effective programs at reducing falls [34]. Older patients should be consistently counseled to modify the home environment to improve safety and reduce risk of fall (install railings along stairways, remove loose floor coverings, etc.) [35]. Factors related to fall risk, such as visual disturbance and comorbid medical conditions, should also be identified and corrected.
- **Lifestyle adjustments**: In a prospective Australian survey, smoking was found as an independent risk factor for fragility fractures in both men and women [36].
- **Nutrition counseling**: Nutrition plays a critical role in reducing the risk of osteoporosis. An adequate calcium, vitamin D and protein intake resulted in reduced bone loss, better calcium retention, reduced age-related bone loss, and reduced fracture risk [37]. The beneficial effect of the Mediterranean eating pattern is well known [37]. The potential advantages of Mediterranean diet are: Vegetables and fruits containing high concentration of potassium will limit hypercalciuria, thus maintaining calcium capital in the bone. In addition, Braam et al. have suggested the benefit of Vit K (1 mg/day), in the postmenopausal women in enhancing BMD and reducing risk.
Fracture [38]. Both Vit C and Vit E were also suggested to maximize the BMD in human [39]. Finally, Vit B6 is known to play an important role in the maturation of collagen, thus participating in bone healing.

Fish offers a great source of omega 3/6 fatty acids which are known to participate in bone healing and in enhancing BMD [40]. In addition, it may be a good source of Vit D. Olive oil has a potent anti-inflammatory and anti-oxidant role, mainly due to its high concentration of Vit E [40]. Vitamin D deficiency is common among patients with osteoporosis and may increase fracture risk. One study, showed that in Lebanon, despite the sunny weather, there is a high degree of vitamin D inadequacy [41]. Inadequate vitamin D supplementation, high BMI and low educational levels were found to be the main risk factors for vitamin D inadequacy [41].

The results of all these studies emphasize the need for urgent measures in our part of the world. These measures include vitamin D supplementation of some food. In Lebanon, dairy products derived from natural cow's milk, which are highly consumed, could be a target for this fortification. Awaiting these measures to be effective, calcium and vitamin D supplementation is imperative in all postmenopausal women living in our part of the world [6]. The National Osteoporosis Foundation (NOF) recommends that postmenopausal women consume at least 1200 mg per day of calcium and 800-1000 IU per day of vitamin D through diet or supplementation.

- Physical exercise: a two-year study showed that a physical exercise program consisting of weight-bearing and resistance exercise, improved BMD significantly [42]. Exercise programs should include balance and postural training [43].

- Osteopathic treatment: The main goals are to normalize joint motion, improve circulation, and maximize the patient’s feelings of well-being [44].

b. Pharmacological intervention

Since 2008, the NOF recommends pharmacological therapy to those with T-scores < -2.5 or in patients with osteopenia (-1 < T-score < -2.5) and high absolute risk of fracture by FRAX. Pharmacologic treatment should also be prescribed for those who have sustained vertebral or hip fractures [45-46].

- Antiresorptive agents: The North American Menopause Society’s evidence-based consensus guidelines for the treatment of patients with osteoporosis, recommend bisphosphonates as first-line treatment [47]. This recommendation is based on the ability of these agents to reduce or prevent both vertebral and nonvertebral fractures [47]. In a rigorously designed meta-analysis, both alendronate and risedronate for three years effectively reduced the risk of non-vertebral fracture in patients with osteoporosis [48]. Some bisphosphonates have been shown to reduce fracture risk after relatively brief periods of use. Both Black et al. [49], and Pols et al. [50], found that women treated with alendronate (5-10 mg/d) had a lower relative risk for symptomatic vertebral and non-vertebral fractures within one year of treatment, compared with placebo. Zoledronic acid (Aclasta®), a third-generation nitrogen-containing bisphosphonate, is the first once-yearly treatment to have been approved for use in patients with postmenopausal osteoporosis or at high risk of fracture [47]. Intravenous zoledronic acid 5 mg once yearly is effective in reducing the risk of several types of fracture in patients with postmenopausal osteoporosis or recent low-trauma hip fracture. Ibendronate, a powerful bisphosphonate, has made it possible for the first time to treat osteoporosis with a single tablet per month [50]. Ibendronate manifested significant improvement of the BMD after 12 months of treatment of patients with decreased BMD, with good tolerance. In addition, in men with low BMD, one year of treatment with oral once-monthly 150-mg ibandronate significantly increased BMD at the lumbar spine and hip, and was generally well tolerated [51].

In general, all bisphosphonates are powerful antiresorptive agents and have a great effect on bone physiology. They all reduce fracture incidence and improve quality of life [47]. We must be aware of their contraindications and their side effects. It seems that bisphosphonates have no effect on prosthesis loosening [52], no effect on bone healing [53], and if used four to six weeks after the fracture, bone healing occurs without delay [53]. One important fact is that most of the studies that evaluate the bisphosphonates were established for the osteoporotic patients, while most of the fragility fractures occur in the osteopenic population [53].

- Strontium ranelate is a new orally administered agent that reduces the risk of vertebral and hip fractures [47]. It has a dual action, both as an antiresorptive and anabolic agent. Evidence for the safety and efficacy of strontium ranelate comes from two large multinational trials, the SOTI (Spinal Osteoporosis Therapeutic Intervention) and TROPOS (Treatment Of Postmenopausal Osteoporosis) studies. In those two studies, strontium ranelate was shown to be effective in preventing fracture not only in osteoporotic patients but also in osteopenic patients. The overall incidence of adverse events did not differ significantly from placebo and were generally mild.

- Denosumab is a fully human monoclonal antibody to receptor activator of NF-κ B ligand (RANKL), a cytokine member of the TNF family that is the principal mediator of osteoclastic bone resorption [47]. In postmenopausal women with osteoporosis, denosumab 60 mg by subcutaneous injection every six months increased bone mineral density (BMD), reduced bone turnover markers, and reduced the risk of vertebral, hip, and non-vertebral fractures. It is well tolerated with a safety profile similar to placebo.
It may be used for the treatment of patients with gastrointestinal contraindications or side effects with oral bisphosphonates.

- **Anabolic agents:** The only anabolic medication currently approved by the FDA is teriparatide [25]. In a large, randomized, placebo-controlled clinical trial, treatment of postmenopausal women with teriparatide (20 µg/d) significantly reduced patient risk of vertebral and non-vertebral fracture after 21 months of therapy [52].

The best solution to consistently deliver the secondary prevention to all patients is the Fracture Liaison Service (FLS). This model has been recognized internationally and by the UK Department of Health [8]. This FLS is operated by a nurse specialist supported by Lead Clinician in Osteoporosis. This nurse identifies patients with new fragility fractures. The nurse specialist arranges an appointment at the One stop FLS clinic where BMD is measured by DXA, and treatment is initiated if indicated. Older patients are referred to the fall assessment pathway. Another role is to network with other agencies to enhance fracture reduction such as continuous education of the patient and his family on the importance of compliance and adherence to the osteoporosis treatment and lifestyle modification. One last role is to participate in the updating of the National Fragility Fracture Registry.

### III. RECOMMENDATIONS

In summary, we can adopt the following recommendations:

1. In the ED, assure admission of hip fracture patients to the orthopedic department as soon as possible.
2. Emphasize on the importance of team work between the surgeon, and other needed specialists. All patients with hip fracture who are stable should be operated without delay.
3. Adopt a multidisciplinary model (anesthetist, nutritionist, physiotherapist, etc.) to assure an adequate postoperative care.
4. Establish a Lebanese fragility fracture registry.
5. Encourage the creation in each hospital, of a new position: the fragility fracture nurse.
6. Implement a secondary prevention strategy by counseling to reduce risk of fall, adequate supplementation of calcium and vitamin D especially in our country, maintaining an appropriate food intake in the fragility fracture population, adding a supervised physical exercise program and osteopathic manipulation. Do not forget to evaluate osteoporosis and treat with appropriate medications if needed.
7. Establish a Lebanese National Hip Fracture Database (LNHFD) using web-based methods. This data collection, entry and follow-up of patients will be assured by the hip fracture nurse in each hospital. The implementation of such LNHFD should be supported by the Lebanese Ministry of Health and the Lebanese Order of Physicians.

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