Team Approach: Multidisciplinary treatment of Hip fractures in elderly patients - Orthogeriatric care

Wender Figved, MD, PhD[1]
Marius Myrstad, MD, PhD[2]
Ingvild Saltvedt, MD, PhD[3,4]
Merete Finjarn, RN[1]
Liv Marie Flaten Odland, RPT, MSc[2]
Frede Frihagen, MD, PhD[5,6]

[1]*Department of Orthopaedic Surgery, Baerum Hospital, Vestre Viken Hospital Trust, Norway*
[2]*Department of Internal Medicine, Baerum Hospital, Vestre Viken Hospital Trust, Norway*
[3]*Department of Geriatrics, St Olav Hospital, University Hospital of Trondheim, Trondheim, Norway*
[4]*Department of Neuromedicine and Movement science, Norwegian University of Science and Technology (NTNU), Trondheim, Norway*
[5]*Division of Orthopaedic Surgery, Oslo University Hospital, Norway*
[6]*Institute of Clinical Medicine, Faculty of Medicine, University of Oslo, Norway*

E-mail address for W. Figved: wender.figved@vestreviken.no
ORCID iD for W. Figved: 0000-0002-8201-9818
Department of Orthopaedic Surgery
Baerum Hospital
Vestre Viken Hospital Trust
1349 Gjettum
Norway

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Take Home Points

- Patients with hip fractures are best managed by a multidisciplinary team.
- The multidisciplinary team consists of orthogeriatrician, orthopedic surgeon, anesthesiologist, orthopedic and/or geriatric nurse, occupational therapist, physiotherapist, clinical pharmacologist and may also include other professions, such as endocrinologist, nutritional therapist, and social worker.
- Key factors include perioperative assessment and early surgery, comprehensive geriatric assessment (CGA), multidisciplinary in-ward assessment including discharge planning, treatment and rehabilitation, and secondary fracture prevention.
- Current evidence show that older people receiving multidisciplinary treatment for hip fracture, CGA, and systematic secondary fracture prevention, have reduced morbidity and mortality, a lower risk of subsequent fractures, and are more likely to return to the same location they lived in before hospital admission.

Introduction

Hip fractures are among the most common, serious and costly fractures in the elderly. The global prevalence in 2010 was 2.7 million. Due to population ageing this is expected to increase to about 4.5 million cases in 2050[1].

Hip fractures are frequent in older people[2], and are often a result of falls due to frailty with sarcopenia, impaired balance and gait. Hip fracture patients share many common characteristics with geriatric patients, as most of them are old, frail, have reduced physical functioning, increased risk of falls, cognitive impairment and dementia, multi-morbidity, and polypharmacy. The broad team approach that is necessary to address this spectrum of conditions in an acute setting is often referred to as comprehensive geriatric assessment (CGA)[3]. When organized in acute geriatric wards, comprehensive geriatric care improves outcomes for frail older patients[4,5]. After orthogeriatric care was introduced in the United Kingdom (UK) the mortality among hip fracture patients has decreased[6,7].

Hip fractures in older individuals are associated with poor short and long term prognoses, with increased mortality, and negative impacts on function, mobility and quality of life. Many patients remain disabled with reduced gait function for the rest of their lives. Hip fractures have substantial sosioeconomic consequenses due to costs related to acute and post-acute institutional care, and need of assistance in daily living.

Surgical care is crucial, but with the goal to improve the patients' prognosis and achieve better function and quality of life, a wider approach is necessary. Recently, studies have demonstrated that even older hip fracture patients benefit from CGA as part of a multidisciplinary orthogeriatric treatment with improved mobility, function and quality of life, and that ortogeriatric care is cost-effective[8-10].

In this review, we aim to address multidisciplinary and orthogeriatric treatment for elderly hip fracture patients, presenting a hip fracture patient admitted to an orthopedic ward.

Clinical Scenario

The patient is an 82-year-old woman with a medical history of hypertension treated with amlodipine and candersartane, hyperthyroidism treated with levothyroxin, and who underwent a successfully surgically treated spinal stenosis decompression 20 years earlier, and type-2 diabetes treated with metformin. Due to paroxysmal atrial fibrillation, she uses oral anticoagulation treatment with warfarin to prevent ischemic stroke. Her vision is impaired due to cataract of one eye and an arterial thrombosis of the other eye. She lives with her husband in an apartment, with no community services. She had no previous cognitive impairment and no problems walking without aids. While shopping, she slipped on a carpet and sustained a fall from a standing height, injuring her left hip. She also suffered a mild head trauma. An ambulance brought her straight to the emergency department (ED) of her local hospital, where an elevated serum glucose level of 23 mmol/L was treated with a fast-acting insulin analog. Intracerebral or subdural bleeding was ruled out with an acute cerebral CT scan. Radiographic evaluation revealed a displaced left femoral neck fracture and mild (asymptomatic) osteoarthritis (Fig. 1).

Her body mass index (BMI) was 22.7 kg/m2, and her American Society of Anesthesiologists (ASA) score was 3. Her electrocardiogram (ECG) was normal. Laboratory studies include an albumin of 2.7 g/dL, a hemoglobin of 10.3 g/dL, international normalized ratio (INR) of 1.3, and a vitamin D of 68 nmol/L. Serum electrolytes and renal function were normal. While still in the ED, a multidisciplinary patient pathway was planned (Fig. 2).

Team Approach

Orthogeriatric care is performed according to the same principles as CGA, and is performed by an interdisciplinary team of professionals specialized in treatment of elderly patients. Usually, the team is comprised of a geriatrician and an orthopedic surgeon, collaborating with a nursing staff trained in geriatrics, physiotherapists, occupational therapists, clinical pharmacologists, and in many cases a nutritionist and a social worker. The team collaborates both informally and in regular interdisciplinary meetings to discuss the patients, develop individual care plans, and define short- and long-term goals for each patient. CGA includes the use of standardized assessment tools for evaluation of cognitive and physical function. Pain assessment should by performed by using numeric or verbal rating scales. Discharge planning start as early as possible. All team professions have dedicated responsibilities.

The orthogeriatric hospital ward should have sufficient space for patients to move around, available aids for mobility and self-care, and calendars and clocks as cues for orientation. CGA focuses on functional status and the patient's socio- and environmental situation. Collaboration across sectors as well as with the patient and her caregivers is necessary to achieve continued rehabilitation and a successful discharge. The aim is to provide optimal medical treatment, avoid inappropriate drug prescriptions, to prevent complications, start rehabilitation as early as possible, and plan for discharge from hospital to further rehabilitation.

Anesthesiologist and orthopedic surgeon

Communication between anesthesiologist, orthopedic surgeon, and orthogeriatrician, is crucial to secure the total medical care throughout the patient pathway. Patient factors and frailty

should be discussed, with the goal of not delaying surgery more than absolutely necessary. Co-morbidity should be acknowledged and accounted for[11,12]. The International Fragility Fracture Network Delphi consensus statement on the principles of anesthesia for patients with hip fracture, released earlier this year, promotes the use of hypotensive neuraxial anesthesia in most patients, and that anesthesia for hip fracture should be undertaken by an appropriately experienced anesthetist. Anesthesia should be administered according to agreed standards at each hospital, using age-appropriate doses, with the aims of facilitating early patient re-mobilization, re-enablement and rehabilitation. Also, if used at all, intra-operative sedation should be adjusted according to the patient's age, frailty and comorbidities, to minimize the risk of delirium[13,14]. Single-dose methylprednisolone may reduce both the prevalence of delirium and the severity of fatigue after hip fracture surgery in older patients[15]. The anesthesiologist and the anesthesiology nurse are also responsible for correct administration of perioperative antibiotics. The orthopedic surgeon and the anesthesiologist should discuss the scope of the planned surgery, including measures taken when using bone cement[16], and measures taken when reversal of anticoagulants are needed[14]. The orthopedic surgeon should consider the surgical treatment options according to hospital guidelines and current evidence[6,17].

After diagnosis, our patient's preoperative assessment was conducted by the orthopedic surgeon and the anesthesiologist on call. Several types of peripheral nerve blocks have been studied, the femoral nerve block and fascia iliaca block being the most common[14,18]. Our patient received a femoral nerve block on the left side while still in the ED. The patient was deemed medically optimized for operative treatment, which was scheduled for the following day. Based on the patient's physiological age, medical comorbidities, and activity level, hospital guidelines recommended a left total hip arthroplasty with a cemented femoral stem, and the anesthesiologist

planned for a spinal anesthetic. The operating room (OR) team consisted of an anesthesiologist, an anesthesiology nurse, two OR nurses, one consultant and one resident orthopedic surgeon. Prior to surgery, the safe surgery checklist was completed, with the use of bone cement reported as a concern[16,19], also securing the timely administration of antibiotic prophylaxis. She received 1 g tranexamic acid intravenously to reduce bleeding[20,21]. She underwent the surgery as planned, with a duration of 53 minutes, associated with 280 mL of blood loss. After 3 hours in the postoperative ward, she was transferred to the orthopedic ward for further rehabilitation and multidisciplinary treatment. Her postoperative hemoglobin was 9.9 g/dL. Postoperative radiographs were examined by the orthopedic surgeon (Fig. 1).

Orthogeriatrician

Early and optimal assessment and treatment of concomitant medical conditions is crucial. A thorough clinical evaluation and laboratory tests should be performed regularly, in order to recognize postoperative complications such as anemia, infection, dehydration and electrolyte disturbances, and perioperative decompensation of comorbidities like diabetes, arrhythmias, and heart failure. Oxygenation must be measured regularly; with oxygen supplies if saturation is low. Blood transfusions should be given if needed. Monitoring of supine and orthostatic blood pressure is important, and cardiovascular drugs have to be adjusted according to these measurements.

A clinical medical review should be performed by the geriatrician, in cooperation with the clinical pharmacist, in order to avoid inappropriate drug treatment. All patients should receive acetaminophen, and a majority needs an opioid. NSAIDs should be avoided due to a high risk of side effects among frail elderly patients, including bleeding, kidney failure, and

exacerbation of congestive heart failure[18]. Adjustments of anticoagulation therapy and antithrombotic prophylaxis should be individually tailored. Constipation is common among hip fracture patients, and treatment with laxatives should start the first postoperative day.

Information on pre-fracture cognition can be obtained from family and caregivers. Delirium is a complication that affects up to 50% of elderly hip fracture patients, with the highest prevalence seen in patients with cognitive impairment[10]. Delirium is associated with increased length of hospital stay, increased mortality, and development of dementia[22-24]. Delirium assessment should be performed pre- and postoperatively, and the risk can be reduced by proactive geriatrics consultation, as well as medical and anaesthesiological considerations[13,15,25]. We suggest using 4AT, a rapid delirium screening tool that could be used by all healthcare workers[26]. The Confusion Assessment Method (CAM) is an alternative[27]. Patients with delirium during hospital stay, especially with no diagnosis of dementia, should be followed after discharge with cognitive assessment.

Our patient had a mild postoperative anemia. Oral anticoagulation therapy with warfarin was re-started on the first postoperative day. Low molecular weight heparin was given until INR reached therapeutic levels, as her international normalized ratio (INR) was 1.3. She received lactulose to prevent constipation. Daily clinical evaluation did not reveal any signs of infection. She had a visual analogue scale (VAS) pain score of 7 out of 10 on the first postoperative day and was treated with oxycodone slow release 5 mg x 2 and paracetamol 1 g x 4 daily, with additional oxycodone 5 mg as needed[18]. A note was made to refer to an ophthalmological consult at discharge for her visual impairment.

Orthogeriatric ward nurse

Use of aids for impaired hearing or vision is important for orientation. Early mobilization with weight-bearing exercise programs and participation in activities of dailiy living (ADL) should be executed by both physiotherapists and nursing staff. Urinary catheters are used perioperatively, but should be removed on the first postoperative day: Patients should be scanned for residual urine and checked for urinary tract infections. Frequency of defecation should be registered, especially in patients with cognitive impairment. Nutrition should be supported, and food intake monitored if patients are undernourished or have poor appetite. Nutritional drinks may be used before and after surgery. Screening for malnutrition should be performed, and an individual nutrition plan should be made if indicated, in cooperation with a nutritionist[28]. An individual rehabilitation plan with short-term goals based on previous function, cognition, type of surgery, and motivation, should be created. A long-term goal based on the current status and the pre-fracture function should be defined in the discharge report.

Our patient had a 4AT score of zero at admission and on the first postoperative day. On the second day, she had a a 4AT score of six: She could not recall the name of the hospital, and was not able to state seven or more months of the year backwards starting with December. Based on information from her family members, she had not had any cognitive problems earlier, and her symptoms was considered to be caused by a postoperative delirium. Her symptoms resolved after treatment with intravenous fluids, and non-pharmacological treatment, including extra nursing staff, emphasizing verbal re-orientation and environmental shielding. No indication was found for pharmacological treatment. Her 4AT score the following day was zero.

Discharge planning is started on admission. Destination for discharge is based upon the patients' functional and medical status, place of living, and the patients' and caregivers' motivation. The fittest patients may be discharged to their own home with assistance from home-

based primary care services, including physiotherapy at home, in a physiotherapy clinic, or at a day-time rehabilitation center. Most ortogeriatric patients need institutional rehabilitation, while some are too frail and may be discharged to a nursing care facility. Communication with general practitioners, rehabilitation facilities and nursing homes about individual patients are mainly based upon discharge reports, covering medical treatment, drug regimens, caring needs, physiotherapy and recommended follow-up.

Occupational therapist

Independency and the ability to carry out ADL are important for most individuals, and among the strongest predictors for survival in geriatric patients[29]. While primary ADL (pADL) include the ability to mobility, eating and other basic functions, instrumental ADL (iADL) describe more complex functions like use of public transport and taking care of personal economy. Observation of function and assessment of ADL with standardized tools are the main tasks of occupational therapists in the CGA as well as in ortogeriatric care. The Barthel ADL-index (pADL) and the Nottingham Extended ADL Scale (iADL) are among the most used tools for this purpose[30,31]. As cognitive function plays an important role in ADL, the occupational therapist uses assessment tools, as well as interviews with caregivers, for screening on cognitive impairment[32].

Physiotherapist

The ability to remain mobile with safe and efficient gait, is an essential part of autonomy and quality of life[33]. Hip fractures represent a threat to the ability to live and walk independently. Early mobilization with weight-bearing activities after hip surgery is highly recommended, and

should be initiated within the first postoperative day[6]. The physiotherapist's main role in the interdisciplinary team, is to initiate progressed activity and exercise/training with an individual and structured approach, based on early assessment of physical function. Pre-injury level of mobility may be recorded retrospectively by a New Mobility Score (NMS)[34,35]. The total of NMS functional level before fracture, age and fracture type may facilitate prediction of the short-term potential of independency in functional mobility during admission and discharge status[36]. The NMS score in our case was 7/9 points, indicating a relatively good pre-injury status.

Grip strength at admission can help clinicians better identify high-risk subjects, who could benefit from intensive multi-domain programs[37,38]. Assessed grip strength in this case revealed a lowered mean score, which may indicate global muscle weakness and frailty. Physical performance and mobility are strong determinants of mobility after hip fracture. The short Physical Performance Battery (SPPB) characterizes lower extremity function, and is regarded as an objective outcome of physical performance for elderly, preferably as near discharge as possible[39,40]. Components of the SPPB (chair stand, gait speed and tandem stance) are also predictive for falls. SPPB completed at day 3 after surgery in this scenario gave a low total score of 2/12, indicating increased risk of falling, and risk of functional decline in the early post-surgery phase. SPPB has been shown test-retest reliable, and is recommended re-tested as part of further rehabilitation[41].

In order to prevent further falls with injuries, a falls assessment was performed during the hospital stay, based on the case history from patient and caregivers on previous falls and mobility problems, the cause(s) of the present fall, and a clinical assessment of comorbidity, drugs, muscle strength and balance.

Fracture-Liason Service

The Fracture Liaison Service (FLS) aims to systematically identify, treat and refer all eligible patients within a local population who have suffered a fragility fracture, with the aim of reducing their risk of subsequent fractures. An FLS, consisting of a committed team of stakeholders, employs a dedicated coordinator to act as the link between the patient and the ortopaedic team, the osteoporosis and falls prevention service, and the primary care system [42,43].

Our patient was assessed during hospital stay. She received vitamin D3, 100,000 IU, due to her suboptimal level, and was started with calcium carbonate 500 mg/vitamin D3 800 IU daily. In our FLS, hip fracture patients are offered anti-osteoporosis treatment as in-patients based on the increased imminent risk of a new fracture, and hence a need to start treatment as early as possible[44]. Also, we have found it difficult for many hip fracture patients to attend an osteoporosis clinic for some time after the fracture. Our patient accepted, and received zoledronic acid 5 mg iv after vitamin D levels were normal, and was referred to the osteoporosis clinic for further follow-up[45].

Clinical pharmacist

Inappropriate drug prescription is common among older patients acutely admitted to hospital including orthopedic wards[46,47]. Inappropriate drug prescription might have negative clinical impact in older patients[48], and drug prescription is associated with risk of hip fractures in older individuals[49-51]. Polypharmacy is common in older people[52], and associated with frailty, disability, falls, mortality, and increased risk of drug-related problems[53,54]. The role of the clinical pharmacist is to identify and resolve drug-related problems. Examples are adverse drug reactions, drug interactions and adherence problems. Possible effects of pharmacist interventions

are reduced risk of delirium and other complications, improved adherence and less re-admissions[55]. Critical differences in drug prescription between geriatric and orthopedic hospital wards have been demonstrated[56].

Our patient had hypothyroidism and insulin-dependent type 2 diabetes, both diseases that may increase the risk of osteoporotic fractures. Over-treatment of levothyroxine is a risk factor, and the lowest dose that provides treatment effect should be sought[57,58]. Patients with type 2 diabetes have an increased risk of fractures. Type 2 diabetes reduces bone quality rather than bone mineral density (BMD)[59]. Older patients with type 2 diabetes have more frequent falls than elderly individuals without diabetes[60]. This patient is also at risk of hypoglycemia and fall, and good blood glucose control is important. The clinical pharmacist noted that levothyroxine should not be taken at the same time of day as the newly added medication of calcium carbonate and vitamin D3, and that a change in drug administration schedule usually minimizes or eliminates this interaction[61]. On advice from the clinical pharmacist, the orthogeriatrician separated the administration of the two interacting drugs, so that levothyroxine would be administered in the evening. Due to her low INR at admittance, her warfarine dose was also adjusted, and the discharge papers included a suggestion to her general practitioner to switch to a novel oral anticoagulant (NOAC).

Follow-Up: Fracture-Liason Service

8 weeks after discharge, the patient presented to the outpatient clinic's osteoporosis team for a planned bone density measurement and evaluation. She was met by an orthopedic ward nurse with osteoporosis training. Questions the patient may have on her surgery and other matters pertaining to her hospital stay, can be answered by the nurse, if necessary after

consultation with other professionals. She arrived with a walker. She had moved back into her own home, after a 3-weeks stay at a rehabilitation facility run by the municipal health service. Until now, she had received some home nursing, and physiotherapy a few times a week. She now manages on her own, with some help from her husband. To assess the risk of future fractures, the nurse will identify the risk factors for osteoporosis, conduct a dual-energy X-ray absorptiometry (DXA) scan, and assess fall risk. If resources permit, BMD may be obtained during the inpatient stay. Patient history and risks were assessed, including diseases, medications, previous fracture, blood samples, family history of osteoporosis, dietary calcium intake, smoking, alcohol, exercise, BMI, loss of height, and finally a basic fall risk assessment.

She had no prior fragility fracture. She is a non-smoker, and reported a modest intake of alcohol. The calcium intake in her diet was low, about 500 mg daily, and due to a misunderstanding, she had stopped taking the prescribed calcium and vitamin D3, which was prescribed for her after the hip fracture. BMI was within normal range, but she reported a height loss of 5 to 6 cm. She reported some back pain episodes, but this had gotten better the last couple of years. Fall risk had previously been identified by the physiotherapist and the orthogeriatrician, and she was followed by a falls prevention programme: She was encouraged to uphold daily activity by ability, as well as participation in training groups for the elderly who integrate strength-balancing exercises. She was reminded of the importance of good blood sugar control, in fear of hypoglycaemia and fall. She had scheduled an appointment with an ophthalmologist.

DXA is a technology that is widely used to diagnose osteoporosis, asses fracture risk, and monitor changes in BMD[62]. Results of the patient's BMD examination showed osteoporosis of the hip; with a total T-score of -2.7 and -2.4 for the femoral neck (Fig. 3). In the column, she had

a normal T-score of 0.6. and the lowest measured vertebra had a T-score of -0.2. Degenerative changes or previous fractures in the lumbar region may give a false elevated T-score.

A Lateral Vertebral Assessment (LVA), a low-dose x-ray examination of the spine to screen for vertebral fractures that is performed on the DXA machine, revealed compression fractures in the Th10 and Th12 vertebrae, that were not known to the patient (Fig. 4).

The completed survey showed established osteoporosis. Based on fracture history and age, recommended treatment was continuing zoledronic acid 5 mg intravenously per year, and calcium carbonate 500 mg/vitamin D3 800 IU daily. The patient received a written report of all findings and a treatment plan, as well as written information on preventive lifestyle advice in order to take care of her bones and prevent future fractures. The patient will be notified of her second infusion of zoledronic acid at 1 year postoperatively, with blood samples in advance. We will consider the need for new BMD and bone-markers after 3 years, for assessment of need for further treatment. Statistically, our patient now has a substantial lowered risk of a subsequent fracture[45,63,64].

Follow-Up: Orthopaedic surgeon

Routines for planned follow-up of hip fracture patients by orthopaedic surgeons differ between health care systems and hospitals, and has been debated[65]. Our patient was scheduled for a follow-up with radiographs 6 months postoperatively. She presented to the outpatient clinic independently, walking without aids, having travelled by bus. She had no pain from her left hip. She reported an Oxford Hip Score[66,67] of 47 out of 48 points, due to slight problems climbing stairs. Per hospital protocols, arthroplasties for femoral neck fractures are not routinely followed beyond 6 months, but patients are encouraged to contact the outpatient clinic if needed.

Discussion

There are different models of orthogeriatric care. Patients may be treated in orthopedic wards with geriatric involvement organized either as consultant services on request, or with daily consultative services, or orthopedic surgeons and geriatricians have shared responsibility and treat patients together. Another approach would be initial treatment in an orthopedic ward with transfer to geriatric wards postoperatively, and a third option is that patients are treated in geriatric wards with orthopedic surgeons having responsibility for the surgical treatment. The literature is still inconclusive as to which of these models are most beneficial. However, models with an integrated approach with early involvement of a geriatric interdisciplinary team seem to be superior compared with models using consultative services, or where there is a late involvement of the geriatric team[68-70].

This case demonstrates a patient receiving perioperative assessment and early surgery, CGA, multidisciplinary in-ward assessment, treatment and rehabilitation, and secondary fracture prevention. Without this team approach, she would have a higher risk of complications and poor outcome due to many factors, such as new falls, secondary fractures and dependency on others, due to untreated delirium, undiscovered and untreated osteoporosis, and unresolved inappropriate drug prescription. During hospital stay, a treatment plan was made that was continued in the rehabilitation facility and then in her own home. Rehabilitation was not stopped until she achieved independent mobility.

Strong evidence supports use of an interdisciplinary care program for patients with hip fractures: AAOS, NICE and Cochrane present useful guidance and evidence summaries[5,6,8].

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Fig. 1:

Radiographs of a displaced left hip fracture (left) with presence of mild radiographic osteoarthritis, and postoperative total hip replacement (right) with a cementless acetabular cup and a cemented femoral stem.

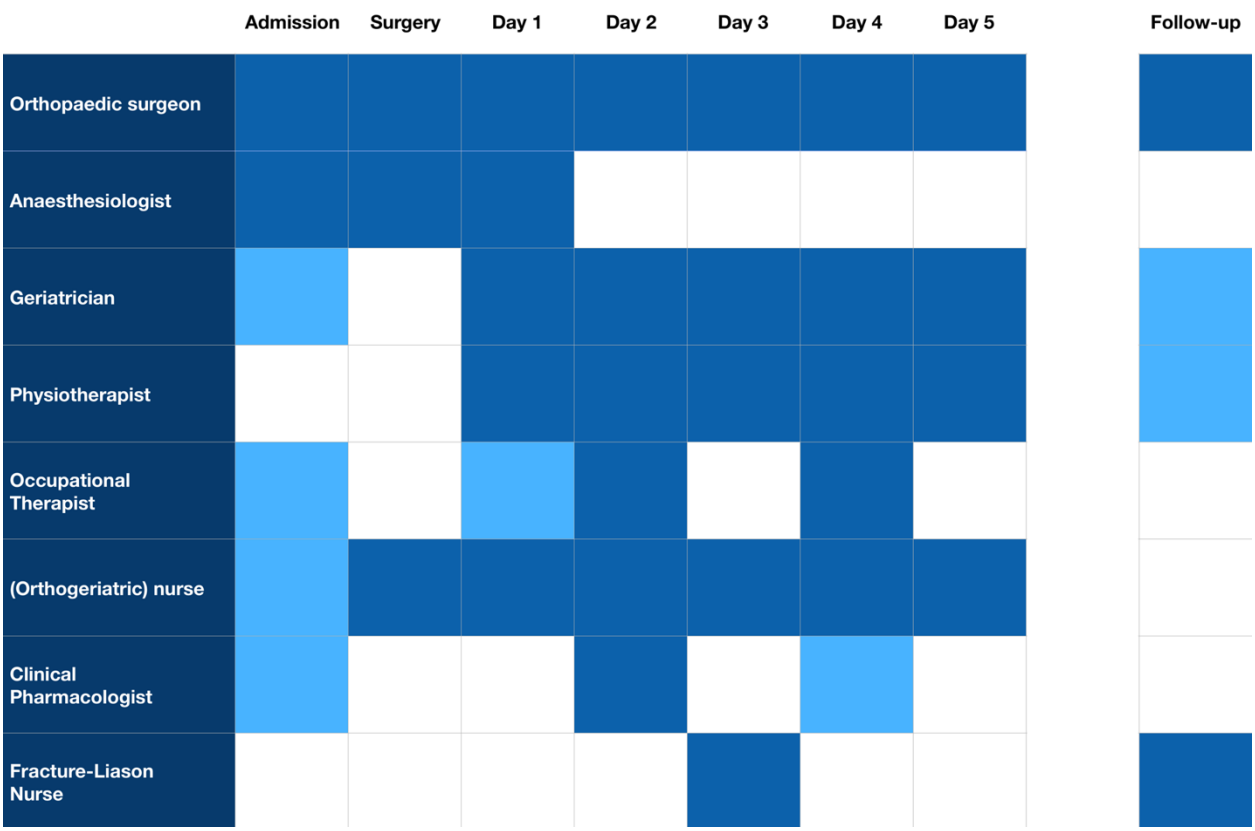

Fig. 2:

The multidisciplinary team approach to managing patients with hip fracture. Dark blue fields indicate essential collaborative actions and patient contacts per day. Light blue fields indicate suggested additional collaborative actions and patient contacts, that may be dependent on hospital staff structure and availability. Different models may include additional professions, either as part of the multidisciplinary team or as on-demand actors; such as endocrinologist, nutritional therapist, social worker and others.

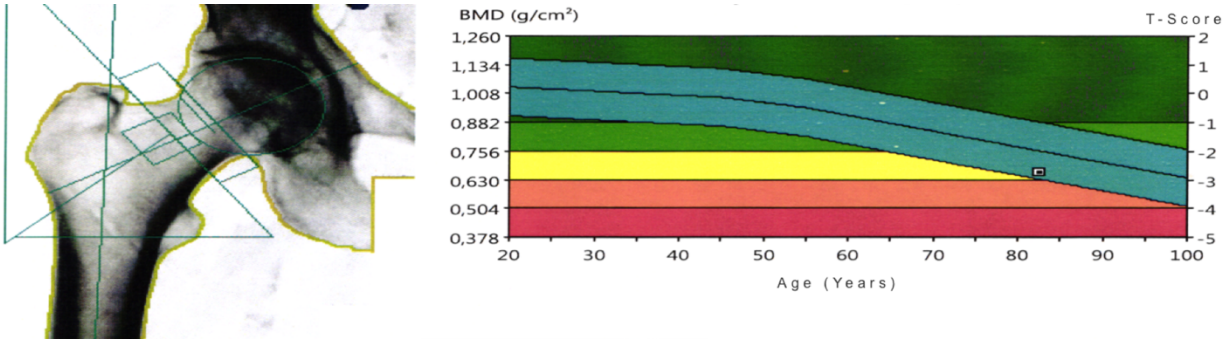

Fig. 3:

Image and graphical result of Dual-energy X-ray absorptiometry (DXA) scan of the right hip showing established osteoporosis, with a a total T-score of -2,7 and -2,4 for the femoral neck.

Fig. 4:

Lateral Vertebral Assessment (LVA), a low-dose x-ray examination of the spine to screen for vertebral fractures that is performed on the DEXA machine, showing vertebral compression fractures in the Th10 and Th12 vertebrae.