

## 12. HIP FRACTURE

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Several recent reviews identified through a focused literature search provided the core references in developing quality indicators for the evaluation and management of hip fracture (Zuckerman et al., 1996; Rubin, 1995). Where these core references cited studies to support individual indicators, we have included the original references.

### **IMPORTANCE**

There are over 250,000 hip fractures in the United States each year, with 90 percent occurring in patients over the age of 50 (Cummings et al., 1990). With the aging of the population, the annual number of hip fractures is projected to double by the year 2040 (Cummings et al., 1990; Cummings et al., 1985). A hip fracture generally occurs in the proximal femur. Such injuries are divided by anatomical area into the following three categories: 1) Femoral neck fractures, which are located in the area distal to the femoral head but proximal to the greater and lesser trochanters; 2) Intertrochanteric fractures, which occur in the metaphyseal region between the greater and lesser trochanters; and 3) Subtrochanteric fractures, which occur just below the lesser trochanter (Zuckerman et al., 1996). Femoral neck and intertrochanteric fractures account for over 90 percent of hip fractures, occurring in approximately equal proportions (Gallagher et al., 1980; Alffram, 1964).

The estimated incidence of hip fracture in the United States is 80 per million population (Cummings et al., 1985; Gallagher et al., 1980). The incidence increases with age, doubling for each decade after 50 years, and is two to three times higher in women than in men (Gallagher et al., 1980; Hedlund and Lindgren, 1987). Other risk factors for hip fracture include a maternal history of hip fracture (Cummings et al., 1995), physical inactivity (Paganini-Hill et al., 1991), excessive consumption of alcohol and caffeine (Hernandez-Avila et al., 1991), low body weight (Farmer et al., 1989), tall stature (Nevitt and Cummings, 1993), previous hip fracture (Finsen and Benum, 1986), use of certain

psychotropic medications (Ray et al., 1989), residence in institutions (Niemann and Mankin, 1968), visual impairment (Cummings et al., 1995), and dementia (Gates et al., 1986). Osteoporosis is an important contributing factor because it decreases the skeleton's resistance to injury. Approximately 90 percent of hip fractures in the elderly result from a simple fall (Baker and Harvey, 1985).

The health of older adults deteriorates after hip fracture, and efforts to reduce the incidence of hip fracture could lower subsequent mortality, morbidity, and health services use (Wolinsky et al., 1997).

### **SCREENING**

There are no recommendations for quality indicators related to screening because it is a symptomatic condition.

### **DIAGNOSIS**

#### **Clinical Features**

A common presentation of hip fracture is that of an elderly person who falls and then experiences hip pain or pain referred to the knee with concomitant difficulty standing or walking. On physical examination, the individual may experience groin or hip pain to palpation on the side of the fracture, and the affected leg may be externally rotated and shortened.

#### **Radiography**

Persons suspected of having a hip fracture should have radiographs with an anteroposterior view of the pelvis and a true lateral view of the hip (Zuckerman, 1996) (Indicator 1). Additionally, if no fracture is seen on radiograph among persons who report hip pain with difficulty standing or walking after a fall, an anteroposterior view obtained with the hip internally rotated 15 to 20 degrees will provide an optimal image of the femoral neck and may reveal a fracture not evident on the standard anteroposterior view. If this radiograph is also normal and clinical findings support the diagnosis of a hip fracture, technetium-99m bone scanning or magnetic resonance imaging (MRI) is appropriate (Rizzo et al., 1993) (Indicator 1). The bone scan is a sensitive indicator of a hip fracture unrecognized on traditional radiography,

although in elderly patients the fracture may not appear until two or three days after the injury. It has been shown that MRI is as accurate as bone scanning in the assessment of occult hip fracture, and reliable results can be obtained within 24 hours after the injury (Zuckerman, 1996).

## **TREATMENT**

The primary goal of treatment is to return the patient to his or her level of function before the fracture. For most patients with hip fracture, this goal is best accomplished with surgery followed by early mobilization. For some patients, however, surgery poses a substantially increased risk of morbidity or mortality. Specifically, a hip fracture patient with a recent or concurrent myocardial infarction has an excessively high risk of perioperative mortality because of the risk of reinfarction. This risk remains at a minimum of 15 percent until six months after myocardial infarction (Tarhan et al., 1972). Surgery should also be delayed for patients in whom anticoagulation therapy cannot be safely discontinued for 48 to 72 hours perioperatively. Non-operative management may also be preferable for non-ambulatory patients with marked dementia who experience minimal discomfort within the first few days after the injury.

### **Preoperative Care**

A careful medical evaluation should be performed on each patient who will undergo surgical repair (Zuckerman et al., 1995). This includes a complete history and physical examination, electrocardiogram, and laboratory evaluation that includes CBC, PT, PTT, electrolytes, BUN, creatinine, glucose, liver function tests, and urinalysis (Indicator 2). This evaluation is performed to reduce risks associated with the surgical repair and anesthesia.

### **Timing of Surgery**

In general, surgical repair should take place as soon after the injury as possible, usually within 24 to 48 hours of diagnosis. Longer intervals before surgery may increase the risk of postoperative medical complications and mortality at one year (Zuckerman et al., 1995). Medical complications include deep venous thrombosis (DVT), secondary

pulmonary embolism, other pulmonary complications such as pneumonia, urinary tract infection, and skin breakdown. However, a delay in surgery may be necessary to stabilize an acute medical condition (Kenzora et al., 1984; Sexson and Lehne, 1987).

#### **Type of Surgical Repair**

The type of surgery is based on: location of the fracture, bone quality, displacement, and comminution; age, level of function before the injury, and ability to participate in a postoperative rehabilitation program; and the experience of the surgeon. Femoral neck fractures can be treated by either internal fixation with multiple screws or prosthetic replacement. Internal fixation is generally used in patients with non-displaced or minimally displaced fractures and in younger patients (<70 years) with displaced fractures. Because the incidence of nonunion and osteonecrosis is much higher with displaced fractures (30-40%) than with non-displaced fractures (<10%) (Barnes et al., 1976), prosthetic replacement is generally preferred in older patients with displaced fractures. Non-displaced fractures are usually treated by internal fixation with a sliding hip screw or similar device.

#### **Prophylactic Perioperative Antibiotics**

There exists modest support for the use of prophylactic antibiotics based on one case series and one RCT. Most studies, however, do not have the statistical power to detect clinically meaningful differences given the low rate of postoperative infection in orthopedic procedures without antibiotics. Aagaard et al. (1994) reviewed 688 patients who underwent hip fracture repair and found a significantly lower rate of deep wound infection in the group receiving prophylactic antibiotics (0.6% vs. 4.6%). Pavel et al. (1974) randomized 1,591 patients to receive prophylactic antibiotics (1 hour preoperatively and intraoperatively) or placebo. Patients receiving prophylactic antibiotics had a postoperative infection rate of 2.8 percent as compared with 5.0 percent in the placebo group ( $p = 0.03$ ). Three additional RCTs of placebo versus antibiotics (Hjortrup et al., 1990; McQueen et al., 1990; Boyd et al., 1973) and one case series (Gerber et al., 1993) failed to find a significant benefit of prophylactic

antibiotics. However, in all three studies, deep wound infection rates were consistently low at about five percent. Assuming a reduction in risk of 40 percent (based on the data of Pavel, et al., 1974), sample sizes of over 525 patients would be required to detect a significant difference between groups. The largest sample size in the three trials was 502 patients.

We found no studies addressing the timing of antibiotic administration. However, in a large case series of 2,847 elective surgeries, wound infection rates were found to be lowest when antibiotics were administered within two hours before surgery (Classen et al., 1992).

In summary, there is evidence from one RCT supporting the use of prophylactic antibiotics in hip fracture patients. Antibiotics appear to reduce the risk of deep wound infections from a baseline of five percent to approximately three percent. Antibiotics should be administered within two hours before surgery (Indicator 3). Our proposed indicator allows for administration at any time on the day of surgery due to difficulties to allow for documentation variability.

The duration of antibiotic treatment after surgery is quite variable and generally reflects the individual physician's preference rather than scientific data. Most physicians continue to administer broad-spectrum antibiotics for 48 hours after surgery, even though there are no data indicating that a 48 hour regimen is more effective than a 24 hour regimen. Cephalosporins are used most commonly, except in patients with a known allergy to these agents.

### **Postoperative Management**

#### *Early Mobilization*

One of the most important aspects of postoperative management is early mobilization to prevent the complications associated with prolonged recumbency. One randomized trial evaluated early mobilization (usually within 24 hours of surgery) as part of a program that also included early discharge from the hospital and a comprehensive rehabilitation program during and after hospitalization (Cameron et al., 1994). Although this trial of 252 patients found no differences in physical independence of patients at four months, it showed that early

mobilization could reduce health care costs. Based on these limited data, we recommend as a quality indicator that rehabilitation should begin the first day after surgery, with the patient moving from the bed to a chair and progressing as soon as possible to standing and walking (Koval et al., 1995) (Indicator 4).

#### *Prophylactic Thromboembolics*

The prevention of thromboembolic complications is critical after a hip fracture. In addition to early mobilization in order to prevent venous stasis (Koval et al., 1994), patients should receive prophylactic thromboembolic medication (Indicator 5). The regimens differ, but all have some degree of efficacy (Feldman et al., 1993; Gerhart et al., 1991). Six randomized trials (Collins et al., 1988; Antiplatelet Trialists' Collaboration, 1994; Powers et al., 1989; Berqvist et al., 1979; Clagett and Reisch, 1988; Leyvraz et al., 1991) support the use of low-dose heparin (5000 units q8 to 12 hours) with an overall reduction in risk of developing DVT of 64 percent, based on data pooled across the trials (overall reduction from 49 percent in placebo to 28 percent in heparin groups) (Collins et al., 1988). Low-dose heparin appears to increase the risk of major bleeding episodes by about 30 percent as compared with patients receiving placebo, but the absolute difference is small (overall rates 3.5 percent in heparin groups as compared with 2.9 percent in placebo) (Collins et al., 1988). The use of aspirin as a prophylactic agent has been examined in a meta-analysis of ten traumatic orthopedic trials (Antiplatelet Trialists' Collaboration, 1994). Aspirin was found to reduce the risk of DVT by 31 percent and reduce the risk of pulmonary embolism by 60 percent. When data from all surgical, orthopedic, and high-risk medical patients were analyzed together, the absolute excess of major bleeding episodes due to aspirin was three per 10,000 patients.

Powers et al. (1989) compared low-dose warfarin (i.e., warfarin started immediately after surgery with INR of 2.0 to 2.7) to aspirin and placebo and found DVT prevalence rates of 20 percent in the warfarin group, 41 percent in the aspirin group, and 46 percent in the placebo group ( $p=.005$ ). Berqvist et al. (1979) have reported that dextran 70 has equal or greater efficacy when compared with low-dose heparin.

Additional data on the effectiveness of other prophylactic agents are available only from general surgical trials and trials examining total hip replacement. In a meta-analysis of general surgical trials (Clagett and Reisch, 1988), dextran was found to lower the incidence of DVT from 24.2 to 15.6 percent. Pooled data from five trials found the incidence of DVT in the dextran groups to be twice that of the heparin group. This meta-analysis also revealed some efficacy of pneumatic compression stockings. Heparin has been compared to low-molecular-weight heparin in one RCT of patients undergoing total hip replacement (Leyvraz et al., 1991). Patients receiving low-molecular-weight heparin were significantly less likely to develop proximal vein thrombosis as compared with the unfractionated heparin group (2.9% vs. 13.1%). The duration of enoxaparin therapy in hip replacement has also been examined. Four studies suggest an incidence of DVT after discharge as high as 24 percent that can be significantly reduced by one month of enoxaparin therapy.

In summary, there is strong evidence supporting the use of low-dose heparin as prophylaxis for DVT starting on admission to the hospital (Indicator 5). Aspirin also appears to have some benefit, but to a lesser extent, and may be considered in patients at high risk for hemorrhagic complications. One study supports the use of low-dose warfarin. There are insufficient data at this time to support the use of enoxaparin or other prophylactic agents.

#### *Pressure Ulcer Prevention and Management*

Pressure ulcers are a significant cause of morbidity in patients with hip fracture, with an incidence of 66 percent. For the prevention of pressure ulcers in high-risk patients, guidelines of the Agency for Health Care Policy and Research (AHCPR) support the efficacy of identifying high-risk individuals with a validated risk assessment tool (e.g., Norton and Braden scales). The optimal frequency for reassessing high-risk patients is not known.

With regard to clinical interventions designed to prevent or manage pressure ulcers once they have occurred, the evidence is less strong. Fair research-based evidence cited in the AHCPR guideline supports repositioning and turning every two hours if consistent with overall

patient goals. Data from six controlled trials and one RCT support placing at-risk individuals on a pressure-reducing device (foam, static air, alternating air, gel, or water mattress) (Indicator 6).

The remainder of data regarding the prevention and management of pressure ulcers are drawn from expert opinion and consensus panels. Recommendations include avoiding skin exposure to moisture due to incontinence, perspiration, or wound drainage; avoiding positioning on bony prominences, specifically the greater trochanter; minimizing friction and shear forces; improving nutrition; and utilizing trapeze devices to assist in transfers or bed changes. Due to the difficulty of identifying patients who are at risk for pressure ulcers from the medical record, we are not recommending any quality indicators related to these interventions.

#### *Urinary Tract Management*

Urinary retention is commonly observed in postoperative hip fracture patients. Successful strategies to reduce voiding problems might lead to decreased morbidity. We identified two RCTs examining urinary bladder management in patients undergoing orthopedic surgery (Skelly et al., 1992; Michelson et al., 1988). One study examined patients with a recently sustained hip fracture and the other examined patients undergoing hip or knee replacement. Both studies randomized patients to immediate removal of the urinary catheter postoperatively or to removal of the urinary catheter in the morning after surgery (Michelson et al., 1988) or 48 hours after surgery (Skelly et al., 1992). The findings of these studies were inconsistent; one found that immediate removal of the catheter was associated with lower rates of retention (Skelly et al., 1992) and the other found lower rates of retention with delayed removal of the catheter (Michelson et al., 1988). In both studies there were no significant differences in the incidence of urinary tract infections. Thus, we do not recommend a quality indicator in this area.

#### *Prevention and Management of Delirium*

Delirium occurs in an estimated 30 to 50 percent of patients with hip fracture (Michelson et al., 1988). The occurrence of delirium in hospitalized patients has been shown to increase length of stay and the

risk of complications, mortality, and institutionalization. Furthermore, the majority of patients who develop delirium have at least some persistent symptoms as much as six months later (Levkoff et al., 1992). In patients with hip fracture, delirium is also likely to interfere with rehabilitation activities. Eight cohort studies have examined the risk factors for developing delirium, but only one specifically focused on patients with hip fracture (Gustafson et al., 1988) and many studies lack statistical power. Nevertheless, the assembled studies indicate a number of recurring modifiable risk factors for developing delirium, including electrolyte and metabolic laboratory abnormalities, use of medications with psychoactive properties, and infection. Three studies that have systematically examined etiologies have also been very small and lack adequate statistical power. These findings, however, all indicate a number of common etiologies that include fluid and electrolyte abnormalities, infection, drug toxicity, metabolic disorders, and low perfusion.

Based on these data, we recommend as a quality indicator that patients undergoing surgery for hip fracture have electrolytes, BUN, glucose, CBC, urinalysis, history of alcohol use, and medication history documented preoperatively (Indicator 2).

## **FOLLOW-UP**

### **Reducing Risk Factors for Hip Fracture**

Data from four case-control studies and four prospective studies indicate that lower body weight, cigarette smoking, caffeine intake, use of long-acting sedatives, and physical inactivity have been identified as risk factors for hip fracture (Cooper et al., 1988; Cummings et al., 1995; Farmer et al., 1989; Grisso et al., 1991; Kiel et al., 1990; Meyer et al., 1993; Paganini-Hill et al., 1981; Paganini-Hill et al., 1991). Cummings et al. (1995) prospectively studied the potential risk factors in 9,516 white women who were 65 years of age or older. Over a four-year period, 192 women had a first hip fracture not due to motor vehicle accidents. In multivariate age-adjusted analyses, modifiable risk factors included treatment with long-acting benzodiazepines or anticonvulsant drugs, high caffeine intake, weight loss, physical

inactivity, impaired visual function, and low calcaneal bone density. The relative risk of having a hip fracture for each of these risk factors ranged from 1.2 to 2.0. Women with multiple risk factors had an especially high risk of hip fracture. In contrast, walking for exercise was associated with a reduced relative risk for hip fracture of 0.7.

A randomized controlled trial of low-dose nasal calcitonin was conducted among 287 women within six to 36 months of menopause. These women were randomly allocated to three years of treatment with either 500 mg per day (5 days a week) of calcium or the same amount of calcium plus 50 IU of nasal salmon calcitonin per day (5 days a week). Persons treated with salmon calcitonin and calcium had improvements in lumbar spine bone mineral density as compared with patients receiving calcium alone (Reginster et al., 1994).

The efficacy and safety of calcitriol in the treatment of postmenopausal osteoporosis was evaluated in a three year prospective randomized trial of 622 women who had one or more vertebral compression fractures. Women received treatment with calcitriol at 0.25 micrograms twice a day or supplemental calcium at one gram per day or elemental calcium daily for three years. Those in the calcitriol group had a significant reduction in the rate of non-vertebral fractures during the second and third years of treatment, as compared with women who received calcium (9.3 vs. 25 fractures per 100 patient-years in the second year, 9.9 vs. 31.5 fracture per 100 patient-years in the third year) (Tilyard et al., 1992).

To determine if vitamin D and calcium reduce the risk of hip fractures among elderly women, Chapuy et al. (1992) studied the effects of supplemental vitamin D and calcium on the frequency of hip fractures and other non-vertebral fractures in 3,270 ambulatory women (mean age, 84 years). Women were randomized to receive 1.2 grams of elemental calcium and 800 IU of vitamin D or a placebo for 18 months. Women who had received vitamin D and calcium had 43 percent fewer hip fractures and 32 percent fewer non-vertebral fractures.

The efficacy of alendronate was tested in a randomized controlled two year study of 188 postmenopausal women aged 42 to 75 years with low bone mineral density of the lumbar spine (Chestnut et al., 1995). Women

who were taking alendronate daily had a five percent increase in hip bone mineral density. The Fracture Intervention Trial aimed to investigate the effect of alendronate on the risk of fractures in postmenopausal women with low bone mass. In this study, 2,027 women were randomly assigned placebo or alendronate (5 mg daily for 24 months, followed by 10 mg daily for 12 months). The women were followed for 36 months. The relative risk for hip fracture for alendronate vs. placebo was 0.49 (confidence interval 0.23-0.99).

Based on these data, we recommend including in a quality indicator for follow-up, that providers assess and address relevant modifiable risk factors for hip fracture including cessation of long-acting benzodiazepines or anticonvulsant drugs when possible, improving visual function when possible, and advising patients to reduce caffeine intake and increase physical activity (Indicator 7). Among patients with low bone mineral density, physicians should also offer patients treatments including estrogen, calcium, vitamin D, calcitonin, and alendronate.

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**RECOMMENDED QUALITY INDICATORS FOR HIP FRACTURE**

The following apply to men and women age 18 and older.

Indicator	Quality of Evidence	Literature	Benefits	Comments
<b>Diagnosis</b>				
1. Patients with symptoms or signs of hip fracture <sup>1</sup> should be offered one of the following imaging studies of the affected hip within 1 day: <ul style="list-style-type: none"> <li>• a radiograph;</li> <li>• a technetium-99m bone scan;</li> <li>• an MRI.</li> </ul>	III	Zuckerman et al., 1996	Improve functional status by accurate diagnosis and management of hip fracture.	Recommended by all the consensus developers and articles reviewing this topic.
2. Patients who have had surgical repair of a hip fracture should have been offered a complete medical evaluation preoperatively, including all of the following: <ol style="list-style-type: none"> <li>a. medical history;<sup>2</sup></li> <li>b. physical examination;<sup>3</sup></li> <li>c. laboratory evaluation;<sup>4</sup></li> <li>d. electrocardiogram.</li> </ol>	III	Zuckerman et al., 1996	Decrease morbidity and mortality.	Allows for improved identification and management of persons at increased risk for complications from surgery or anesthesia.
<b>Treatment</b>				
3. Patients who have had surgical repair of a hip fracture should have received antibiotics prophylactically on the same day that surgery was performed.	I III	Aagaard et al., 1995; Pavel et al., 1994	Reduce incidence of deep wound infections after surgical repair of hip fracture.	A case series of 688 patients and a randomized trial of 1591 patients found reduced rates of deep wound infections among patients who received prophylactic antibiotics (0.6% and 2.8%, respectively) compared with patients not receiving them (4.6% and 5.0%, respectively).
4. Patients who have a surgically repaired hip fracture should begin rehabilitation on post-operative day one.	I	Cameron et al., 1994	Improve functional status.	A randomized controlled trial of early mobilization after hip fracture surgery found an associated reduction in health care costs.

Indicator	Quality of Evidence	Literature	Benefits	Comments
5. Persons with hip fractures should be given prophylactic thromboembolics <sup>5</sup> on admission to the hospital.	I	Antiplatelet Trialists' Collaboration, 1994; Berqvist et al., 1979; Clagett and Reisch, 1988; Collins et al., 1988; Feldman et al., 1993; Gerhart et al., 1991; Koval et al., 1994; Leyvraz et al., 1991; Powers et al., 1989	Reduce incidence of deep venous thrombosis.	Lower rates of deep venous thrombosis have been found in several randomized trials using various prophylactic thromboembolics, including low-dose heparin, aspirin, and low-dose warfarin.
6. Patients hospitalized with hip fracture who are at risk for developing pressure sores <sup>6</sup> should have both of the following done while hospitalized: <ul style="list-style-type: none"> <li>a. Be repositioned every 2 hours;</li> <li>b. Be provided a pressure-reducing mattress.<sup>7</sup></li> </ul>	III	Panel on the Prediction and Prevention of Pressure Ulcers in Adults, 1992	Prevent pressure sores from developing or worsening.	

Indicator	Quality of Evidence	Literature	Benefits	Comments
<b>Follow-Up</b>				
7. Patients who have had a hip fracture should have documented within 2 months (before or after) the presence or absence of modifiable risk factors <sup>8</sup> for subsequent hip fracture.	I II III	Cauley et al., 1995; Chapuy et al., 1992; Chestnut et al., 1995; Cummings et al., 1995; Ettinger et al., 1985; Felson et al., 1993; Grady et al., 1992; Hammond et al., 1979; Hutchinson et al., 1979; Johnson and Specht, 1981; Kiel et al., 1987; Naessen et al., 1990; NIH, 1994; Paganini-Hill et al., 1981; Paganini-Hill et al., 1991; Reginster et al., 1994; Tilyard et al., 1992; Weiss et al., 1989	Prevent future hip fractures by addressing modifiable risk factors.	Many studies support risk reduction and drug interventions to increase bone mass.

Definitions and Examples

<sup>1</sup> Symptoms of hip fracture include those associated with a fall within the prior 7 days and/or at least one of the following: sudden onset of unilateral pain with walking, unilateral pain with movement, or an inability to stand. Signs of hip fracture include any of the following: pain in the affected hip with palpation and movement, and external rotation and shortening of the affected leg.

<sup>2</sup> Medical history refers to documentation of any medical problems or medications currently being taken.

<sup>3</sup> Physical examination refers to documentation of a heart, lung, abdominal, or neurologic examination.

<sup>4</sup> Laboratory evaluation of patients having surgical repair of hip fracture includes any one of the following: hemoglobin, hematocrit, platelet count, protime, prothrombin time, electrolytes, BUN, creatinine, glucose, urinalysis.

<sup>5</sup> Prophylactic thromboembolics include any one of the following: low-dose heparin (5000 units subcutaneously q8-12 hours), aspirin (325 mg daily), low-dose warfarin (to achieve an INR of 2.0-2.7, starting immediately after surgery).

<sup>6</sup> Patients are at risk for developing pressure sores if they have any of the following risk factors: malnutrition, unable to walk prior to the hip fracture, urinary incontinence, or a prior history of pressure sores.

<sup>7</sup> Pressure-reducing mattresses include those made of foam, air, gel, or water.

<sup>8</sup> Modifiable risk factors may include the following: use of long-acting sedatives or anti-convulsants, impaired vision, high caffeine intake (>3 cups/day), inactivity, smoking, and osteoporosis. Discussion of modifiable risk factors may result in the following: discontinuation of long-acting sedatives or anti-convulsants, referral to an eye specialist, reduction of caffeine intake, increasing physical activity, smoking cessation, and use of medications shown to increase bone mass (e.g., estrogen, calcium, calcitonin, calcitriol, vitamin D, and alendronate).

Quality of Evidence Codes

- I Randomized controlled trials
- II-1 Nonrandomized controlled trials
- II-2 Cohort or case analysis
- II-3 Multiple time series
- III Opinions or descriptive