3-27-2017

Bisphosphonate Related Osteonecrosis of the Jaw: OSCE Case Study

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Permission Page

Title: Bisphosphonate Related Osteonecrosis of the Jaw: OSCE Case Study

Department: Nursing

Degree: Master of Science

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Abstract

Bisphosphonates (BPs) are one of the most common medications used in the treatment of osteoporosis. Rare but serious conditions which have been associated with BP exposure include atrial fibrillation, esophageal cancer, atypical femoral fractures and osteonecrosis of the jaw. There are many proposed risk factors for developing bisphosphonate related osteonecrosis of the jaw (BRONJ).

In the case study presented below, the patient is a 67 year old Caucasian female. She has a history of breast cancer and is on Arimidex, an aromatase inhibitor (antiestrogen medication). She is postmenopausal. She has a history of a hip fracture and her DEXA scan indicates she has osteoporosis. She is being placed on Fosimax which is an oral bisphosphonate. A review of literature was conducted on bisphosphonate therapy and the development of BRONJ to see what additional considerations should be made for this patient.

Background

Osteoporosis is a bone condition "characterized by normal bone mineralization but low bone mass…and disruption of the bony architecture" (Dunphy, Winland-Brown, Porter & Thomas, 2015, p. 807). Throughout life, bones continue to remodel and rebuild themselves. Osteoclasts break down bone while osteoblasts build new bone. Typically osteoblasts and osteoclasts maintain a homeostatic relationship and bone turnover and rebuilding remain relatively stable. This relationship is influenced by a number of hormones including estrogen. Estrogen "has been shown to inhibit osteoclastogenesis, induce osteoclast apoptosis, and decrease erosive activity of osteoclasts" (Dunphy et al., 2015, p. 810). Therefore postmenopausal women (or women being treated with antiestrogen medications) are at an

increased risk of developing osteoporosis due to osteoclastic activity outpacing osteoblastic activity.

Osteoporosis is treated through a variety of lifestyle management treatments, nutritional supplementation of calcium and Vitamin D, and various medications including bisphosphonates therapy.

Bisphosphonate Therapy

Bisphosphonate (BP) therapy is the most common pharmacological intervention in the treatment of osteoporosis. Bisphosphonates reduce the activity of osteoclasts which decreases the rate of bone resorption and increases the bone density. BPs bind tightly to the surface of bones. Absorption of oral BPs are around 1% while absorption of IV BPs are higher than 50%. Bisphosphonates levels decrease rapidly in plasma but may last as long as 10 years in bone structures (Hasegawa et al., 2013; Sigua-Rodriguez, Da Costa Riberiro, De Brito, Alvarez-Pinzon, & De Albergaria-Barbosa, 2014).

Oral bisphosphonates are typically well tolerated but do require specific patient education on administration and potential side effects. Most oral bisphosphonates are available in daily or weekly formulations. They must be taken on an empty stomach with at least 8 ounces of water to maximize absorption and decrease the risk of the medication sticking in the esophagus. The patient must remain in an upright position for a minimum of 30 minutes after taking the medication to decrease complications of reflux. Oral BPs are contraindicated in those with esophageal disorders, a history of certain bariatric surgeries, and those unable to remain upright for 30 minutes following medication administration (Rosen, 2017).

IV BPs side effects include an increase the risk of hypocalcemia and transient flu-like symptoms (Rosen, 2017). IV BPs are most commonly used at much higher doses than oral BPs to treat metastatic cancers (especially breast, lung, and prostate) and multiple myeloma.

Rare but serious conditions which have been associated with BP exposure include atrial fibrillation, esophageal cancer, atypical femoral fractures and osteonecrosis of the jaw (Suresh, Pazianas & Abrahamsen, 2014). This paper will focus on bisphosphonate related osteonecrosis of the jaw (BRONJ).

Case Report

Date: 3/10/2017

Chief Complaint: 8 week post-op recheck for right hip replacement

Subjective

HPI: The patient is a 67 year old Caucasian female who presents today for post-hospitalization follow-up. Eight weeks ago she fell in the bathtub, developing a right hip fracture which required total right hip replacement. She reports her incision is healing well. She denies any redness or signs of infection. She had not had any fevers. She has completed physical therapy and is able to ambulate without difficulty. She feels she has healed well and has good range of motion in her hip. Takes 650 mg Tylenol TID for pain which she rates at an average of 3/10 (worst). With medication, her pain is 0/10. Denies any other physical complaints or concerns at this time.

Past medical history: hypertension, right breast cancer

Surgeries: right hip replacement (2017), right breast lumpectomy

Medications: Lisinopril 10 mg PO daily, Arimidex 1 mg PO daily, Tylenol 650 mg PO TID PRN. Denies supplements, herbs, homeopathic treatments or other OTC medications.

Allergies: NKDA. No food, environmental or latex allergies.

Social history: She is a retired high school Chemistry teacher. She is widowed and has three grown children. She is a current smoker of ½-1 pack of cigarettes daily with a 75 year pack history. Drinks 1-2 alcoholic drinks per month. No current exercise plan but has been walking daily since her hip replacement. Denies any illegal drug use.

Family history: Non-contributory.

Screenings/preventive care:
Mammogram – last completed October 2016, negative
Pap smear – unsure when she last had one completed. Reports she has never had abnormal screen.
Colonoscopy – has not had one
Dexa scan – 5/16/2011
Lung cancer screening – has not had one
Hepatitis C screening – has not had one
Dentist – sees regularly
Eye exam – not addressed

Immunizations:
TD/Tdap – unsure of last date
Influenza – none this season
Pneumovax – has not received
Zostavax – had recently, unsure of date

ROS
Constitutional: Denies fever, chills, night sweats. No recent weight loss.
Chest: No chest pain or palpitations. No shortness of breath. No cough or cold symptoms.
GI/GU: No changes in appetite. No changes in bowel or bladder habits. No dark or tarry stools. No blood in urine. No urgency or frequency.
MSK: See HPI.
Mental health: Reports her mood has been good.

Objective
Vital signs: see chart

Physical exam
General: Patient is well-groomed. No distress. Answers questions thoroughly. Maintains bright affect and good eye contact. Cooperative throughout examination.
Lungs: Breathing easy, regular and unlabored. Breath sounds clear through all lung fields, no wheezes or crackles.
Heart: Regular heart rate and rhythm. S1, S2, no murmur.
Abdomen: Soft, nontender, no organmegaly.
Right hip: Incision healed. No unusual erythema or swelling. No signs of infection. No tenderness to palpation. Appropriate range of motion.

DEXA scan
Lumbar spine: The total BMD for L1 to L4 is 0.594 g/cm. The BMD is 67% of the young adult reference population and 69% of the age matched population. The T-score is -4.1.
WHO classification – osteoporosis

Femoral neck: The total BMD is 0.620 g/cm. The BMD is 73% of the young adult reference population and 90% of the age matched population. The T-score is -2.1.

Who classification – osteopenia

Comparison: Today's study is compared with a previous examination dated 5/16/11 and a baseline examination of 5/18/2010.

Lumbar spine: There has been an interval decrease in lumbar spine BMP of 1.7% when compared to the baseline examination with an interval increase of 2.9% when compared to the previous examination.

Hip: There has been an interval increase in hip BMP of 0.2% when compared to the baseline examination with an interval decrease of 1.0% when compared to the previous examination.

Conclusion:

1. Bone density consistent with osteoporosis.
2. Fracture risk is high.

Recommendations:

1. Adequate vitamin D and calcium.
2. Follow up DEXA scan in 2 years to evaluate for change or response to treatment.

Assessment

1. 8 week right hip replacement post-operative exam
2. Osteoporosis

Plan

Patient presents today for post-op exam following a right hip replacement secondary to falling in her bathtub and fracturing hip 8 weeks ago. She has successfully completed physical therapy and has good ROM in her hip. I have encouraged her to continue walking daily. As she feels her pain is at a manageable level, I have encouraged her to decrease the amount of Tylenol she is taking daily and discontinue it if possible. She should follow-up with orthopedics as scheduled.

DEXA scan completed today shows findings consistent with osteoporosis and her BMD has decreased from baseline and last DEXA scan. Patient will begin vitamin D and calcium supplements daily. Fosimax 70 mg PO weekly prescribed. Instructions regarding medication provided. Patient is to call my office if she has any problems tolerating this medication.

Provided counseling on tobacco cessation. Patient is not interested in quitting smoking at this time.

Recommended patient schedule well-visit to review needed screenings and general health. Influenza and Pneumovax will be given today.

Patient in agreement with the above treatment plan. Denies any questions at this time. She should call or return to the clinic if she has any new or worsening symptoms. Please schedule well-exam.

Literature Review

In the case study presented, the patient is a 67 year old Caucasian female. She has a history of breast cancer and is on Arimidex, an aromatase inhibitor (antiestrogen medication). She is postmenopausal. She has a history of a hip fracture and her DEXA scan indicates she has osteoporosis. She is being placed on Fosimax which is an oral bisphosphonate. A review of literature was conducted on oral bisphosphonate therapy and the development of BRONJ to see what additional considerations should be made for this patient.

Pathophysiology and Diagnosis of BRONJ

While the exact pathophysiology of BRONJ is not fully understood, there are two proposed theories.

> One is the osteoclast-based, "inside-out," theory, in which inhibition of osteoclastic activity and marked suppression of bone turnover, together with spread of physiologic micro-damage and possibly local infection, leads to bone death within the jaw, with subsequent exposure. As such, the bone exposure is a late event. The second, "outside-in," theory suggests a break in the oral mucosa leads to ingress of bacteria and local infection which, coupled with poor bone remodeling, leads to bone death (Lerman et al., 2013, p. 977).

Additionally, it is believed that BPs may destroy some of the microvasculature of bone, causing decreased wound healing (Hasegawa et al., 2013) and there is a reduction of endothelial derived growth factors (Vaszilko et al., 2014).

The American Society for Bone Mineral Research has developed three criteria for the diagnosis of BRONJ: "(1) current or previous treatment with bisphosphonate; (2) exposed bone in the maxillofacial region that has persisted for more than eight weeks; and (3) no history of radiation therapy to the jaws" (Coskun Benlidayi & Guzel, 2013, p. 1). The American Association of Oral and Maxillofacial Surgeons (AAOMS) list several risk factors for developing BRONJ including: drug related risk-factors, duration of therapy, local risk factors, demographic and systemic risk factors, genetic risk factors, and preventative factors (Coskun Benlidayi & Guzel, 2013).

Drug Related Risk Factors

Shintani et al. (2015) conducted a study of 59 patients who were treated for BRONJ in Japan. The aim of their study was to compare the prognosis of patients who received oral BPs with those treated with IV BPs. All patients discontinued BP therapy when they were diagnosed with BRONJ. The treatment of BRONJ lesions was based on the severity of the lesion and followed the guidelines defined by AAOMS.

There were 29 patients in the oral BP group and 30 patients in the IV BP group (although 3 were eventually excluded as they refused treatment for BRONJ). In the oral BP group, 28 of the patients were being treated for osteoporosis and one for Paget 's disease. The patients in the IV BP group were being treated for malignancies including 18 for breast cancer, 6 for multiple myeloma, 4 for prostate cancer, and 1 each for gastric cancer and hepatocellular

carcinoma. Each patient was seen monthly for a year after diagnosis and treatment of their BRONJ lesion.

In the oral BP group, 27 of 29 patents (93%) were fully healed within the year while only 12 of 27 patients (44%) who received IV BPs were fully healed. This indicates that patients who are on oral BP therapy and develop BRONJ may recover quicker than those who have been treated with IV BPs.

Duration of Therapy

Barasch et al. (2011) compared 191 patients with osteonecrosis of the jaw (ONJ) with 573 matched control patients (3 for each ONJ patient). Their patients stemmed from 3 areas in the United States. All forms of ONJ were included although patients with a history of facial trauma or sickle cell disease were excluded. Data collected included "tooth loss, periodontal disease, caries, endodontic problems, gingival bleeding, suppuration, pain or sensitivity, neurosensory disturbances, and information on dental procedures" (p. 440) which occurred in the 3 years preceding diagnosis of ONJ (or the previous 3 years for the case controlled matches).

The researchers found that 113 of 191 (83%) of the ONJ patients and 71 of 573 (15%) of the control patient had been on BP therapy. Median length of use was 5.6 years for the ONJ patients and 4.2 years for the control cases. "Duration of bisphosphonate use < 2 years was associated with a ten-fold risk of ONJ, while with duration > 2 years, that risk nearly quadrupled" (Barasch et al., 2011, p. 441). Additionally, the risk of developing ONJ was higher in patients treated with IV BPs as compared to oral BPs.

Local Risk Factors

Pichardo and van Merkesteyn (2013) conducted a study reviewing 45 patients in the Netherlands diagnosed with BRONJ to determine if a dental origin could be found. Sixteen patients had received oral BP therapy for a minimum of 24 months each. Twenty-nine patients had received IV BP therapy for a minimum of 12 months each. The patients were classified into 4 groups based on the cause of their BRONJ lesion: a certain dental focus (recent dental procedure or pre-existence of periodontal disease at site of lesion), a presumable dental focus (an elevated mylohyoid ridge or trauma caused by ill-fitting dentures), spontaneous (with no previous dental history or trauma) and unknown (unclear or untraceable dental history).

In 36 of the 45 cases a certain dental focus was found. In 9 of the 45 cases a presumable dental focus was found. There were no cases of spontaneous BRONJ. One of the 45 cases was of unknown origin. They did not find a difference in the origin of BRONJ lesions in those taking oral BPs compared to those taking IV BPs.

Dental extraction.

Dental extraction has been proposed as a major risk factor of developing ONJ. Following a tooth extraction, patients have a 5.3 to 53 times higher risk of developing ONJ. However, oral bacterial infections (such as those stemming from an infected tooth) may also place a patient on BPs at high risk of developing BRONJ, so extraction of an infected tooth may not be avoidable (Yamazaki et al., 2012).

Yamazaki et al. (2012) conducted a cohort study to “estimate the cumulative incidence (of developing ONJ) after tooth extraction in patients with and without administration of BP, and to identify potential risk factors, including oral status” (p. 1398). They conducted a

retrospective analysis of 3,216 patients who had tooth extraction surgery at a university hospital in Japan. Patient information collected included patient demographics, risk factors, types of BPs administered, and the condition of dental status.

There were 126 patients who had been treated with BPs (86 received oral BPs, 17 received IV BPs). There were 3,090 patients who had no history of BP therapy. Of the 126 patients with a history of BP therapy, 5 (3.9%) developed BRONJ. Only 1 (0.032%) of the 3,090 patients who were BP naïve developed ONJ. "By route of administration, cumulative incidence was 1.0% among patients treated with oral BP and 14.8% in those treated with intravenous BP (Yamazaki et al., 2012, p. 1400).

The authors found the major risk factor of ONJ development was BP therapy, especially when given intravenously. Age alone was not a significant risk factor; however patients over the age of 65 had a higher rate of IV BP treatment, therefore increasing their risk. Smoking status, steroid use, chemotherapy, diabetes, and oral health were not statistically significant risk factors in this study. Poor oral health had been found to be a risk factor in other studies, but the authors of this study report their patients received oral examinations, screenings, and oral cleaning which may have decreased the potential complications of poor oral health among their participants.

Due to the low number of patients who developed ONJ, the authors report it is difficult to conclusively determine which additional risk factors may lead to developing ONJ lesions.

Dental implants.

Dental implants have also been suggested as a risk factor for developing BRONJ. López-Cedrún et al. (2013) conducted a retrospective study of 9 patients who were treated with oral

BPs, received dental implants, and developed BRONJ within 3 years. The participants of this study lived within a 100 kilometer radius of Galicia, Spain. The aim of their study was "to describe the clinical characteristics of BRONJ associated with dental implants in patients taking bisphosphonates orally" (López-Cedrún et al., 2013, p. 875). The data variables collected included:

> sex, age, type of bisphosphonate given, indications for and duration of treatment, coexisting conditions, use of corticosteroids, smoking, number and sites of implants inserted, number of implants involved in the BRONJ lesion, interval between the insertion of the implant and the development of BRONJ, clinical presentation of the lesions, treatment of the lesions, and the clinical course (López-Cedrún et al., 2013, p. 875).

Their study involved 9 patients (8 women, 1 man) who received a total of 57 dental implants (29 mandibular and 28 maxillary). BRONJ lesions were more commonly found involving the mandibular implants (present in 8 of the 9 patients), especially in the molar and premolar areas. Four of the patients developed BRONJ within the first year of receiving dental implants; the other 5 patients developed BRONJ later than one year.

Due to the limited number of patients in this study, the researchers were unable to determine which coexisting factors may influence the development of BRONJ.

Demographic and Systemic Risk Factors

Osteoporosis.

Huang et al. (2015) conducted a population-based cohort study in Taiwan containing two groups who received dental extractions between the years 2000 and 2010. The first group

contained 19,399 patients who were diagnosed with osteoporosis. The second group contained 38,669 age and gender matched comparison patients. Patients with a history of osteonecrosis were excluded from both groups. The goals of this study are "(1) to investigate the incidence of BRONJ in osteoporotic patients with oral BPs administration, and (2) to estimate the correlation between BRONJ and BPs usage in patients with osteoporosis" (Huang et al., 2015, p. 3).

After controlling for age, gender, hypertension, diabetes and cancer; the researchers found the osteoporosis group developed ONJ at a rate of 11.72 per 10,000 person-years compared to 5.32 per 10,000 person-years in the non-osteoporosis group. The rate of ONJ development slightly increased (but not statistically significant) in patients who were treated with oral BPs and those with mild osteoporosis who did not receive BP treatment as compared to those without osteoporosis. However, those who had a large cumulative dose of BPs or had used BPs for many years had a statistically higher rate of developing ONJ than patients without osteoporosis.

In both cohorts, when the annual frequency of dental extraction increased, the risks of developing ONJ increased. Both groups had low rates of ONJ with an annual frequency of dental extraction below two. However, patients who had osteoporosis treated with BPs who had more than two dental extractions in one year developed ONJ at a rate of 46.6 per 10,000 person-years. Frequent dental extractions may be related to poor dental hygiene and dental care which may independently raise the risk of ONJ development. Based on their research and review of literature, the researchers reported that the severity of osteoporosis is a large factor in the development of ONJ while BPs "play a synergistic role" (Huang et al., 2015, p. 9).

Estrogen therapy.

Vaszilko et al. (2014) conducted a prospective study involving 93 patients (74 females, 19 males) seen at their clinic in Budapest who were diagnosed with BRONJ. Comorbid diseases were recorded. Each patient's ONJ lesion was surgically treated in a similar manner and recurrence rates were noted. As it is well known that lower levels of estrogen increase osteoporosis risks, the authors wanted to explore if there is a relationship between antiestrogen therapy and BRONJ development.

Thirty-seven of the 93 patients in this study had breast cancer with 80% of those patients having estrogen receptor positive cancer treated with antiestrogen therapy. The researchers found that patients who had estrogen receptor negative breast cancer developed recurrent BRONJ at rates similar to other underlying pathologies (such as multiple myeloma or prostate cancer). However, patients with estrogen positive cancer treated with antiestrogen therapy developed recurrent BRONJ lesions at a statistically significant higher rate than breast cancer patients who were not on antiestrogen therapy. This indicates that breast cancer itself is not a risk factor but rather decreased estrogen levels that may lead to recurrent BRONJ lesions.

Oral health in postmenopausal women.

Grgić et al. (2017) conducted a non-interventional clinic study of 120 postmenopausal women treated at a single dental clinic in Serbia. The women were 50 to 70 years old and postmenopausal. They were divided into three groups. The first group (O) consisted of 45 women diagnoses with osteoporosis and had never been on BP therapy or had been treated with oral BPs for less than 6 months. The second group (OBP) consisted of 45 women

diagnosed with osteoporosis who had been on oral BP therapy for 6 months or more. The third, control group (C) consisted of 30 women who did not have osteoporosis. Each patient was examined by the same periodontist and periodontal health was measured using the plaque index, the gingival index, the bleeding index, clinical attachment loss, pocket depth, and the DMFT (decayed, missing, and filled teeth) index.

"Our study showed that women who are taking BP therapy had higher gingival index than C or O group and higher pocket depth than the O group" (Grgić et al., 2017, p. 155). The OBP group also had an increased bleeding index. However, they did not find significant differences in the overall stage of periodontal disease between the three groups. The researchers concluded that oral BP therapy may cause local irritation in the oral cavity, leading to increased risk of lesion development.

Preventative Factors

There is much debate regarding how BRONJ lesions should be treated. "Specific management regimens have included chlorhexidine rinses, antibiotic therapy, non-surgical sequestrectomy, and surgical debridement and/or resection of necrotic bone (Lerman et al, 2013, p. 978). Most organizations recommend conservative management however these guidelines are based on expert opinion and have not been thoroughly researched.

Two surgical interventions.

Mozzati, Arata, and Gallesio (2013) completed a prospective study comparing two different surgical tooth extraction procedures on patients who were receiving oral BP therapy at a single dental center in Italy. All of the patients were currently on BP therapy, had been taking oral BPs for a minimum of 24 months and had never had irradiation of the maxillofacial

area or previous dental extractions. "A total of 334 subjects were treated with delicate surgery and closure by primary intention (Protocol A), while the other 366 were treated with nontraumatic avulsion and closure by secondary intention (Protocol B)" (p. 1708). All patients received a radiologic examination preoperatively and one year postoperatively. They also received professional oral hygiene one week prior to surgery.

There were a total of 700 patients between the two groups and a total of 1,480 extractions completed. None of the patients developed BRONJ or experienced delayed healing. Based on their results and review of literature, the researchers proposed that BRONJ development in patients on oral bisphosphonate therapy is a rare complication but good oral care and minimally traumatic oral surgery may further reduce the risk.

Discontinuing BP therapy prior to dental surgery.

Hasegawa et al. (2013) completed an observational study to determine how discontinuing oral BP therapy for 3 months prior to tooth extraction affects the development of BRONJ and wound healing. Their study included 212 Japanese patients (18 males and 183 females), with a total of 434 teeth extracted. The first group (101 patients, 262 teeth) discontinued BP treatment for 3 months prior to having their extraction surgery. The second group (111 patients, 172 teeth) continued on BP treatment as it was deemed too risky for them to discontinue their BP medication or the oral surgery was required sooner than 3 months.

There were no cases of BRONJ development in the group that discontinued BPs prior to surgery although there were 2 cases which had delayed wound healing following tooth extraction. They were treated with antibiotics and a mouth rinse. Both cases healed within 12

weeks. One case of BRONJ developed in the second group, developing an intraoral fistula with bone exposure. At 120 weeks after tooth extraction, this wound was not yet fully healed.

Based on the results on their study and their review of literature, the authors suggested discontinuing oral BPs 3 months prior to and 3 months after elective invasive dental surgery when possible. As BPs remain in bone for several years after discontinuation, they conclude:

> Discontinuation of BP therapy for a few months may have little effect on the BP that has already incorporated into the bone. However, other effects of BP, such as its antiangiogenic activity and inhibition of proliferation and migration of epithelial cells, may be reduced, and this may help healing of the overlying mucosa (Hasegawa et al., 2013, p. 561).

Learning Points

While the body of knowledge regarding BRONJ lesions is vast, consensus regarding the development, risk factors, and treatment of BRONJ is not fully understood and the available evidence is contradictory at times. Regarding the studies collected in this review of literature, several weaknesses are present. Most of the studies enrolled patients in limited geographical area. Some of the studies contained too few patients to make generalized assumptions regarding BRONJ. Each of the studies by itself does not provide evidence that is strong enough to apply to a generalized population but each study adds to the growing body of knowledge that makes understanding of this condition stronger.

The patient in the case study has several risk factors of developing BRONJ. She has osteoporosis which has been found to be an independent risk factor (Huang et al., 2015). As she is starting on oral BP therapy, she needs to be aware that this does increase her risk of

developing BRONJ but the risk is very small compared to IV therapy (Shintani et al., 2015; Barasch et al., 2011; Yamazaki et al., 2012). The risk does increase the longer she is on the medication, with nearly a 4-fold increase after being treated with BPs for longer than 2 years (Barasch et al., 2011). An expert panel has suggested moderate-risk patients be placed on a drug holiday after 5 years of BP treatment (Suresh et al., 2013).

The majority of BRONJ lesions are of known dental origin (Pichardo and van Merkesteyn, 2013). Dental extraction and/or dental implants may be a triggering event for the development of BRONJ (Yamazaki et al., 2012; López-Cedrún et al. 2013). Additionally, oral BPs may cause local irritation in the mouth which may precipitate BRONJ development (Grgić et al., 2017).

This patient has a history of breast cancer that was estrogen receptor positive. She is on an antiestrogen medication. Use of this medication can increase the severity of her osteoporosis and may be an additional risk factor for developing BRONJ (Vaszilko et al., 2014).

This patient should receive regular oral care and cleanings. She should be aware that she should see a dentist if she develops any oral pain or lesions. If she requires oral surgery, it is important her provider is aware that she is on oral BP therapy. The provider should consider discontinuing her BP medication for up to 3 months before and after the surgery if delaying the surgery will not compromise the patient (Hasegawa et al., 2013).

While the use of oral bisphosphonate therapy does carry a risk, the benefits of the medication make it an appropriate choice for the patient in the case study. After educating the patient on the benefits and risks of the medication, if she is in agreement with starting the medication, the provider should prescribe it immediately. She should be educated on appropriate dental care and what to do if she develops oral pain or lesions. At each follow-up

visit, the provider should discuss this medication with the patient to determine if she is compliant with taking the medication as prescribed and if she is experiencing any side effects. The provider and patient should collaborate on the plan of care on a yearly basis and determine if the benefits of this medication continue to outweigh the risks.

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