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PATHOLOGICAL FRACTURE OF MANDIBLE - TREATMENT OPTIONS

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ABSTRACT

A fracture that is caused by a pathological disease that already exists in the bone is known as a pathologic fracture. Even though it is an uncommon occurrence, jaw fractures with or without minor trauma should raise the possibility of a mandibular pathologic fracture. Numerous pathologic fracture causes are included in this review. The presentation, diagnosis, and treatment of pathologic fractures are also briefly reviewed. As a result of their frequent radiographic recommendations and jaw examinations, dentists may be the first to detect these fractures. For prompt diagnosis and treatment, dentists should thus possess a comprehensive understanding of its pathogenesis.

INTRODUCTION:

A fracture is an entire or partial discontinuity in the bone brought on by an external or internal stress. A pathologic fracture is one that results from weakened bone architecture from an underlying pathological lesion, even in cases of low impact trauma[1]. Acute pathologic fractures can be identified by a number of symptoms and indicators. Because of the concealment of symptoms from underlying disease, it might even be a protracted silent affair. The most common injuries are mandibular fractures, of which 2% are pathologic fractures[2].

If left untreated, mandibular pathologic fractures can result in malunion and subsequent infections in addition to excruciating pain and functional limitations. The initial evaluation that should be done when a fracture is discovered is to determine whether the involved bone was normal, normal but insufficient, or aberrant. Pathologic fracture treatment is challenging because it requires stabilizing and reducing bone that has already been weakened by underlying pathology. It is challenging since there may be fewer options for treatment when bone pathology is a widespread systemic illness.

Causes of bone weakness leading to mandibular pathologic fractures are:

1. Inadequate or abnormal bone formation
2. Resorption of internal bone mass weakening the bony architecture
3. Reduction of bone quality decreasing ability to bear the stress of function
4. Pathologic bone remodelling
5. Local bone destruction due to cysts and tumours (primary and metastatic) thus reducing the total amount of bone available to bear the load of mastication.

Signs and symptoms of pathologic mandibular fractures:

Signs of the fracture and the underlying pathologic process will be present in any pathologic fracture. These include exophytic lesion, buccolingual swelling and vestibule obliteration, jaw deviation, pain, tenderness, clicking, numbness in the lower lip and chin area, trouble chewing, movement of jaw pieces, open bite, malocclusion, and ecchymosis.

Diagnosing pathological fractures:

The location and extent of the fracture must first be determined via investigations. radiographs such as the orthopantomogram and posterior-anterior view can reveal a pathologic fracture across the inferior border and a damaging radiolucent lesion on the jaw. One may observe overriding of the mandibular inferior border's edges. It is possible to perform a computed tomography (CT) or cone beam computed tomography (CBCT) scan to determine the whole extent of the fracture and to get a general understanding of the underlying disease. Early marrow alterations can be detected extremely well by magnetic resonance imaging (MRI). In radiography and CT scans, it can be useful in locating metastases before they show up, but it is less useful in anatomical bone.

By performing an incisional biopsy on a suspicious lesion at the fracture site, the pathologic process is identified. When a metastatic lesion is suspected, a work-up that includes a contrast-enhanced CT scan of the head and neck as well as an assessment of the neck lymph nodes is necessary. The investigations also involve abdomen ultrasounds and chest X-rays.

A complete blood count (CBC) is part of the laboratory examination process for any

suspected cancer. It is necessary to measure the C-reactive protein (CRP) levels and erythrocyte sedimentation rates (ESR), which indicate the participation of an inflammatory process. For particular cancers, it will also be necessary to measure different tumor marker levels. To help rule out the possibility of thyroid cancer, a thyroid panel is required. Tests for kidney function should also be carried out. A whole body radionuclide bone scan can be helpful in locating additional skeletal areas where tumor involvement may be present.

Osteogenesis Imperfecta:

Bone fragility is a characteristic of this dominantly or recessively inherited connective tissue condition[3]. The aberrant matrix that the osteoblasts create fractures when small mechanical loads are applied. Fractures are common in patients with osteogenesis imperfecta, either as a result of very minor trauma or as a spontaneous event. Due to the increased mechanical loads on the extremities, fracture is observed in over 80% of them. Although they happen infrequently, facial bone fractures have been documented. A patient with osteogenesis imperfecta experienced a mandibular fracture after an atraumatic extraction of a molar, according to Gallego et al. These fractures can be treated with maxillomandibular fixation and open reduction using plates. In cases of osteogenesis imperfecta, physical therapy, rehabilitation, and orthopaedic surgery are crucial[3]. Further care is necessary even after treatment because the repaired bone could not be of as high quality.

Mandibular atrophy:

The mandible gets smaller in size as mandibular atrophy progresses. A mandibular fracture that is smaller than 15-20 mm wide, as defined by Luhr's classification, is referred to as an atrophic mandibular fracture[4]. Even slight trauma or mastication can cause a severely atrophic mandible to fracture. These fractures, which commonly affect both sides of the mandibular body, account for less than 1% of all facial fractures[5]. The patient may have both intraoral and extraoral ecchymosis related to a fracture, along with anterior mandibular pain and movement.

There are several reasons why treating an atrophic edentulous mandibular fracture can be difficult. These fractures typically affect the elderly population, who may not be in good enough health to undergo surgery. Additionally, the elderly population experiences a reduction in bone regrowth. There is not enough or good-quality bone for fracture repair because of significant atrophy. There are no teeth to help reduce fractures, and the blood flow to this bone is more periosteal and less endosteal, delaying healing even more.

Plans for treating these fractures are made in accordance with the patient's blood supply and condition. Liquid diets and closed reduction are options if health is seriously damaged. However, rigorous internal fixation and open reduction can produce good results and allow for an expedited return to function. The intraoral technique will remove the possibility of scarring and facial nerve harm during open reduction. If an extraoral technique is used, there will be less periosteal stripping, more fragment visualisation, and a lower risk of infection from the intraoral environment. It is thought that using a locking bone plate system will avoid disrupting the periosteal vascular supply underneath. Additionally, the plate does not always need to make close contact with the bone when using the locking plate technique. They can be applied to the mandibular inferior border,

preventing the necessity for removal while creating dentures. Even with minimal masticatory stresses in the edentulous mandible, less rigid solutions like mini-plates might not be the best choice in atrophic factures because the mandible is still exposed to forces from other directions[5].

Osteoporosis:

This is a progressive bone disease that only shows visible signs of the primary weight-bearing trabeculae and is defined by a loss in bone mass and density. Due to the deterioration of the bone architecture, these patients, especially older women will be more likely to fracture[6]. Patients with osteoporotic bone fractures are advised to immobilize the damaged area as loading may trigger a stress fracture. To avoid jaw fractures, limited bone removal and tooth sectioning techniques should be employed when extracting impacted teeth from osteoporotic patients.

Osteopetrosis:

An genetic bone condition called osteopetrosis results in abnormal osteoclastic resorption. Osteoblasts function normally whereas osteoclasts are unable to resorb bone. Bone density increases throughout the skeleton as a result of the imbalance between osteoblastic bone apposition and osteoclastic resorption[7].

The impacted bone breaks more readily, most likely as a result of incorrectly aligned trabeculae along the planes that support the bone against force. Osteomyelitis is another osteopetrosis consequence that can weaken the bone even more and increase its vulnerability to fracture. Individuals suffering from osteopetrosis should practice good oral hygiene because their osteomyelitis may not heal properly in these cases[7].

Osteomyelitis:

Mandibular osteomyelitis can arise when immunodeficiencies coexist with a primary infection that is not well treated. Numerous predisposing conditions, including diabetes, osteogenesis imperfecta, squamous cell carcinoma, and pyknodysostosis, have been linked to osteomyelitis. Mandibular osteomyelitis may be so prevalent as to result in mandibular fractures. Intravenous antibiotics are used in the management of osteomyelitic fractures, and operations such as sequestrectomy are then performed. The quantity of healthy bone that remains must be assessed after the infection and its foci have been removed. The best course of treatment for pathological fractures linked to osteomyelitis should be closed reduction with intermaxillary fixation in order to prevent further ischemia necrosis from the implantation of plates[7,8].

Impacted third molar:

A rare consequence of impacted third molar resorption is pathologic mandibular fracture[9]. Massive bone removal is typically necessary for deeply impacted molars, which could weaken the mandible and increase the risk of fracture. A pericoronitis or abscess, two inflammatory processes, can weaken the bone at the impaction site.

A pathological mandibular fracture linked to tooth extractions may happen during the operation or in the first few weeks following it. This kind of pathological fracture can be linked to a number of risk variables, including age, gender, impaction types, infection status, and surgical method. In elderly patients, ankylosis of the impacted tooth may potentially complicate removal,

requiring more extensive bone removal[10]. To minimise the quantity of bone removed, sectioning the teeth is strongly advised. After the third molar is extracted, the patient should take special precautions to avoid biting into hard foods. Depending on the degree of bone displacement, therapy for a fracture may involve a soft diet and either closed or open reduction.

Cysts and Benign tumours:

Numerous cystic lesions, including radicular cysts, follicular cysts, aneurysmal bone cysts, and odontogenic keratocysts, can cause pathological mandibular fractures when they become extensive[11]. The mandibular angle and the body are where fractures linked to benign cysts are most commonly found. The growth of cystic lesions or tumors causes the surrounding bone to expand, thin, and resorb, weakening it and increasing its susceptibility to fracture. Treatment will include fixing the damaged parts and curing the cysts or removing the tumor. If there is not enough healthy bone left over after surgery, subsequent repair is necessary[12].

Leukemia:

Proliferation of aberrant hematopoetic cell clones is known as leukemia. Normal hematopoetic cell lines are displaced by the leukemic cells when they proliferate. The femur, humerus, pelvis, skull, metacarpals, ulna, and vertebrae are among the bones that may be affected by leukemia.

Leukaemic bone involvement on radiographs has been referred to as a "motheaten." perhaps if they are uncommon, pathological fractures can be the first indication of a disease process that is still active or perhaps the first sign to manifest, which can be verified by a haematological examination[13]. The ongoing nature of the illness and the involvement of not just the long bones but also other face bones complicate the management of fracture in leukemia patients.

Osteoradionecrosis:

Radiation has two opposing effects on tissues: it can cause healing and damage. In the absence of recurrent or metastatic disease, post radiation osteoradionecrosis (PRON) is defined as bone necrosis (devitalization and devascularization) that may occur in conjunction with radiation therapy for cancer[14]. Because the bone structure at the site will be destroyed by osteoradionecrosis, the area will become vulnerable to injuries that are difficult to heal because of weakened vasculature. Radiation therapy administered for primary tongue and oropharyngeal tumors will result in increased radiation exposure to the mandibular jaw bone.

Primary and secondary malignant lesions:

Mandibular primary and metastatic cancers may potentially result in fractures. These comprise lesions such as oesophageal cancer, metastasizing lesions of thyroid follicular carcinoma, and angiosarcoma[15-17]. Jaw metastases can manifest as paresthesia, pathologic fractures, teeth movement, discomfort, and swelling. Metastatic lesions are typically poorly defined and radiolucent on radiography, though they can also be radiopaque mixed lesions[15,17].

The metastatic process should be given top consideration when treating pathological mandibular fractures linked to metastatic lesions. It is critical to identify the main cancer. The lesion should be removed, and the jaw should be immobilized. Because a pathological

fracture may indicate an advanced stage of neoplastic disease, treatment options are frequently restricted by the patient's overall condition. When treating resectable malignancies, radical surgery should be performed along with mandibular reconstruction. Depending on the ultimate pathology, postoperative radiation, chemotherapy, and radiation treatment may come next.

Multiple Myeloma:

This is a plasma cell neoplasm that causes anaemia, renal insufficiency, and osseous damage in the bone marrow by plasmacytosis. Diffuse osteopenia, localised osteolytic lesions, pathologic fractures, and hypercalcemia are the causes of bone loss. About 30 to 40 percent of people with multiple myeloma experience fractures. These fractures could be caused by myeloma cells directly depositing in the bone or by tumour-releasing proteins including osteoclast activation factors and factors that repress osteoblasts causing bone resorption. Osteoblast apoptosis can also be induced by malignant plasma cells[18].

Renal osteodystrophy;

The phrase "renal osteodystrophy" refers to all pathologic bone features in individuals suffering from renal insufficiency. Hyperphosphatemia and hypocalcemia brought on by the aberrant kidney function lead to secondary hyperparathyroidism.

Conventional radiography can detect osseous resorption, soft-tissue calcification, osteopenia, amyloid deposition, and fracture in cases with renal osteodystrophy. Fractures are the most frequent side effect of renal osteodystrophy. These can be pathologic caused by brown tumors or amyloid deposits or insufficiency caused by osteomalacic bone[19].

Paget disease:

Osteoclastic resorption of normal bone is first accelerated in Paget's disease. Increased osteoblastic activity forms new aberrant bones. Osteoclastic resorption eventually diminishes and is replaced by osteoblastic apposition. In its most extreme form, this chronic illness causes excruciating pain[20]. Weight-bearing bones are brittle and can break easily or gradually bend under stress, resulting in abnormalities such as bending and compression of the spinal nevus. Deafness and blindness may result from cranial foramina narrowing if the base of the skull is impacted. Much less frequently are the bones distal to the elbow and knee, the jaws, the ribs, and the facial bones involved. In order to treat fracture in Paget's disease, pain must be addressed first. The shattered portion is subsequently reduced.

Implant placement:

Fracture won't result from implanting in smaller edentulous sites if the method and planning are done correctly. The jaw may become weak if there is extensive alveolar bone loss and a protracted edentulous span. The likelihood of fracture during implant insertion is higher in jaws when the anterior mandibular bone is less than 12 mm. It happens as a result of unfavourable mechanisms.

Osteomyelitis and implant failure can potentially result in fractures[8]. One potential weak spot could be the marginal bone loss surrounding a dental implant. Thus, determining the breadth and height of the available bone before implant implantation and, if required, utilizing bone grafts can assist prevent this accident[1].

The preferred course of action in cases of fracture resulting from implant failure is removal of the failed implant, antibacterial therapy, debridement, and fracture reduction[8].

Kinky Hair Syndrome:

This syndrome is an uncommon X-linked illness that interferes with the metabolism and absorption of copper. Kinky hair from faulty connective tissue and widespread osteoporosis are further characteristics of this neurological illness. Healing is poor in cases with fractures in this situation. Treatment with copper replacement therapy offers some respite[21].

Gorham's disease (vanishing bone disease):

The disorder known as massive osteolysis is characterised by the spontaneous loss of bone. It is a destructive, idiopathic, non-cancerous development of angiomatous tissue that is being replaced by fibrous tissue. Adolescents or young adults are typically affected by massive osteolysis, with the mandible being the second most common site after the arm. Depression may be observed, but there is typically no palpable bulk or soreness in the affected location. Small radiolucencies that resemble osteoporosis may first be seen on radiography, and these may eventually be followed by the disappearance of a section of the bone or a localized group of bones[22].

CONCLUSION:

The two facets of managing a pathologic fracture are fracture management and pathology management. Fracture reduction will be carried out before the systemic cause is fully treated if the underlying pathology is a widespread systemic condition. However, fracture management and the eradication of the underlying pathology will take place concurrently if the pathology is a limited bone disease. Infection management must be given top importance. It is essential to conduct routine follow-ups to assess the healing process at the fracture reduction site and recurrence.

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