



PATHOLOGICAL MANDIBULAR FRACTURES: A RETROSPECTIVE STUDY

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SUMMARY

Pathological mandibular fractures occur in regions with previously damaged bone structure due to different etiologies.

The purpose of the study is to present a retrospective review of patients with pathological mandibular fractures who passed through the Clinic of Oral and Maxillofacial Surgery of St. George University Hospital, Plovdiv, for the period 2005-2019 and to compare the results with published literature.

Material and methods: The study includes 1328 patients with pathological fractures of the mandible with different etiology. Data were collected on age, gender, pre-existing bone damage and lesions, history of any interventions of the lower jaw and treatment approach.

Results: Patients with pathological mandibular fractures are 5,1% of all patients who passed through the clinic for this period. Two hundred of them are associated with benign or malignant bone tumors, 161 with osteomyelitis, 202 with other causes: third molar extraction, implant placement, osteonecrosis.

Conclusion: Pathological mandibular fractures have different etiologies. Diagnosis and treatment of this condition are challenging, and the treatment plan should be decided individually, according to the underlying disease.

Keywords: pathological fracture, mandible, lower jaw, osteomyelitis,

INTRODUCTION:

Pathological fractures of the lower jaw represent a very small percentage of all mandibular fractures. They occur in places where the integrity of the bone structure is damaged as a result of another primary process [1]. The most common reasons for this can be divided into: non-tumor and tumor causes. Various interventions in the area of the facial skull, such as extraction of the third molar, osteonecrosis in radiation therapy, osteomyelitis, etc., can lead to a violation of bone integrity. Tumor causes include both benign - most often bone cysts, and malignant, primary or metastatic tumors.

In this article, we will present our experience in pathology, diagnosis and treatment of patients over a 15-year period. The treatment of these patients is challenging and is judged depending on the etiology of occurrence [2, 3, 4, 5].

MATERIALS AND METHODS:

The study includes 1328 patients with pathological fractures of the mandible, who passed through the Clinic of Oral and Maxillofacial Surgery of St. George University Hospital for the period 2005-2019 - 5.1% of the total number of patients who passed through the clinic for this period. Of these, the most common are fractures as a result of tumor processes - 200 patients, followed by osteomyelitis of the bone - 161 patients.

Mandibular fractures associated with tumors

Pathological fractures of the lower jaw associated with benign bone tumors are extremely rare- 25 for the fifteen-year period. In the group, we also include the only 5 patients with cystic findings. They are all men, mean age 52.6 years (range 18-72 years), respectively with: residual cyst (2 patients), aneurysmal bone cyst (1 patient), odontogenic cyst (1 patient), follicular cyst (1 patient). Of the remaining benign tumors, hemangiomas and ossifying fibroids are the most common.

Pathological fractures based on a cystic lesion occur before surgical removal [6]. The sites of occurrence in these cases are mainly in the area of the mandibular angle and body and relatively less frequently in the area of the symphysis and condyles [7]. Surgical treatment of these patients is divided into two types:

- in the presence of sufficient underlying healthy bone, open reduction and internal fixation is performed in combination with removal of the cystic formation;
- in case of insufficient underlying healthy bone tissue or a large bone defect, resection of the involved areas and subsequent reconstruction [1].

Pathological fractures, as a result of malignant tumor formations, are mainly due to metastatic tumors in the mandible. Primary tumors originate as follows: thyroid gland (19%), breast (23%), squamous cell carcinoma (31%), lung cancer (19%) and others (8%). The affected anatomical areas are the mandibular angle, followed by the body and the condyles. The mean age of the patients was 62.14 years, range 18-87 years. Men are more often affected, and in malignant tumors, the frequency of involvement is approximately the same for both sexes (Table 1).

Table 1. Patients with pathological fracture of the mandible as a result of a tumor process for the period 2005-2019.

Year	Total number of patients	Total number of fractures	Tumor fracture	Male	Female	Benign	Malignant
2005	1618	164	17	11	6	3	14
2006	1733	89	7	5	2	1	6
2007	1469	107	31	18	13	5	26
2008	1688	102	9	9	0	1	8
2009	1507	111	7	6	1	1	6
2010	1437	87	8	7	1	1	7
2011	1753	97	12	8	4	1	11
2012	1846	90	16	11	5	2	14
2013	1840	73	8	3	5	1	7
2014	1622	73	13	4	9	2	11
2015	1594	52	11	6	5	1	10
2016	2028	69	7	6	1	0	7
2017	2153	57	17	12	5	2	15
2018	1900	74	14	8	6	1	13
2019	1840	83	23	14	9	3	20
Total	26028	1328	200	128	72	25	175

Surgical treatment of this group of patients depends on the underlying pathological process and is often limited due to the general condition of the patients, as metastases in the area of the mandible are the result of advanced primary neoplastic processes. Radical removal of the tumor formation by segmental resection of the mandible and selective or radical lymphatic cervical dissection is defined as the 'gold standard' for treatment if the tumor formation allows it [1]. Depending on the underlying pathological process and the TNM stage of the patient, reconstruction of the jaw is performed using the bone structure of the fibula and subsequent chemotherapy or radiation therapy. Very often, however, the general condition of the patients does not allow this (Fig.1, Fig.2)

Fig. 1. Orthopantomogram of a patient with osteomyelitis, osteonecrosis, and pathological mandibular fracture.



Fig. 2. 3-dimensional CT reconstruction of the same patient



Mandibular fractures associated with osteomyelitis

Osteomyelitis of the mandible can develop as a result of untreated or improperly treated primary infection [3,5]. This weakens the bone and leads to subsequent pathological fracture. Several predisposing conditions could lead to the development of osteomyelitis of the mandible - diabetes, immunodeficiency, osteogenesis imperfecta, and others [8].

The mean age of patients with pathological mandibular fracture based on osteomyelitis is 50.7 years, range 19-78 years; males are significantly more affected. The fracture sites are the mandibular angle and the body. (Table 2)

Table 2. Patients with pathological mandibular fracture as a result of osteomyelitis for the period 2005-2019.

Year	Total number of patients	Total number of fractures	Male	Female	Osteomyelitis fracture	Male	Female
2005	1618	164	122	42	31	26	5
2006	1733	89	68	21	19	17	2
2007	1469	107	79	28	14	9	5
2008	1688	102	83	19	18	10	8
2009	1507	111	92	19	11	9	2
2010	1437	87	78	9	19	17	2
2011	1753	97	72	25	11	7	4
2012	1846	90	69	21	7	5	2
2013	1840	73	57	16	12	11	1
2014	1622	73	51	22	9	6	3
2015	1594	52	39	13	4	4	0
2016	2028	69	51	18	3	2	1
2017	2153	57	44	13	2	0	2
2018	1900	74	57	17	0	0	0
2019	1840	83	49	34	1	1	0
Total	26028	1328	1011	317	161	124	37

The treatment plan begins with a course of antibiotics, if possible, after an antibiogram for a minimum of 6 weeks and preferably intravenous administration [1]. The restoration of the fractured area depends on the condition of the bone. If necessary, sequesterectomy or resection of the affected area is performed. The newly obtained bone defect can be filled with a 2.4 mm mandibular plate with subsequent reconstruction, simultaneously or in stages, depending on the general condition of the patient. According to Ogasawara and co-workers, closed replacement with intermaxillary fixation is recommended as a treatment for the pathological fracture associated with osteomyelitis to avoid future ischemic necrosis at the site of reconstruction [3].

Other causes leading to pathological fracture of the mandible

Two hundred two patients with pathological fractures of the mandible are associated with other causes. These include third molar extraction, implant placement, osteonecrosis as a result of radiotherapy in the facial area or treatment with bisphosphonates- bisphosphonates related osteonecrosis of the jaw (BRONJ). (Table 3)

Table 3. Number of patients with other causes leading to pathological mandibular fracture

	Number of patients	% of all fractures
Tooth removal	98	7,38
Implant placement	35	2,635
Osteonecrosis	32	2,41
BRONJ	31	2,33
other	6	0,45

Mandibular fracture as a result of tooth extraction is rare. It can occur at the time of extraction or in the post-operative period. Most patients are over 40 years of age, and most often, it happens with the extraction of the third molar. There are several risk factors for this type of fracture. These include age, gender, choice of surgical technique, the underlying bone or tooth pathology, and patient assistance, which includes avoiding chewing solid foods immediately after the intervention [9]. The main cause of such a pathological fracture is considered to be a decrease in bone elasticity with age, narrowing of the periodontal ligament and ankylosis of the third molar in adults, which may require extensive osteotomy [9, 10].

Mandibular fracture, as a result of implant placement, is also rare. Females are more often affected, mean age 59.1 years. The reason for this is significant resorption of bone tissue, with a thickness of the anterior part of the mandible less than 12 mm, due to which the ratio between implant length and the distance to the occlusal plane is compromised resulting in unfavorable biomechanics [5]. The fractures are more often in the symphysis. In fact, a large proportion of mandibular fractures result from the placement of dental implants in the symphysis area due to bone depletion in this area to perform an overdenture prosthetic rehabilitation [5, 11, 12]. There is variability in the time of onset of the fracture: from 3-6 weeks to 3 months after implant placement, and one case of fracture at the time of placement. There are several ways to treat this type of fracture, the choice is individual and based on the history of a particular patient. Open reduction and internal fixation via an extraoral approach is the most frequently adopted treatment option [5], followed by conservative treatment and bone graft with fixation.

Mandibular fractures resulting from osteonecrosis - osteoradionecrosis (ORN) or bisphosphonate-related os-

teonecrosis of the jaw (BRONJ) are not uncommon. They are found in adult patients, mainly with progressive diseases, wallowing disorders, a result of previous surgery and/or radiation therapy. Treatment includes coverage of the main pathological problem requiring surgical intervention or radiotherapy, followed by the restoration of the function of the mandible and the ability to resume chewing, speech and facial proportions.

Oral bisphosphonates are the most commonly prescribed antiresorptive drugs for the treatment of osteoporosis. However, there are several adverse effects associated with oral bisphosphonates, including BRONJ. With a better understanding of this side effect, reported incidences for BRONJ in oral bisphosphonate users have in-

creased in time. Several risk factors such as dentoalveolar surgery, therapy duration, and concomitant steroid usage have been linked to BRONJ [13]. These are mainly patients with proven osteoporosis or cancer (breast or prostate cancer), 16 female patients, 4 male, mean age 59.5 years, (42-78 years).

CONCLUSION:

Pathological mandibular fractures have different etiologies. Diagnosis and treatment of this condition are challenging, and the treatment plan should always be consistent with the concomitant disease to provide the best possible quality of life in such patients.

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