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Management Of Infected Mandibular Fractures. A Review

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Abstract
Treatment of infected mandibular fractures has been a challenge due to the complications of nonunion and malunion that follows.Immobilization with maxillomandibular fixation , splints, removal of diseased teeth , external fixation, use of antibiotics, debridement, and rigid internal fixation played a major role in management. The infected fractures are not just the result of microorganisms but also results from moving fragments resulting from improper immobilisation and non vital bone. Infected mandibular fractures is a commonly encountered postoperative complication and it has the highest rate of infections among other maxillofacial fractures and in many traumatic injuries . Factors that increase the risk of infections are the patient's systemic condition, nature of injury, time of medical care and type of treatment utilized.Mandibular fractures are very challenging to manage which requires high surgical expertise to treat. Infection and other fractures related to mandibular fracture becomes more challenging.

Keywords: fractures , fixation , mandible , review, complications

Introduction

Treatment for infected mandibular fractures is very challenging and consists of varied protocols. Factors that are important for management include pain limitation , preservation of bone , tooth , restoration of motor and sensory nerve function , elimination of infection . These fractures are common in surgical practice because many individuals with facial trauma fail to seek immediate treatment.Many advanced methods for treating infected mandibular fractures have been developed. Due to high risk of infection, it is advised to perform an open reduction with a rigid internal fixation or maxillomandibular fixation [(1)]. Before the era of rigid internal fixation for mandibular fractures, treatment consisted of anti-biotics, drainage and removal of associated teeth. Causes for infected mandibular fractures are multifactorial such as Instability, failed RIF appliances , diseased teeth,immunocompetent individuals, patient noncompliance, and delay in treatment. Infection in the fractured mandible could lead to a combination of frank purulence, fever, swelling or erythema adjacent to the fracture site and leukocytosis. Fractures that are extending through the periodontal ligament and at the site of the tooth bearing area are easily contaminated by oral bacteria . The main goals for managing the mandibular fractures are anatomical reduction, immobilization, prevention of infection and return to function. Removal of infected tooth , fracture reduction and stabilization with rigid internal fixation provides successful management in infected mandibular fractures[(2)].Our team has extensive knowledge and

research experience that has translate into high qualitypublications[3],[4],[5],[6],[7–16][17],[18–20].[21,22].

Review Literature Antibiotic Therapy :

Patients with osteomyelitis post infection and initiated with systemic I.v antibiotics. Removal of infection should precede osseous union , metal hardware should not be placed into the infected site. Hardware must be removed from the site that becomes infected.Neurosensory and facial nerve function of preoperative and postoperative treatment is to be recorded by various tests . Tests that are done to record are brush stroke, directional discrimination, light touch, 2-point discrimination, and pin-prick sensation. Some cases facial nerve weakness is experienced if there is soft tissue component involvement of the infection.Nuclear scintigraphy is used for the identification and management of osteomyelitis.These scans are useful to identify inflammation but does not clearly show the infection in bone . These tests help to better assess the prognosis of the infection and discontinue antibiotics once infection subsided.[1]

Infections Due To Contamination :

The rate of infection in open fractures is high . Bacteria will produce infection in the site of metal implants . Implants from infected wounds causes unresponsiveness to antibiotics , bacterial colonization or biofilm on their surface. Glycolax present in the cell wall of the bacteria will increase the level of infection, which will cause difficulty in antibiotic penetration. In the early postoperative state, mandibular fracture treated with internal fixation became infected . With the infection nonsurgical treatment may not be effective due to lack of rigidity[23]. Once infection develops in the fracture immediately the implant or devitalized tooth should be removed. severe cellulitis or closed abscess, the patient is given with intravenous antibiotics , incision and drainage is done[24]. The patient is taken to surgery for open reduction and internal fixation .

Cause Of Infection And Management:

Extraction of vital teeth, Poor dentition , periodontal disease causes fracture gap infection . Periodontally infected or endodontically treated teeth in the fracture gap must be extracted.

Inadequate immobilization is one of the most important factors that delays bony union or causes nonunion. Bone grafting is done for severe defects , reduction and immobilization with intermaxillary fixation. Antibiotics used in open mandibular fractures reduces the risk of postfracture infection . Proper dentition at the site of fracture is important for stable fragment immobilization. Immobilisation , prevention of infection , rehabilitation of function are important for successful bone healing and proper postoperative instructions should be followed for the proper function [25].

Complications:

Complications that affect the patient with mandibular fractures are neurosensory disorders, malocclusion and infections. The infections secondary to mandibular fractures have a standard treatment. Salivary fistulas, facial nerve damage, facial scarring,bleeding from arteries and veins, infection, delayed wound healing, hemorrhage, bone consolidation, occlusion changes, TMJ dysfunction[26].

Maxillomandibular Fixation :

It helps in maintaining the proper closure at the site of surgical extraction and also helps to reinforce the patients with a soft diet . This technique is contraindicated for certain people with specific systemic conditions like epilepsy, lung disorders or are uncompliant.It is more traditional conservative and also cost effective than any other procedure . It helps to maintain better occlusion and uses Erich arch bars with interdental wiring. But there will be risk of wire stick infection at the site . There are other techniques such as 4 point fixation that require self intermaxillary fixation . screws placed in the maxillary or mandibular bone depending on the dentition , fracture site and density of bone. It has advantages such as short operating time, helps to maintain good oral hygiene and better tolerability. Other materials such as hardware steel wiring and biomet Microfixation OmniMax gives good occlusal stability , in Erich arch bars with 4-point fixation. Complications seen such as wound dehiscence, new tooth damage at hardware removal, screw loosening, premature loss of screw , compromised airway, poor oral hygiene, speech difficulties, weight loss and atrophy in the masticatory muscles are some of the drawbacks of maxillomandibular fixation[27].

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Rigid Internal Fixation :

It has a better outcome and better time consumption than any other methods . Rigid internal fixation allows immediate mobilization of the mandible , high acceptance for treating mandibular fracture . Mandibular fractures are contaminated by bacteria and Postoperative infection also caused due to insufficient stability in the fracture . Rigid fixation is proven to be a very good method for managing mandibular fractures . Mandibular reconstruction has a high successful rate with rigid internal fixation . Patients with alcohol abuse have more complications such as delayed healing. This method is immediate , pain-free and mobilizes the jaw which is extensively used in fractures of the mandible and immediate postoperative function . Rigid internal fixation method requires a high standardised operation theatre ,high sanitised environmental and good postoperative care. Avulsive traumas in the mandible can be treated only by internal rigid fixation . IRF prevents disruption of neovascularization , infection growth in soft tissue and micromovement of the fragments.[28][29][30].

Conclusion :

Though there are a myriad of treatments for the mandibular fracture, the presence of infection makes it a challenge.The prime importance for the management of infected mandibular fractures could be summarised as, Elimination of the infection source, suitable antibiotic coverage and immobilisation warranted by rigid internal fixation.

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References

1. Mehra P, Van Heukelom E, Cottrell DA. Rigid internal fixation of infected mandibular fractures. J Oral Maxillofac Surg. 2009 May;67(5):1046–51.
2. Johansson B, Krekmanov L, Thomsson M. Miniplate osteosynthesis of infected mandibular fractures. J Craniomaxillofac Surg. 1988 Jan;16(1):22–7.
3. J PC, Pradeep CJ, Marimuthu T, Krithika C, Devadoss P, Kumar SM. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study [Internet]. Vol. 20, Clinical Implant Dentistry and Related Research. 2018. p. 531–4. Available from: http://dx.doi.org/10.1111/cid.12609
4. Wahab PUA, Abdul Wahab PU, Madhulaxmi M, Senthilnathan P, Muthusekhar MR, Vohra Y, et al. Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study [Internet]. Vol. 76, Journal of Oral and Maxillofacial Surgery. 2018. p. 1160–4. Available from: http://dx.doi.org/10.1016/j.joms.2017.12.020
5. Mudigonda SK, Murugan S, Velavan K, Thulasiraman S, Krishna Kumar Raja VB.Non-suturing microvascular anastomosis in maxillofacial reconstruction- a comparative study. Journal of Cranio-Maxillofacial Surgery. 2020 Jun 1;48(6):599–606.
6. Narayanasamy RK, Muthusekar RM, Nagalingam SP, Thyagarajan S, Ramakrishnan B, Perumal K. Lower pretreatment hemoglobin status and treatment breaks in locally advanced head and neck squamous cell carcinoma during concurrent chemoradiation. Indian J Cancer. 2021 Jan;58(1):62–8.
7. Wang H, Chinnathambi A, Alahmadi TA, Alharbi SA, Veeraraghavan VP, Krishna Mohan S, et al. Phyllanthin inhibits MOLT-4 leukemic cancer cell growth and induces apoptosis through the inhibition of AKT and JNK signaling pathway. J Biochem Mol Toxicol. 2021 Jun;35(6):1–10.
8. Li S, Zhang Y, Veeraraghavan VP, Mohan SK, Ma Y. Restorative Effect of Fucoxanthin in an Ovalbumin-Induced Allergic Rhinitis Animal Model through NF-κB p65 and STAT3 Signaling. J Environ Pathol Toxicol Oncol. 2019;38(4):365–75.
9. Ma Y, Karunakaran T, Veeraraghavan VP, Mohan SK, Li S. Sesame Inhibits Cell Proliferation and Induces Apoptosis through Inhibition of STAT-3 Translocation in Thyroid Cancer Cell Lines (FTC-133). Biotechnol Bioprocess Eng. 2019 Aug 1;24(4):646–52.
10. Bishir M, Bhat A, Essa MM, Ekpo O, Ihunwo AO, Veeraraghavan VP, et al. Sleep Deprivation and Neurological Disorders. Biomed Res Int. 2020 Nov 23;2020:5764017.

11. Fan Y, Maghimaa M, Chinnathambi A, Alharbi SA, Veeraraghavan VP, Mohan SK, et al. Tomentosin Reduces Behavior Deficits and Neuroinflammatory Response in MPTP-Induced Parkinson's Disease in Mice. J Environ Pathol Toxicol Oncol. 2021;40(1):75–84.
12. Zhang C, Chen Y, Zhang M, Xu C, Gong G, Veeraraghavan VP, et al. Vicenin-2 Treatment Attenuated the Diethylnitrosamine-Induced Liver Carcinoma and Oxidative Stress through Increased Apoptotic Protein Expression in Experimental Rats. J Environ Pathol Toxicol Oncol. 2020;39(2):113–23.
13. Gan H, Zhang Y, Zhou Q, Zheng L, Xie X, Veeraraghavan VP, et al. Zingerone induced caspase-dependent apoptosis in MCF-7 cells and prevents 7,12-dimethylbenz(a)anthracene-induced mammary carcinogenesis in experimental rats. J Biochem Mol Toxicol. 2019 Oct;33(10):e22387.
14. Saravanakumar K, Park S, Mariadoss AVA, Sathiyaseelan A, Veeraraghavan VP, Kim S, et al. Chemical composition, antioxidant, and anti-diabetic activities of ethyl acetate fraction of Stachys riederi var. japonica (Miq.) in streptozotocin-induced type 2 diabetic mice. Food Chem Toxicol. 2021 Jun 26;155:112374.
15. Veeraraghavan VP, Hussain S, Papayya Balakrishna J, Dhawale L, Kullappan M, Mallavarapu Ambrose J, et al. A Comprehensive and Critical Review on Ethnopharmacological Importance of Desert Truffles: Terfezia claveryi, Terfezia boudieri, and Tirmania nivea. Food Rev Int. 2021 Feb 24;1–20.
16. Wei W, Li R, Liu Q, Devanathadesikan Seshadri V, Veeraraghavan VP, Surapaneni KM, et al. Amelioration of oxidative stress, inflammation and tumor promotion by Tin oxide-Sodium alginate-Polyethylene glycol-Allyl isothiocyanate nanocomposites on the 1,2-Dimethylhydrazine induced colon carcinogenesis in rats. Arabian Journal of Chemistry. 2021 Aug 1;14(8):103238.
17. Sathya S, Ragul V, Veeraraghavan VP, Singh L, Niyas Ahamed MI. An in vitro study on hexavalent chromium [Cr(VI)] remediation using iron oxide nanoparticles based beads. Environmental Nanotechnology, Monitoring & Management. 2020 Dec 1;14:100333.
18. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. Prog Orthod. 2020 Oct 12;21(1):38.
19. Ramakrishnan M, Dhanalakshmi R, Subramanian EMG. Survival rate of different fixed posterior space maintainers used in Paediatric Dentistry – A systematic review [Internet]. Vol. 31, The Saudi Dental Journal. 2019. p. 165–72. Available from: http://dx.doi.org/10.1016/j.sdentj.2019.02.037
20. Felicita AS, Sumathi Felicita A. Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor – The sling shot method [Internet]. Vol. 30, The Saudi Dental Journal. 2018. p. 265–9. Available from: http://dx.doi.org/10.1016/j.sdentj.2018.05.001
21. Su P, Veeraraghavan VP, Krishna Mohan S, Lu W. A ginger derivative, zingerone-a phenolic compound-induces ROS-mediated apoptosis in colon cancer cells (HCT-116). J Biochem Mol Toxicol. 2019 Dec;33(12):e22403.
22. Wan J, Feng Y, Du L, Veeraraghavan VP, Mohan SK, Guo S. Antiatherosclerotic Activity of Eriocitrin in High-Fat-Diet-Induced Atherosclerosis Model Rats. J Environ Pathol Toxicol Oncol. 2020;39(1):61–75.
23. Nishioka GJ, Jones JK, Triplett RG, Aufdemorte TB. The role of bacterial-laden biofilms in infections of maxillofacial biomaterials [Internet]. Vol. 46, Journal of Oral and Maxillofacial Surgery. 1988. p. 19–25. Available from:http://dx.doi.org/10.1016/0278-2391(88)90295-9
24. Reynolds FC, Zaepfel F. MANAGEMENT OF CHRONIC OSTEOMYELITIS SECONDARY TO COMPOUND FRACTURES [Internet]. Vol. 30, The Journal of Bone & Joint Surgery. 1948. p. 331–8. Available from:http://dx.doi.org/10.2106/00004623-194830020-00007
25. Fischer-Brandies E, Dielert E. The infected mandibular fracture [Internet]. Vol. 103, Archives of Orthopaedic and Traumatic Surgery. 1984. p. 337–41. Available from: http://dx.doi.org/10.1007/bf00432422

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26. Zweig BE. Complications of mandibular fractures. Atlas Oral Maxillofac Surg Clin North Am. 2009 Mar;17(1):93–101.
27. Edmunds MC, Alex McKnight T, Runyan CM, Downs BW, Wallin JL. A Clinical Comparison and Economic Evaluation of Erich Arch Bars, 4-Point Fixation, and Bone-Supported Arch Bars for Maxillomandibular Fixation [Internet]. Vol. 145, JAMA Otolaryngology–Head & Neck Surgery. 2019. p. 536. Available from: http://dx.doi.org/10.1001/jamaoto.2019.0183
28. Lindqvist C, Kontio R, Pihakari A, Santavirta S. Rigid internal fixation of mandibular fractures - An analysis of 45 patients treated according to the ASIF method [Internet]. Vol. 15, International Journal of Oral and Maxillofacial Surgery. 1986. p. 657–64. Available from: http://dx.doi.org/10.1016/s0300-9785(86)80105-3
29. Iizuka T, Lindqvist C. Rigid internal fixation of mandibular fractures [Internet]. Vol. 21, International Journal of Oral and Maxillofacial Surgery. 1992. p. 65–9. Available from: http://dx.doi.org/10.1016/s0901-5027(05)80533-8
30. Adell R, Eriksson B, Nylén O, Ridell A. Delayed healing of fractures of the mandibular body [Internet]. Vol. 16, International Journal of Oral and Maxillofacial Surgery. 1987. p. 15–24. Available from: http://dx.doi.org/10.1016/s0901-5027(87)80026-7.

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