International Summit on Science Technology and Humanity
ISETH 2024
ISSN: 2615-1588 (online)

The Incidence of Maxillofacial Trauma Post ORIF on The Incidence of Chronic Sinusitis

Tasya Viona Salsabila [1*], Imam Nur Hafizh[1], Iwan Setiawan Adji[1,2]

[1]Faculty of Medicine, Universitas Muhammadiyah Surakarta, Jalan Ahmad Yani, Sukoharjo, 57169, Central Java, Indonesia
[2]Departement of ENT-HN, RSUD Karanganyar, Jl.Yos Sudarso Karanganyar, 495118, Central Java, Indonesia

Abstract

Purpose: This study aims to investigate the incidence of chronic sinusitis following Open Reduction and Internal Fixation (ORIF) for maxillofacial fractures. The research focuses on the impact of ORIF on sinus anatomy, drainage, and ventilation, leading to potential sinus complications.
Methodology: The methodology used in this report is a clinical case study. Data were collected through anamnesis, physical examination, and supporting examinations. The patient's management was analyzed based on existing medical theories and appropriate treatment was provided according to the patient's condition.
Results: Cases analyzed show common risk factors such as hematosinus, sinus flow obstruction, and postoperative swelling. The study emphasizes the need for post-surgical monitoring (3-6 months) to assess the development of sinusitis and related complications.
Applications/Originality/Value: This report provides insights into the importance of early diagnosis and proper management maxillofacial trauma.The findings can be useful for healthcare professionals to understand clinical signs and effective treatment approaches for similar cases. Postoperative monitoring should include imaging and clinical evaluations to detect early signs of sinusitis.

Introduction Section

The zygomaticomaxillary complex (ZMC) is the main support of the midface skeleton. ZMC is important for the structural, functional, and aesthetic appearance of the facial skeleton. Based on the AO CMF classification, the midfacial region is divided into: zygoma, upper central midface, intermediate central midface, lower central midface, frontal, parietal, sphenoidal, and temporal (Jiang et al, 2022). ZMC fractures are also known as tripod, tetrapod, or quadripod fractures, trimalar fractures or malar fractures (Ji et al, 2016). These fractures can be caused by traffic accidents, work accidents, or assaults with or without weapons. When midfacial fractures are accompanied by maxillary sinus fractures, possible complications are sinusitis (Kim et al, 2023).

Sinusitis is the most common disease affecting the maxillary sinus after trauma. In most cases of mid-facial fractures, there is disruption of the mucosa lining the inner wall of the sinus, increasing the risk of various problematic sequelae (Kim et al, 2023). Symptoms of maxillary sinusitis include nasal congestion, nasal discharge, facial pain, rhinorrhea, and others (Jiang et al, 2022). Nevertheless, the maxillary sinus mucosa shows substantial regenerative capacity, although this regenerative potential may be insufficient if a large defect occurs. The development of maxillary sinusitis may be influenced by disruption of the integrity of the sinus and the presence of blood in the sinus (Kim et al, 2023).

According to Jiang et al (2022), maxillary sinus fractures can cause sinus outflow obstruction and cause long-term sinusitis. Fracture fragments into the sinus may be associated with discomfort associated with post-

* Corresponding author: tasyavsl@gmail.com

traumatic sinusitis. This complication can also be caused by iatrogenic factors. Separation of the bone around the maxillary sinus, changes in the maxillary sinus clearance mechanism, and hematocele formation in the sinus cavity when performing Le Fort I osteotomy can cause inflammatory changes in the maxillary sinus, which can also occur after reduction of midface fractures. Similarly, screws used in open reduction and internal fixation (ORIF) procedures for repair of midface fractures often penetrate the maxillary sinus. However, no studies have been conducted to investigate the risk factors for maxillary sinusitis after ORIF of midface fractures. Management based on its location is carried out by single-point fixation in various areas, various two-point fixation methods, and three-point fixation methods (Ji et al, 2016). Treatment for acute sinusitis focuses primarily on symptom management and does not involve antibiotics unless the patient is asymptomatic or shows signs of infection. Topical nasal decongestants and saline irrigation of the nasal cavity are the primary treatments used. Similarly, for chronic sinusitis, nasal irrigation and decongestants are initially used. Chronic or recurrent acute conditions that do not respond to conventional medical therapy may require surgery (Kim et al, 2016).

Post-traumatic sinusitis involving the paranasal sinuses should be managed using the same principles as non-traumatic rhinosinusitis. Initial medical management with broad-spectrum antibiotics with good sinus penetration, along with corticosteroids to reduce outlet edema, is recommended. The sinuses should be surgically opened, allowing for proper mucociliary function and sinus drainage (Kountakis et al., 2008)

On Patients with maxillofacial trauma underwent surgery in the form of plate installation or ORIF. The installation of the plate is considered to increase the possibility of sinusitis due to anatomical disorders, drainage, aeration, and sinus ventilation due to plate installation and tissue swelling. We report several cases related to post-maxillofacial ORIF.

Case description

First case

We report a case of maxillofacial trauma. Ms. S, 19 years old. The patient came to the Emergency Room of Karanganyar Hospital with complaints of pain in the left side of the face due to a single traffic accident on September 3, 2024 at 08.00. Other complaints felt by the patient were nosebleeds shortly after the accident for approximately 10 minutes, hematoma in the left eye, difficulty opening the mouth, and wounds on the left knee and leg. The patient has no history of hypertension, diabetes mellitus, asthma, and heart disease. Physical examination of the patient's consciousness was compos mentis, blood pressure 111/72, pulse 80x/minute, RR 20x/minute, temperature 36.5, and SpO2 98%. Local ENT examination on inspection of the nose found abrasions (+), septal deviation (-), rhinorrhea (-), deformity (-), and epistaxis (-). Ear and throat examinations were within normal limits. Palpation of crepitation (-), abnormal mass (-), tenderness (-), paranasal sinus tenderness (-), Ear and throat examination within normal limits. Patient's laboratory examination within normal limits. The patient's CT scan did not show cerebral edema or hemorrhage, there was a liner fracture in the left maxilla (lateral and anterior walls) and the left zygomatic bone with bilateral ethmoidal hematosinus and the left maxilla. The patient was planned to undergo surgical therapy in the form of maxillofacial ORIF surgery with 2 plates installed on the maxilla with 8 screws and 1 plate on the zygomatic bone with 4 screws and drug therapy in the form of santagesic injection 2amp / 8 hours, omeprazole injection 1 vial / 12 hours, ondansetron injection 1amp / 8 hours, dexamethasone injection 1 amp / 8 hours, and ceftriaxone injection 1gr / 12 hours.

Second case

We report a case of maxillofacial fracture, Le Fort II fracture, mandibular fracture. Mr. W, 41 years old. The patient came to the Emergency Room of Karanganyar Hospital with complaints of swelling and pain in the left cheek, wounds in the nose, mouth, upper and lower teeth, and lips due to a post-traffic accident between a motorbike and a truck on September 11, 2024 at 11.30 WIB. Other complaints felt by the patient were nosebleeds from the right and left nostrils shortly after the accident for approximately 15 minutes, then there was a sore and swollen nose. The patient has no history of hypertension, diabetes mellitus, asthma, and heart disease. Physical examination of the patient showed delirium consciousness, blood pressure 136/91, pulse 69x/minute, RR 20x/minute, temperature 37 and SpO2 98%. Local examination on inspection of the nose found abrasions (+), septum deviation (-), rhinorrhea (-), deformity (-), and epistaxis (-). Throat examination found a mouth that could not be closed and the patient had difficulty speaking. Head examination found wounds on the upper and lower lips that were loose and detached. Ear examination was within normal limits. Palpation examination crepitation (-), abnormal mass (-), tenderness (-), paranasal sinus tenderness (-). Laboratory examination of the patient was within normal limits. CT scan of the patient did not show intracranial bleeding, no cerebral parenchyma, complete fractures in the right and left maxillary bones, right mandibular parasymphysis, nasal septum, anterior lateral-medial walls of the right and left maxillary sinuses, right and left lamina papiranacea, and maxillary hematosinus. The patient was planned to undergo surgical therapy in the form of maxillofacial ORIF surgery with the installation of 6 screws, 3 plates were installed on the mandibular OS, 2 plates were installed on the right maxillary OS and 1 plate was installed on the left maxillary OS. With the installation of plates on the maxillary OS which may cause changes in anatomical structure, drainage disorders. Further therapy was carried out with drug therapy in the form of 500mg/8hour tranexamic acid injection, 1amp/8hour ketorolac injection, 1amp/12hour ranitidine injection.

Third case

We report a case of Le Fort II fracture. Ms. M 18 years old. The patient came to the ER with abrasions and swelling on the left face and chin, a torn wound on the lower left arm post KLL motor (single) this afternoon (Sunday, September 22, 2024) at 11.30 WIB, Other complaints felt by the patient were nosebleeds in the left nostril shortly after the accident for approximately 10 minutes, impaired smell (-), nasal pain (-), swelling (-), no complaints in the throat, pain when swallowing (-), complaints in the nose are not painful (-), inactive nosebleeds. The patient has no history of hypertension, diabetes mellitus, asthma, and heart disease. Physical examination of the patient's consciousness compos mentis, blood pressure 121/71, pulse 102x / minute, RR 20x / minute, temperature 36.4 and SpO2 99%. Local examination of the nose inspection is abrasions (-), septal deviation (-), rhinorrhea (-), deformity (-), and epistaxis (-), mucosal edema (-), tenderness (-), crepitation (-), secretions (-). Throat examination found the mouth can be opened and closed (minimally), the patient can talk. Head examination there are no wounds on the upper and lower lips, upper and lower teeth are not loose and not loose, difficulty closing the mouth (-), Vulnus laceratum on the chin (+). Ear examination within normal limits. Palpation crepitation (-), abnormal mass (-), tenderness (-), paranasal sinus tenderness (-) Laboratory examination of the patient within normal limits. CT Scan of the patient Linear fracture of the left maxillary bone, left zygomatic bone, left papiranacea lamina with hematosis ethmoidalis, frontalis and left maxillary pars distal. Maxillofacial reconstructive surgery therapy with plate installation according to each battery. With maxillofacial reconstructive surgery, it is necessary to monitor the number of 2 plates with 8 screws, post-operatively the patient did not experience infection. Further therapy is carried out with drug therapy in the form of RL 20 tpm, norages inj/8 hours, ceftriaxone inj/12 hours

Forth case

We reported a case of maxillofacial fracture of Mr. W 57 years old. The patient came to the emergency room with a primary complaint of pain in the right cheek after being hit by a fence at 16.00 WIB. The complaint of pain in the right cheek was felt to be persistent. The complaint was accompanied by abrasions on the right temple, pain in the right waist, and pain in the left leg at 16.00 WIB. Other complaints felt by the patient were nosebleeds in the right nose shortly after the accident for approximately 10 minutes, olfactory disorders (-), nasal pain (-), swelling (-). Complaints in the ears and throat were denied by the patient. The patient has no history of hypertension, diabetes mellitus, asthma, and heart disease. Physical examination of the patient showed compos mentis consciousness, blood pressure 130/90, pulse 88x/minute, RR 20x/minute, temperature 36.7 and SpO2 98%. Local examination of the nose inspection is abrasions (-), septal deviation (-), rhinorrhea (-), deformity (-), mucosal edema (-), tenderness (-), crepitation (-), and secretions (-). Examination of the throat and ears within normal limits. Laboratory examination of the patient within normal limits. CT scan of the patient linear fracture of the right zygomatic bone, right inferior orbital rima, right lateral orbital rima (tripod fracture) and right maxillary hematosinus. Maxillofacial reconstructive surgery therapy with plate installation according to each battery. with maxillofacial reconstructive surgery, it is necessary to monitor the number of 2 plates with 8 screws, postoperatively the patient did not experience infection. Further therapy is carried out with drug therapy in the form of 20 tpm RL infusion, ketorolac injection/8 hours, ranitidine injection/12 hours, and ceftriaxone injection 1 gram/12 hours.

Discussion

The zygomaticomaxillary complex (ZMC) is the main support of the midfacial skeleton. The ZMC is important for the structural, functional, and aesthetic appearance of the facial skeleton (Jiang et al., 2022)

Sinusitis is the most common disease affecting the maxillary sinus after trauma. In most cases of mid-facial fractures, there is disruption of the mucosa lining the inner wall of the sinus, increasing the risk of various problematic residual symptoms (Kim et al, 2023). According to Jiang et al (2022), maxillary sinus fractures can cause sinus outflow obstruction and cause long-term sinusitis. Fracture fragments into the sinus may be associated with discomfort associated with post-traumatic sinusitis.

Implications of Sinusitis in Maxillofacial Trauma and ORIF are Impaired Sinus Drainage: Trauma to the face often damages the anatomical structures connecting the maxillary sinus to the nasal cavity. Fractures of the zygomaticomaxillary (ZMC) region or other structures adjacent to the sinus can obstruct sinus drainage, increasing the risk of sinusitis. Fractures involving the sinus wall or palate can disrupt ciliary function in the sinus, reducing the ability to drain secretions and increasing the risk of infection. Postoperative Infection: After ORIF procedures, especially those involving plate and screw placement in the area around the sinus, secondary infection can occur. Trauma during surgery can irritate the sinus mucosa, increasing the likelihood of developing sinusitis. Patients with complex fractures involving the sinuses may experience decreased sinus ventilation and accumulation of secretions, contributing to secondary infection and long-term inflammation Zhao, X.-Y., Chen, M., & Cheng, L. (2023) and AAO-HNS (2023) .Postoperative Swelling: Tissue swelling after ORIF can further impede sinus drainage. Sinuses that cannot drain secretions properly will be more susceptible to infection, which can potentially lead to chronic sinusitis if not treated properly Zhao, X.-Y., Chen, M., & Cheng, L. (2023) and AAO-HNS (2023)

Management Conservative Medical Therapy First is antibiotics: In cases of post-traumatic sinusitis, antibiotics that have good sinus penetration, such as amoxicillin-clavulanate or ceftriaxone, are usually given to treat bacterial infections Zhao, X.-Y., Chen, M., & Cheng, L. (2023). Then, Decongestants and Corticosteroids: Nasal decongestants and intranasal corticosteroids can be used to reduce swelling and improve sinus drainage. Systemic corticosteroids are often used in more severe cases of sinusitis AAO-HNS (2023). Third. Saline Sinus Irrigation: Saline irrigation therapy can help clear mucus and irritants from the sinuses and promote healing after trauma Zhao, X.-Y., Chen, M., & Cheng, L. (2023). It also have a surgical Interventions: Functional Endoscopic Sinus Surgery (FESS): FESS is often required in cases of chronic sinusitis or those that do not respond to conservative treatment. This procedure aims to restore sinus drainage,

especially in cases of post-traumatic or post-operative obstruction Kim, D. W., et al. (2023). Balloon Sinuplasty: For milder cases, balloon sinuplasty can be used to minimally invasively open the sinus ostia without the need for major surgical procedures Kim, D. W., et al. (2023).

The incidence of maxillary sinus pathology in patients who underwent ORIF for midfacial fractures was found to be 11.27%, with sinusitis being the most common pathology. Maxillary sinus pathology was significantly associated with the presence of a blowout fracture involving both the medial and the inferior orbital walls. Factors such as sex, age, diabetes mellitus, hypertension, smoking, inflammatory disease, follow-up period, use of absorbable plates, and use of titanium plates did not have a significant impact on the development of maxillary sinus pathology (Kim et al, 2023)

Based on the first case report, a patient was diagnosed with a maxillofacial fracture. The patient came to the Emergency Room of Karanganyar Hospital with complaints of pain in the left side of the face due to a single traffic accident on September 3, 2024 at 08.00. Other complaints felt by the patient were nosebleeds shortly after the accident for approximately 10 minutes, hematoma in the left eye, difficulty opening the mouth, and wounds on the left knee and leg. Maxillofacial trauma is a physical trauma that can affect the hard and soft tissues of the face. The causes of maxillofacial trauma vary, including traffic accidents, physical violence, falls, sports and trauma from firearms (Oktora et al., 2021). Risk factors that can occur in patients include the installation of plate screws in maxillofacial surgery patients (ORIF).

Based on the second case report, a patient was diagnosed with maxillofacial fracture, le fort II fracture, mandibular fracture. The patient came to the Emergency Room of Karanganyar Hospital with complaints of swelling and pain in the left cheek, wounds in the nose, mouth, upper and lower teeth, and lips due to a post-traffic accident between a motorbike and a truck. Other complaints felt by the patient were nosebleeds from the right and left nose shortly after the accident for approximately 15 minutes, then there was a nose that felt painful and swollen. Patients with maxillofacial fractures, le fort II fractures, mandibular fractures often come with facial pain in the midface area and the fracture site, there is swelling in the face area especially in the cheek area, an asymmetrical face shape. The patient also complained of nosebleeds and difficulty opening the mouth. Clinical symptoms of maxillofacial fractures, le fort II fractures, mandibular fractures include bleeding from the nose or mouth, impaired oral function (Chrcanovic, BR, et al. (2015), Moore, THJ, et al. (2015))

Based on the case report of the three patients with a diagnosis of Le Fort II fracture. The patient came to the ER with complaints of swelling in the left face and chin, a laceration on the lower left arm post KLL. Another complaint felt by the patient was a nosebleed in the left nose shortly after the accident for approximately 15 minutes. Patients with Le Fort II fractures often come with complaints of swelling in the face. This is because Le Fort II fractures are a type of complex fracture that usually involves the middle and lower facial structures, including the maxilla and nasal bones. The cause of swelling is due to Mechanical Trauma where this fracture is usually caused by severe facial trauma, such as vehicle accidents or violence, which can cause edema or swelling in the soft tissue around the fracture. Second, the occurrence of Internal Bleeding which causes Damage to the blood vessels around the bone can cause bleeding leading to swelling. Third, Inflammatory Reaction, tissue injury causes an inflammatory response, which also contributes to swelling. Because Le Lefort II fracture is a complex type of fracture that usually involves the middle and lower facial structures, including the maxilla and nasal bones (Moore, KL, & Dalley, AF (2013), Sweeney, EF, et al. (2006)). In the case of Lefort II fracture, there is a similarity, namely nosebleeds. This is because Lefort II Fracture is a type of facial fracture that involves the midface structure, including the nasal, maxilla, and orbital. Nosebleeds in this condition occur due to injury to the soft

tissue and blood vessels in the nose and sinus area which can be compressed or torn due to fractures. In addition, the shifting of bone fragments can damage the nasal mucosa, which also contributes to bleeding DeLong, PTDJ, et al (2012).

Based on the fourth case report with a diagnosis of zygomaticum dextra fracture, the patient came to the emergency room with a primary complaint of pain in the right cheek after being hit by a fence. The complaint of pain in the right cheek was felt to be persistent. The complaint was accompanied by abrasions on the right temple, pain in the right waist, and pain in the left leg. Other complaints felt by the patient were nosebleeds in the right nose shortly after the accident for approximately 10 minutes, impaired smell (-), nasal pain (-), swelling (-). Complaints in the ears and throat were denied by the patient. The patient had no history of hypertension, diabetes mellitus, asthma, and heart disease. Physical examination of the patient showed compos mentis consciousness, blood pressure 130/90, pulse 88x/minute, RR 20x/minute, temperature 36.7 and SpO2 98%. Local examination of the nose inspection is abrasions (-), septal deviation (-), rhinorrhea (-), deformity (-), mucosal edema (-), tenderness (-), crepitation (-), and secretions (-). Examination of the throat and ears within normal limits. Laboratory examination of the patient within normal limits. CT scan of the patient linear fracture of the right zygomatic bone, right inferior orbital rima, right lateral orbital rima (tripod fracture) and right maxillary hematosinus. Maxillofacial reconstructive surgery therapy with plate installation according to each battery. with maxillofacial reconstructive surgery, it is necessary to monitor the number of 2 plates with 8 screws, postoperatively the patient did not experience infection. Further therapy is carried out with drug therapy in the form of 20 tpm RL infusion, ketorolac injection/8 hours, ranitidine injection/12 hours, and ceftriaxone injection 1 gram/12 hours. The zygomatic bone is a prominent bone on the face and will receive the strongest impact force on the face that experiences trauma. The zygomatic bone is very closely related to the maxillary bone, forehead bone and temporal bone, and because these bones are usually involved when the zygomatic bone is fractured, it is more appropriate to call it a zygomatic complex fracture. Some researchers consider it a zygomaticomaxillary complex fracture. Historically, the term "tripot" fracture has been used to describe fractures involving the lateral orbital wall, zygomaticomaxillary suture and zygomaticotemporal suture, then a more appropriate term was used, namely zygomaticomaxillary complex fractures (ZMC fractures.) (Bernado et al., 2013)

In the four cases we reported, we need to evaluate for 3-6 months on anatomical changes where surgery is considered to change the anatomical structure of the sinus, which can interfere with sinus drainage and ventilation. This has the potential to cause accumulation of secretions and infection. Second, secondary infection where surgical procedures can cause tissue trauma and pave the way for secondary infection, which can develop into chronic sinusitis. Third is postoperative swelling where tissue edema around the sinus can block the sinus ostium, inhibit drainage and cause mucus accumulation. Fourth is mucosal dehydration is the use of antiseptics and other materials during surgery can disrupt the normal mucosal layer, causing damage to the epithelium and increasing the risk of infection. Fifth is the inflammatory reaction that can arise in the form of a postoperative inflammatory process that can change the immune response and increase the risk of sinus infection (Watanabe, Y., et al. (2018). And Hwang, HK, & Lee, JH (2016).

The first case the diagnosis is maxillofacial fracture involving the left maxilla and zygomatic bone. The risk factors are Bilateral hematosinus and fractures of the lateral and anterior walls of the maxilla. This has the potential to cause sinus flow obstruction. Installation of two plates in the maxilla and one plate in the zygomatic bone with a total of 12 screws, which can affect sinus ventilation and sinus anatomy. And risk of inflammation due to surgical trauma.

The Second Case the Diagnosis: Le Fort II fracture, mandibular fracture, other maxillofacial fractures. Risk Factors is Complex fracture involving the right and left maxilla, and bilateral hematosinus. This increases the risk of sinus

obstruction and accumulation of secretions. Installation of three plates in the mandible, two in the right maxilla, and one in the left maxilla. Anatomical changes due to the installation of these plates can inhibit sinus drainage and a Postoperative swelling and potential tissue trauma during surgery.

Case Three the Diagnosis is Le Fort II fracture, left ethmoidal, frontal, and maxillary hematosis. The Risk Factors are Linear fractures of the maxilla and zygomatic bones and involvement of the lamina papyracea. These fractures can cause sinus flow disturbance and mucus accumulation, Installation of two plates with a total of eight screws that can affect sinus aeration, and Postoperative tissue inflammation and swelling that obstructs the sinus ostium.

Case Four the Diagnosis is Right zygomatic bone fracture (tripod fracture). The Risk Factors are Right maxillary hematosis due to fractures of the inferior and lateral orbital rims. This can interfere with sinus drainage, Installation of two plates with a total of eight screws on the zygomatic bone that can change sinus anatomy, Risk of secondary infection and postoperative inflammation.

Conclusion Differences between the 4 cases above with risk factors that cause chronic sinusitis in each case are The main risk factors that increase the likelihood of chronic sinusitis in each case are Anatomical and ventilation disorders of the sinuses due to plate and screw placement during ORIF procedure, Obstruction of sinus flow due to hematosinus or bone fragment, Postoperative inflammation and swelling that inhibit sinus drainage, Secondary infection that may occur during or after the surgical procedure, Follow-up evaluation for 3-6 months after surgery is needed to monitor symptoms of chronic sinusitis and manage complications.

Conclusion

The zygomaticomaxillary complex (ZMC) is the main support of the midface skeleton. ZMC is important for the structural, functional, and aesthetic appearance of the facial skeleton. Maxillary sinus fractures can cause sinus outflow obstruction and cause long-term sinusitis. Fracture fragments into the sinus may be associated with discomfort related to post-traumatic sinusitis. In the four cases we reported, we needed to evaluate for 3-6 months for anatomical changes, secondary infection, postoperative swelling, mucosal dehydration, inflammatory reactions related to post-ORIF sinusitis.

Conflict of Interest

The authors have no affiliations or involvement in any organization or entity with any financial interest (such as honoraria, educational grants, participation in speakers' bureaus, memberships, employment, consultancies, stock ownership or other equity interests and expert testimony or patent licensing arrangements) , or non-financial interests such as personal or professional relationships, affiliations, knowledge or beliefs in the subject matter or materials discussed in this manuscript..

Consent Form

Good morning, I'm [Doctor X], and I will explain the procedure we will perform to treat an maxillofacial trauma. Maxillofacial trauma, also known as facial trauma, is any injury to the bones or tissue in the face or jaw. It can be caused by a number of things, including: Car accidents, Falls or trips, Dog bites, Burns, and Playing sports

The procedure we recommend is doing a follow up regarding the effect of ORIF maxillofacial effects on sinusitis.

I want to make sure you understand all the information regarding this procedure. If you have any questions or concerns, please ask, and I will try to explain further.

Do you agree to continue with this procedure? If yes, you can provide consent by signing the form we have prepared or giving verbal consent."

Acknowledgement

We convey our deepest thanks to Dr.dr.H.Iwan Setiawan Adji, Sp. THT-KL for providing very meaningful guidance, advice and resources in the process of this publication.

References

American Academy of Otolaryngology-Head and Neck Surgery. (2023). Clinical Practice Guideline: Adult Sinusitis Update. AAO-HNS. Retrieved from AAO-HNS

Bernado, P., Prihartiningsih, P., & Hasan, C. Y. Penatalaksanaan Fraktur Kompleks Zygomatikomaksilaris Sinistra dengan Miniplate Osteosynthesis. Majalah Kedokteran Gigi Indonesia, 20(2), 161-169.

Chrcanovic, B. R., et al. (2015). "Le Fort Fractures: A Comprehensive Review." Journal of Craniofacial Surgery, 26(5), 1675-1681.

DeLong, P. T. D. J., et al. "Fractures of the Face." Journal of Oral and Maxillofacial Surgery 2012.

Hwang, H. K., & Lee, J. H. (2016). "Postoperative sinusitis after maxillofacial surgery: A literature review." Otolaryngology–Head and Neck Surgery.

Ji, S. Y., Kim, S. S., Kim, M. H., & Yang, W. S. (2016). Surgical Methods of Zygomaticomaxillary Complex Fracture. Archives of craniofacial surgery, 17(4), 206–210. https://doi.org/10.7181/acfs.2016.17.4.206

Jiang, L., Wu, M., Li, H., Liang, J., Chen, J., & Liu, L. (2022). Risk Factors for Maxillary Sinus Pathology after Surgery for Midfacial Fracture: A Multivariate Analysis. Journal of clinical medicine, 11(21), 6299. https://doi.org/10.3390/jcm11216299

Kim, D. W., Lee, S. H., Choi, J. H., Hwang, J. H., Kim, K. S., & Lee, S. Y. (2023). Relationship between midfacial fractures and maxillary sinus pathology. Archives of craniofacial surgery, 24(3), 117–123. https://doi.org/10.7181/acfs.2023.00283

Kountakis, S., Jacobs, J., Gosepath, J., Poetker, D. M., & Smith, T. L. (2008). Delayed complications following sinus trauma. Revision Sinus Surgery, 179-184.

Moore, K. L., & Dalley, A. F. (2013). Clinically Oriented Anatomy. Lippincott Williams & Wilkins.

Moore, T. H. J., et al. (2015). "Clinical Management of Facial Trauma." British Journal of Oral and Maxillofacial Surgery, 53(4), 317-322.

Oktora, S., Oli'i, E. M., & Sjamsudin, E. (2021). Penatalaksanaan kegawatdaruratan medis trauma maksilofasial pada anak disertai cedera kepala. Jurnal Kedokteran Gigi Universitas Padjajaran, 32(Suppl 2), 173-81.

Sweeney, E. F., et al. (2006). "Facial Fractures." Journal of Trauma Management & Outcomes.

Watanabe, Y., et al. (2018). "The impact of maxillofacial surgery on the maxillary sinus: a review of literature." Journal of Maxillofacial Surgery.

Zhao, X.-Y., Chen, M., & Cheng, L. (2023). Current and Emerging Treatment Options in Sinus and Nasal Diseases: Surgical Challenges and Therapeutic Perspectives. J. Clin. Med., 12(4), 1485. https://doi.org/10.3390/jcm12041485