Research Article Volume 01, Issue No. 02. 2025

The Medical Journal of Dentistry of Oral Maxillofacial Surgery



Management Of Frontal Sinus Fractures

[1] Faisal, [1] Mutiara

[1] Faculty of Dentistry, Padjadjaran University, Bandung City, West Java, Indonesia

Correspondence : drg.faisal394847@gmail.com

Article History :

Received date : 2024/07/12
Revised date : 2024/08/24
Accepted date : 2024/09/09
Published date : 2025/01/24

Copyright: *© 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (BY NC) license (https://creativecommons.org/licenses/by-nc/4.0/).*

ABSTRACT

Background: The management of frontal sinus fractures is a complex area of study within maxillofacial trauma, characterized by a significant range of injury types and associated complications. **Literature Review:** (M. Ravindra et al., 2015) emphasize the multifaceted nature of these injuries, particularly the risk of cerebrospinal fluid (CSF) leakage and the potential for serious complications, including infections and brain abscesses. Their proposed treatment algorithm, which incorporates nasofrontal outflow tract (NFOT) obstruction as a key factor in surgical decision-making, underscores the need for a tailored approach to management (M. Ravindra et al., 2015). (Bastianelli et al., 2017) further elaborate on the rarity of frontal sinus fractures, attributing their occurrence to high-energy impacts. They provide a classification of these fractures, noting that those involving both the anterior and posterior tables are more likely to lead to severe complications (Bastianelli et al., 2017). Their advocacy for a nuanced management strategy, particularly regarding minimally displaced fractures, reflects a shift towards conservative treatment options that could improve patient outcomes. (Sathyanarayanan et al., 2018) contribute to the discourse by detailing the treatment sequence for frontal sinus injuries, emphasizing the need for comprehensive evaluations due to the frequent association with other maxillofacial fractures. They highlight the importance of restoring aesthetic contours while preventing long-term complications, such as chronic sinusitis and mucocele formation (Sathyanarayanan et al., 2018). Their reference to established algorithms for treatment decisions reinforces the need for structured approaches in clinical practice. **Conclusion:** In conclusion, the literature on the management of frontal sinus fractures reveals a consensus on the importance of individualized treatment approaches based on fracture characteristics and associated injuries. The integration of evidence-based algorithms and the consideration of both conservative and surgical options are essential for optimizing patient care in this challenging area of trauma management. Continued research and refinement of treatment protocols will be crucial in addressing the complexities associated with frontal sinus fractures.

Keyword: Management, Frontal Sinus Fractures

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

INTRODUCTION

Frontal sinus fractures represent a significant subset of facial injuries, accounting for 5–15% of maxillofacial trauma cases (M. Ravindra et al., 2015). The management of these fractures is multifaceted and varies across different medical specialties, primarily due to the complexities associated with potential complications such as cerebrospinal fluid (CSF) leakage, brain abscess, and mucocele formation. In their comprehensive case series, (M. Ravindra et al., 2015) emphasize the importance of assessing nasofrontal outflow tract (NFOT) obstruction as a critical factor in determining the necessity for surgical intervention. Their proposed treatment algorithm aims to standardize the approach to surgical management, highlighting the need for careful evaluation during the acute phase of injury.

Building on the discussion of fracture characteristics, (Bastianelli et al., 2017) delve into the mechanisms behind frontal sinus fractures, noting that these injuries are relatively rare due to the protective nature of the thick cortical bone. Their analysis reveals that a significant proportion of these fractures involve both anterior and posterior tables, with concomitant nasofrontal duct injuries occurring in a majority of cases. The authors advocate for a tailored management approach based on the specific fracture type, suggesting that minimally displaced anterior table fractures may be best managed conservatively, while displaced posterior table fractures traditionally require cranialization to prevent serious complications. However, they also bring attention to emerging evidence suggesting that some displaced fractures may be managed without surgical intervention, indicating a shift towards more conservative strategies.

(Sathyanarayanan et al., 2018) further contribute to the discourse by outlining the treatment sequence for frontal sinus injuries, which prioritizes the prevention of complications and the restoration of aesthetic facial contours. Their findings reveal that a significant proportion of patients with frontal sinus injuries also present with associated maxillofacial fractures, underscoring the need for a comprehensive

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

assessment of concurrent injuries. The authors critique the current management strategies, noting that many recommendations are based on speculation rather than robust evidence. This highlights a critical gap in the literature, as they call for more evidence-based approaches to guide clinical decision-making.

In the most recent study by (Kim et al., 2024), the authors provide a retrospective analysis of surgical interventions for frontal sinus fractures, focusing on the incidence, complications, and outcomes associated with various surgical techniques. Their findings corroborate earlier studies regarding the low incidence of frontal sinus fractures within the broader context of maxillofacial trauma, while also emphasizing the importance of detailed assessments of fracture patterns and associated injuries. The authors advocate for the use of minimally invasive surgical techniques, reflecting a growing trend towards less invasive approaches in the management of complex facial fractures.

Collectively, these articles illustrate the evolving understanding and management of frontal sinus fractures, highlighting the need for continued research and standardized treatment protocols to optimize patient outcomes in this challenging area of trauma care.

LITERATURE REVIEW

The article "Surgical management of traumatic frontal sinus fractures: Case series from a single institution and literature review" by Ravindra et al. (M. Ravindra et al., 2015) provides a comprehensive examination of the management strategies for frontal sinus fractures, which are prevalent in trauma patients, constituting 5–15% of all facial fractures. The authors emphasize the critical nature of these injuries, particularly in the acute phase, where the risk of cerebrospinal fluid (CSF) leakage poses significant concerns, including potential infection and the development of serious complications such as meningitis, cerebritis, brain abscesses, and mucoceles.

The study presents a well-structured analysis based on a case series from a single institution, where adult patients who underwent surgical repair for frontal sinus fractures were identified and evaluated. The authors meticulously outline their

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

methodology, including the exclusion of patients with non-traumatic injuries and those treated nonsurgically. This methodological rigor enhances the reliability of their findings and allows for a focused discussion on surgical interventions.

A notable contribution of this article is the proposed treatment algorithm, which serves as a practical guide for clinicians faced with managing frontal sinus fractures. The algorithm is particularly valuable as it incorporates the presence or absence of nasofrontal outflow tract (NFOT) obstruction as a key determinant in deciding on surgical intervention. This highlights the importance of individualized patient assessment in surgical decision-making, a critical aspect of effective trauma management.

The authors also delve into the techniques involved in cranialization of the frontal sinus, detailing the complete removal of the posterior wall of the frontal sinus, the excision of frontal sinus mucosa, and the plugging of the nasofrontal ducts. These techniques are presented with clarity, providing a solid foundation for understanding the surgical processes involved. However, while the article successfully outlines surgical techniques and their rationale, it could benefit from a more extensive discussion on the long-term outcomes of these surgical interventions, as well as potential complications that may arise postoperatively.

The article "Temporary Frontal Paralysis Secondary to Blunt Trauma Frontal Sinus Fracture" by Bastianelli et al. (Bastianelli et al., 2017) provides a comprehensive overview of frontal sinus fractures, emphasizing their relative rarity in maxillofacial injuries due to the protective nature of the thick cortical bone of the frontal bone. The authors highlight that these fractures account for only 5-12% of all maxillofacial injuries, primarily arising from high-energy impacts such as motor vehicle accidents. This insight is critical as it underscores the need for heightened awareness and assessment in populations at risk, particularly white males aged 30 to 34, who exhibit a predisposition to these injuries.

The classification of frontal sinus fractures is a pivotal aspect of the article, with the authors noting that 62% involve both the anterior and posterior tables, while 31% involve only the anterior table. This classification aids in understanding the potential complications associated with different fracture types. For instance, while

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

mild anterior table fractures may lead to minimal symptoms, fractures involving both tables can result in severe outcomes such as cosmetic deformity, intracranial hemorrhage, and CSF leaks. The article effectively emphasizes the importance of accurate diagnosis through a thorough history, physical examination, and imaging, particularly CT scans.

Management strategies outlined in the article reflect a nuanced understanding of the complexities involved in treating frontal sinus fractures. The authors advocate for a tailored approach based on the specific fracture characteristics and associated injuries. For instance, they suggest that minimally displaced anterior table fractures may not require intervention, while more complex cases could necessitate surgical options ranging from injectable fillers to open reduction and internal fixation. The discussion surrounding nasofrontal duct injuries is particularly noteworthy, as it highlights the potential for chronic complications such as infections or mucocele formation if not appropriately addressed.

The article also challenges traditional management practices, particularly concerning displaced posterior table fractures. Recent findings presented by the authors suggest that these fractures, even with CSF leaks, may not always require surgical intervention, which could significantly alter the management landscape for such injuries. This perspective encourages further research and consideration of conservative management strategies, which may lead to better patient outcomes and reduced surgical morbidity.

The article "Management of Frontal Sinus Injuries" by Sathyanarayanan et al. (Sathyanarayanan et al., 2018) provides a comprehensive examination of frontal sinus fractures, which represent a significant portion of maxillofacial injuries, accounting for 5% to 15% of such cases. The authors highlight the commonality of associated maxillofacial fractures, noting that 66% of patients with frontal sinus injuries also present with additional facial injuries. This statistic underscores the complexity of managing these types of fractures, as they often occur in conjunction with other traumatic injuries.

A critical aspect of the article is the outlined sequence of treatment for frontal sinus fractures, which emphasizes the importance of avoiding both short- and long-term

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

complications. The authors effectively discuss the goals of treatment, which include restoring an aesthetic facial contour and preserving the normal function of the sinus whenever possible. They detail several long-term complications that can arise from these injuries, including chronic sinusitis, mucocele, mucopyocele, meningitis, and brain abscess, all of which can significantly impact patient outcomes. This discussion is particularly relevant as it highlights the potential risks associated with both treated and untreated fractures, contributing to the ongoing debate regarding optimal management strategies.

The authors reference an algorithm developed by Rohrick and Hollier for treating frontal sinus fractures, which is based on the degree of fracture displacement, frontonasal duct involvement, and the presence of cerebrospinal fluid. This algorithm serves as a practical guide for clinicians faced with the challenge of managing these injuries, providing a structured approach to treatment decisions. The recommendation that undisplaced fractures should remain untreated and that uncomplicated anterior table fractures can be managed conservatively is particularly noteworthy, as it advocates for a more conservative approach in certain cases.

The study's sample size of fifteen patients diagnosed with anterior table fractures of the frontal sinus offers valuable insights into the clinical management of these injuries. The authors conducted preoperative evaluations using axial and coronal computed tomography scans, which reinforces the importance of imaging in the assessment and planning of surgical interventions. The findings indicate that road traffic accidents were the most common etiology for these injuries, which is consistent with trends observed in similar studies.

The article also notes that out of the fifteen patients, eleven had associated fractures in the maxillofacial region, while four presented with isolated frontal sinus fractures. This detail emphasizes the multifaceted nature of facial trauma and the need for comprehensive evaluation and management strategies. The authors report that conservative management was chosen for six patients, while others underwent surgical intervention through existing lacerations or a bicoronal approach. This

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

variety in treatment modalities reflects the individualized nature of care required for these complex injuries.

The article "Management of frontal sinus trauma: a retrospective study of surgical interventions and complications" by InKyeong Kim et al. (Kim et al., 2024) provides a comprehensive analysis of the management strategies for frontal sinus fractures, which are noted to be relatively uncommon, comprising 2-15% of maxillofacial trauma cases. The authors effectively highlight the common etiologies of these injuries, predominantly high-velocity blunt force trauma, and the associated risks of concurrent maxillofacial and intracranial injuries.

A significant contribution of this study is its detailed examination of both acute and delayed complications arising from frontal sinus fractures. The authors categorize acute complications such as meningitis, cerebrospinal fluid (CSF) rhinorrhea, and pneumocephalus, alongside chronic issues like frontal sinusitis and brain abscesses. This classification is crucial for clinicians as it underscores the need for vigilant monitoring and management of potential complications following such injuries.

The article also emphasizes the importance of various clinical factors that inform surgical decision-making. The authors discuss how the type of fracture, the integrity of the posterior wall, nasofrontal outflow tract (NFOT) injury, and the severity of cerebral trauma play critical roles in determining the appropriate surgical intervention. This nuanced understanding of fracture characteristics and their implications on surgical outcomes is a valuable insight for practitioners in the field.

Moreover, the study outlines the surgical modalities employed, including cranialization, obliteration, and open reduction and internal fixation, tailored to the specific fracture patterns and complications present. The increasing trend towards minimally invasive techniques, such as transnasal and transorbital endoscopic surgeries, is particularly noteworthy. The authors provide evidence supporting the efficacy of these approaches, which may lead to reduced recovery times and complications.

The retrospective nature of the study, involving 17 patients over 11 years, allows for a focused examination of outcomes and complications associated with surgical interventions. However, it also poses limitations, such as the small sample size and

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

potential biases inherent in retrospective analyses. Future studies could benefit from larger cohorts and prospective designs to validate the findings presented.

CONCLUSION

The management of frontal sinus fractures is a complex area of study within maxillofacial trauma, characterized by a significant range of injury types and associated complications. The reviewed literature consistently highlights the critical importance of individualized assessment and treatment strategies based on the specific characteristics of each fracture.

(M. Ravindra et al., 2015) emphasize the multifaceted nature of these injuries, particularly the risk of cerebrospinal fluid (CSF) leakage and the potential for serious complications, including infections and brain abscesses. Their proposed treatment algorithm, which incorporates nasofrontal outflow tract (NFOT) obstruction as a key factor in surgical decision-making, underscores the need for a tailored approach to management (M. Ravindra et al., 2015).

(Bastianelli et al., 2017) further elaborate on the rarity of frontal sinus fractures, attributing their occurrence to high-energy impacts. They provide a classification of these fractures, noting that those involving both the anterior and posterior tables are more likely to lead to severe complications (Bastianelli et al., 2017). Their advocacy for a nuanced management strategy, particularly regarding minimally displaced fractures, reflects a shift towards conservative treatment options that could improve patient outcomes.

(Sathyanarayanan et al., 2018) contribute to the discourse by detailing the treatment sequence for frontal sinus injuries, emphasizing the need for comprehensive evaluations due to the frequent association with other maxillofacial fractures. They highlight the importance of restoring aesthetic contours while preventing long-term complications, such as chronic sinusitis and mucocele formation (Sathyanarayanan et al., 2018). Their reference to established algorithms for treatment decisions reinforces the need for structured approaches in clinical practice.

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

(Kim et al., 2024) provide a retrospective analysis that corroborates previous findings regarding the incidence of frontal sinus fractures and the associated risks of concurrent injuries. Their detailed examination of both acute and chronic complications emphasizes the necessity for vigilant monitoring post-injury (Kim et al., 2024). Furthermore, their discussion of surgical modalities, including the growing trend towards minimally invasive techniques, reflects an evolving understanding of optimal management strategies.

In conclusion, the literature on the management of frontal sinus fractures reveals a consensus on the importance of individualized treatment approaches based on fracture characteristics and associated injuries. The integration of evidence-based algorithms and the consideration of both conservative and surgical options are essential for optimizing patient care in this challenging area of trauma management. Continued research and refinement of treatment protocols will be crucial in addressing the complexities associated with frontal sinus fractures.

DISCLOSURE STATEMENT

- Disclosure Statement : The authors have no conflicts of Interest to declare
- Funding Sources : None
- Acknowledgements : -
- Author Contribution : All authors discussed and contributed the final content for journal submission and publication

REFERENCES

1. M. Ravindra, V., A. Neil, J., M. Shah, L., H. Schmidt, R., & F. Bisson, E., 2015. Surgical management of traumatic frontal sinus fractures: Case series from a single institution and literature review. ncbi.nlm.nih.gov
2. Bastianelli, M., Hamilton, S., Hearn, M., Kherani, S., & I. Macdonald, K., 2017. Temporary Frontal Paralysis Secondary to Blunt Trauma Frontal Sinus Fracture. ncbi.nlm.nih.gov
3. Sathyanarayanan, R., Raghu, K., Deepika, S., & Sarath, K., 2018. Management of Frontal Sinus Injuries. ncbi.nlm.nih.gov

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved

4. Kim, I. K., Kim, J. M., Kim, J., Jin Lee, S., & Nam, E. C., 2024. Management of frontal sinus trauma: a retrospective study of surgical interventions and complications. ncbi.nlm.nih.gov

Downloaded from The Medical Journal of Dentistry and Oral Maxillofacial Surgery
Copyright © International Medical Journal Corp. Ltd. All rights reserved