

**ARTIFICIAL INTELLIGENCE-BASED DIAGNOSTIC METHODS  
IN PATIENTS WITH COMBINED INJURIES OF THE  
MAXILLOFACIAL SKELETON**

*Bakiyeva SH.X., Karimberdiyev B.I., Djurayev J.A.  
Tashkent State Medical University, Tashkent, Uzbekistan.*

**Abstract.** Combined injuries of the maxillofacial skeleton represent complex traumatic conditions requiring accurate and rapid diagnosis. Traditional diagnostic methods, although effective, may be limited in cases of multi-structural damage. In recent years, artificial intelligence (AI) has emerged as a promising tool in medical imaging and trauma diagnosis. This study evaluates the role of AI-based diagnostic methods in patients with combined maxillofacial injuries. A total of 140 patients were analyzed using clinical examination, computed tomography (CT), and AI-assisted image interpretation systems. The results demonstrated that AI significantly improves diagnostic accuracy, reduces interpretation time, and enhances the detection of complex fracture patterns. The study confirms that AI-based systems can serve as an effective auxiliary tool in maxillofacial trauma diagnostics, improving clinical decision-making and treatment planning.

**Keywords:** artificial intelligence, maxillofacial trauma, diagnosis, computed tomography, machine learning, facial fractures.

**Introduction.** Combined injuries of the maxillofacial skeleton are among the most challenging conditions in trauma and otorhinolaryngology practice. These injuries often involve multiple anatomical structures, including the mandible, maxilla, zygomatic complex, orbital walls, and nasal bones. Accurate and timely diagnosis is critical for effective treatment and prevention of complications.

Conventional diagnostic methods such as clinical examination, radiography, and computed tomography (CT) remain standard approaches. However, interpretation of complex imaging data may be difficult, time-consuming, and subject to human error, especially in multi-fragment fractures.

Artificial intelligence (AI), particularly machine learning and deep learning algorithms, has recently shown significant potential in medical imaging analysis. AI systems can automatically detect fracture lines, classify injury types, and assist clinicians in decision-making processes. The aim of this study was to evaluate the effectiveness of AI-based diagnostic methods in patients with combined injuries of the maxillofacial skeleton and to compare their performance with conventional diagnostic approaches.

**Materials and Methods.** This retrospective study included 140 patients with combined maxillofacial skeletal injuries treated at a multidisciplinary clinical center. The study population consisted of patients aged 18–65 years. All patients underwent standard diagnostic procedures, including clinical examination and CT imaging of the facial skeleton. In addition, AI-based diagnostic software was used for automated image analysis and fracture detection.

The AI system was trained on large datasets of maxillofacial CT images and utilized deep learning algorithms to identify fracture patterns, displacement, and bone involvement. The output of the AI system was compared with radiologist interpretations and intraoperative findings.

Diagnostic performance was evaluated based on sensitivity, specificity, accuracy, and time required for image interpretation. Statistical analysis was performed using standard descriptive methods.

**Results.** The application of AI-based diagnostic systems significantly improved the detection of maxillofacial fractures. The overall diagnostic accuracy of AI-assisted CT interpretation was 94%, compared to 87% for conventional radiological assessment. AI systems demonstrated high sensitivity

in detecting mandibular fractures (96%), zygomatic fractures (93%), and orbital wall fractures (91%). The detection of complex multi-fragment injuries was particularly improved.

The average time required for image analysis was reduced from 12–15 minutes (manual interpretation) to 3–5 minutes using AI assistance. In 18% of cases, AI identified subtle fracture lines that were initially missed during standard radiological evaluation. These findings were later confirmed intraoperatively. The integration of AI into diagnostic workflow improved treatment planning accuracy in 89% of cases.

**Discussion.** The results of this study demonstrate that artificial intelligence significantly enhances the diagnostic process in patients with combined maxillofacial injuries. AI-based systems provide rapid, accurate, and objective analysis of complex imaging data.

One of the key advantages of AI is its ability to detect subtle and multi-planar fractures that may be overlooked in conventional analysis. This is particularly important in maxillofacial trauma, where small diagnostic errors can lead to significant functional and aesthetic consequences. However, AI should not replace clinical judgment but rather serve as a supportive tool. Integration of AI with clinical expertise and radiological assessment ensures the highest diagnostic accuracy. The main limitations of AI systems include dependency on training datasets and the need for continuous validation across different populations and imaging protocols. Despite these limitations, AI represents a promising direction in modern trauma diagnostics and has the potential to become a standard component of maxillofacial imaging analysis.

**Conclusion.** Artificial intelligence-based diagnostic methods significantly improve the accuracy and efficiency of diagnosing combined injuries of the maxillofacial skeleton. AI-assisted imaging allows faster detection of fractures, better characterization of injury patterns, and improved surgical planning. The integration of AI into clinical practice enhances diagnostic reliability and

supports decision-making in complex trauma cases. However, AI should be used as an adjunct to, rather than a replacement for, expert clinical evaluation.

## REFERENCES

1. Artificial Intelligence in Medical Imaging. Zhou S.K., Greenspan H., Shen D. Elsevier, 2020.
2. Cummings Otolaryngology: Head and Neck Surgery. Flint P.W. et al. Elsevier, 2015.
3. Djuraev J.A., Soatov I.O. MET (Tyrosine Kinase Receptor Gene) Gene Polymorphism Among Patients with Chronic Polyposis Rhinosinusitis and Chronic Rhinosinusitis. *Klinicheskaya Meditsina (Clinical Medicine)*, Tashkent Medical Academy Journal, 2023, № 1, pp. 113–116. ISSN 2181-7812. Tashkent Medical Academy, Tashkent, Uzbekistan.
4. Djuraev J.A., Soatov I.O., Rakhimjanova G.A., Mardonov Kh.A. Results of a Clinical-Cytomorphological Study Conducted to Identify Different Forms of Chronic Polyposis Rhinosinusitis. *Eurasian Journal of Otorhinolaryngology – Head and Neck Surgery*, 2024, Vol. 3, Issue 4, pp. 56–61. Tashkent Medical Academy, Tashkent, Uzbekistan. DOI: <https://doi.org/10.57231/j.ejohns.2024.3.4.0010>
5. Djuraev Jamolbek Abdukakhorovich, Soatov Ilyosjon Olim ugli. Comparative Analysis of the Frequency of the MMP9 Gene rs3918242 Polymorphism in a Group of Patients with Chronic Polyposis Rhinosinusitis. *Problems of Biology and Medicine*, 2024, No. 4 (155), pp. 73–76. Tashkent Medical Academy, Tashkent, Uzbekistan. ISSN 2181-7812.
6. Khasanov U.S., Soatov I.O., Khodjanov S.H., Axundjanov N.O., Rakhimjanova G.A. Results of an Analysis of the Prevalence of the rs20417 Polymorphism in the COX2 Gene Among Patients with Chronic Polyposis Rhinosinusitis and Chronic Rhinosinusitis and in the Control Group. *American Journal of Medicine and Medical Sciences*, 2024, 14(12): 3149–3153. DOI



10.5923/j.ajmms.20241412.13 Tashkent Medical Academy, Tashkent, Uzbekistan.

7. Lee S. et al. AI in maxillofacial fracture detection. *Journal of Oral and Maxillofacial Surgery*, 2022.

8. Litjens G. et al. A survey on deep learning in medical image analysis. *Medical Image Analysis*, 2017.

9. Ronneberger O. et al. U-Net: Convolutional networks for biomedical image segmentation. *MICCAI*, 2015.

10. Soatov Ilyosjon Olim o'g'li, Djuraev Jamolbek Abdukaxarovich. Pathomorphological Structure of Polypoid Tissue of Patients with Chronic Polypoid Rhinosinusitis. *Medical Journal of Uzbekistan*, 2023, № 2, pp. 59–64. Tashkent Medical Academy, Tashkent, Uzbekistan.

11. Soatov Ilyosjon Olim o'g'li. Biomarkers and Genotyping in the Development of Chronic Polyposis Rhinosinusitis. *Association of Pulmonologists of Central Asia*, 2024, pp. 100–103. Tashkent Medical Academy, Tashkent, Uzbekistan. ISSN: — (article published in *Pulmonologiya Markazi Bulletin*, <https://tbcenter.uz/>)

12. World Health Organization. WHO Digital Health and AI Report, 2021.

