

ASSESSING THE DIAGNOSTIC POWER AND MANAGEMENT RECOMMENDATIONS OF CHATGPT-4 VISION ON ORBITAL FRACTURE IN CT SCAN



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Introduction

- Facial CT scan is essential in the evaluation and management of fractures.
- ChatGPT-4 Vision (GPT-4v) is a multimodal large language model that allows a user to upload image(s) and shows promising results when utilized for diagnosing distal radius fractures and assisting with the decision-making (1,2).
- Objective: Evaluate the performance of ChatGPT-4 Vision in the analysis of facial CT for diagnosis of orbital fracture and its recommended management, compared with the assessments and recommendations from oculofacial plastic surgeons.



Results

- Correct identification of presence of orbital fracture in all 19 cases:
 GPT-4v = 100.0% Vs Surgeons = 100.0%
- Correct identification of laterality of fracture in all 19 cases:
 GPT-4v = 47.37% Vs Surgeons = 100.0% (χ2=24.26, p<0.01)
- Correct Identification of fractured bone in all 19 cases:
 GPT-4v = 100.0% Vs Surgeons = 100.0%
- Correct identification of inferior rectus entrapment in 5/19 cases: GPT-4v = 73.68% Vs Surgeons = 100.0% (χ2=8.60, p<0.01)
- Correct identification of size of fracture in all 19 cases: GPT-4v = 63.16% Vs Surgeons = 100.0% (χ2=15.96, p<0.01).
- Appropriate recommendation of surgical management in all 19 cases: GPT-4v = 68.42% Vs Surgeons = 94.75% (χ2=7.27, p<0.01)

Figure 1. Sample input of 1 slice coronal view and axial view featuring orbital floor fracture.

Prompt and GPT-4v response below:

GPT-4v Prompt:

As a facial trauma surgeon, you are asked to analyze the axial and coronal view of an orbit CT of the same person. Is there a fracture on the image? Yes or No. If the answer was yes – Which bone is broken in the uploaded images? How large is the fracture in the uploaded images? Also, is there rectus muscle entrapment in the uploaded images? What treatment do you recommend based on the analysis of the uploaded images? Do you recommend surgical intervention based on the analysis of the uploaded images?

<u>GPT-4v response for Figure 1:</u>

Fracture Detection:

• Yes, there is a fracture visible in the images.

Bone Broken/Size:

- The right inferior orbital wall (orbital floor) is broken.
- It is a large fracture.
- Muscle Entrapment:
- The coronal view indicates potential displacement of the orbital contents, but it is not clear if there is significant muscle entrapment.

Treatment Recommendation:

- **1.** Clinical Evaluation:
 - Confirm the presence of symptoms such as diplopia, enophthalmos, and infraorbital nerve hypoesthesia.
 - Preform a thorough physical examination, including assessing extraocular movements and globe position.
- 2. Observation:
 - If the fracture is non-displaced and there are no significant symptoms (diplopia or enophthalmos less than 2 mm), observation with regular follow-up can be considered.
- 3. Surgical Intervention:
 - Indications for surgery:

Methods and Materials

- 19 cases of various orbital floor fractures with CT images were obtained from open-source online image search. Cases included two or more views (axial and coronal).
- ChatGPT-4 Vision was given a prompt to assess the CT images along with making recommendations (Figure 1).
- An attending physician and a fellow blinded to the image collection were asked to assess the same CT images and to make recommendations based on imaging only.
- Both ChatGPT-4 Vision and surgeons assessed each case for identification of fractures, laterality, size of fractures (small, medium, large), likelihood of extraocular muscle entrapment, and treatment recommendations.

- Significant diplopia affecting quality of life.
- Enophthalmos greater than 2mm.
- Large fracture involving more than 50% of the orbital floor.
- Clinical evidence of muscle entrapment or persistent symptoms despite conservative management.
- Surgical approach:
 - Approach via a transconjunctival or sub-ciliary incision.
 - Reduce and stabilize the fracture.
 - Use an orbital implant (e.g. titanium mesh, porous polyethylene) to reconstruct the orbital floor and restore normal anatomy.
- 4. Postoperative Care
 - Prescribe antibiotics if an implant is used to prevent infection.
 - Recommend corticosteroids to reduce post-operative edema.
 - Schedule regular follow-up appointments to monitor healing and address any complications.

5. Recommendation for this Case:

- Surgical intervention is recommended based on the significant size of the fracture and the potential complications if left untreated.
- The surgical approach should aim to repair the orbital floor and ensure the proper position of the orbital contents to prevent long term complications such as enophthalmos and persistent diplopia.
- 6. Conclusion:
 - The patient should undergo surgical repair of the right inferior orbital wall fracture to restore the orbital anatomy and prevent future complications

Conclusions

- GPT-4v is able to accurately identify the presence of orbital floor fracture on single coronal and axial CT images.
- GPT-4v is significantly less accurate than oculofacial trauma surgeons in its ability to identify fracture laterality, likelihood of muscle entrapment, and correctly recommend surgical intervention.
- Performance of CT analysis by GPT-4v was compared to surgeons with radiologist's interpretation serving as gold-standard.

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