

Use of Intraoperative C-Arm Fluoroscopy in Open Reduction and Internal Fixation of Mandibular Condyle Fracture - A Case Report

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Abstract

The Rationale: Condyle fractures are a common type of mandibular fracture that can result in malocclusion. Open reduction and internal fixation (ORIF) in condylar fracture is considered as the most acceptable treatment modality. **Patient Concerns:** The patient complained of pain and difficulty in the jaw while chewing. **Diagnosis:** An orthopantomogram and reverse Towne's view can lead to diagnosis of the condylar fracture. **Treatment:** Open reduction and internal fixation using intraoperative real-time visualisation of subcondylar fracture reduction utilising the C-arm fluoroscopic approach were used to allow for adequate anatomical repositioning and fast restoration of function to meet the patient's concerns. **Outcomes:** We were able to achieve correct reduction of the fracture fragments with restoration of function and occlusion. **Take-away Lessons:** When this procedure is used to treat condylar fractures, surgeons can get a better view of the fracture segments while eliminating the need for postoperative intermaxillary fixation and also reduces the complications from inappropriate reduction and fixation.

Keywords: C-shaped arm, facial trauma, mandible fracture, maxillofacial fracture, open reduction and internal fixation

INTRODUCTION

Compared to the surgical approaches and access to other mandibular fractures, access to the mandibular condyle is quite limited, therefore inadequate reduction of the condylar fracture may go unnoticed.^[1] Notably, the C-shaped arm (C-arm) fluoroscopic technique, routinely used in orthopaedic surgery, has not been widely applied to the maxillofacial region.^[2] There has been no case reports on the use of C-arm fluoroscopy in ORIF of mandibular condyle.

A young male patient reported to our hospital with a chief complaint of pain on the right side of the mandible following a road traffic accident. Multiple fractures involving the left mandibular subcondylar area and right parasymphysis were discovered on clinical and radiographic evaluation [Figure 1]. The purpose of this study is to describe intraoperative use of C-arm technique for visualisation of reduction and fixation of mandibular subcondylar fracture in a patient and demonstrate its clinical feasibility.

CASE REPORT

A 22-year-old male patient reported to SGT Hospital after he met with a motorbike accident complaining of tenderness with respect to the right side of the mandible. On clinical and radiographic (orthopantomogram and reverse Towne's view) examination, multiple fractures involving the left mandibular subcondylar region and right parasymphysis were noted [Figures 1 and 2]. After taking written consent, open reduction and internal fixation of the fracture were planned under general anaesthesia.

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The left subcondylar fracture was exposed using the retromandibular transparotid transmassetric approach. Both fracture segments were reduced and the patient was subjected to intermaxillary fixation using arch bar and wires.^[2] Intraoperative radiographic evaluation was done to confirm accurate reduction and fixation (using single 2 mm L plate and 42 × 6 mm screws) of the left subcondylar fracture using C-arm in two planes [Figures 3a, b and 4a, b]. The L plate was used because that helps in controlling both torsional and mediolateral displacement of fracture fragments^[1] [Figure 5].



Figure 1: Preoperative orthopantomogram showing fractures involving the left mandibular subcondylar and right parasymphysis of mandible



Figure 2: Preoperative reverse Towne's view showing fractures involving the left mandibular subcondylar area

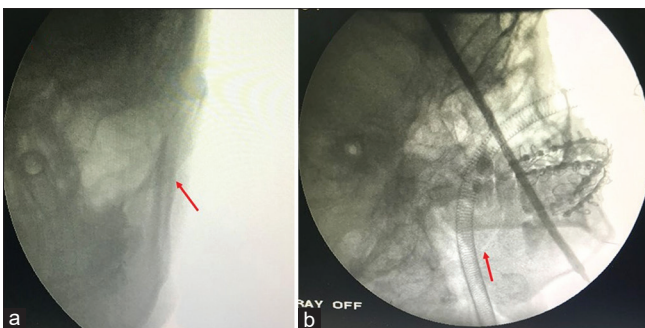


Figure 3: (a) Posteroanterior projection of left mandibular subcondylar fracture after fracture reduction. (b) Lateral oblique projection of left mandibular subcondylar fracture after fracture reduction

For evaluation of the mediolateral plane, the patient's head was positioned on the operating table with the Frankfort horizontal (FH) line perpendicular to the tabletop. Radiation was directed from the bottom up to the intensifier above the table. As the x-ray axis was parallel to the FH line, the image of the mandibular condyle was masked by the zygoma, therefore, the axis was canted about 15 degrees cranially with reference to the FH line. The skull's sagittal plane was rotated about 15 degrees ipsilateral to the x-ray axis, free of the mastoid bone's image. For the evaluation of the condyle in the anteroposterior plane, images were taken using lateral oblique projection.^[3] Satisfactory reduction and fixation were achieved, which was confirmed by C-arm.

Right parasymphysis was exposed using a vestibular approach and fixed with a 2.0 mm titanium 4 hole with gap and a 2 hole with gap miniplates using 2 mm × 8 mm screws and satisfactory reduction and fixation was achieved. Layer-by-layer closure was done for both the surgical sites. The patient has been on follow-up since a year with satisfactory occlusion and function and no complaints.

DISCUSSION

Condylar fractures account for 18-45% of all mandibular fractures and are very common fractures of the mandible.^[4,5] ORIF in condylar fracture is considered as the gold standard.^[5] It is difficult to estimate the reduction after ORIF because of the ambiguity in securing a satisfactory operative field. Insufficient reduction of condylar fractures may lead to less satisfactory results and an increased incidence of complications.^[6]

Certain sites (e.g., noncommunitated condylar fracture) can be evaluated by selecting a specific direction of the x-rays. Therefore, as our surgical treatment indication, we selected noncommunitated condylar fractures in the neck and the base. It is difficult to evaluate the reduction after ORIF because of the uncertainty in securing a sufficient visibility of the operative field.^[6] In our case, although lateral and posterior border reduction were checked clinically, the anterior and medial border were evaluated using intraoperative C-arm fluoroscopy for accurate fixation.

Since the reduction of fractured segments in anterior and medial border of condyle is difficult to evaluate clinically, C-arm fluoroscopy was used intraoperatively. Tomoaki Imai *et al.*^[3] have suggested that C-arm fluoroscopy allowed a good posterior-anterior visualisation of condylar fractures and also favoured its timely adjustment to evaluate fracture reduction. He has also advocated the use of this modality for the management of zygomaticomaxillary complex fractures.^[3] In this strategy, the C-arm technique for the moderate to severely displaced cases may contribute to repositioning the condyle, leading to intraoperative reassessment before and after fixation. We do not advocate that the modality presented is either mandatory or useful for all types of condylar fractures.^[3]

Even though ultrasonography does not use ionising radiation, it is of limited use in cases of condylar fracture management because the condylar fracture fragments can be displaced in

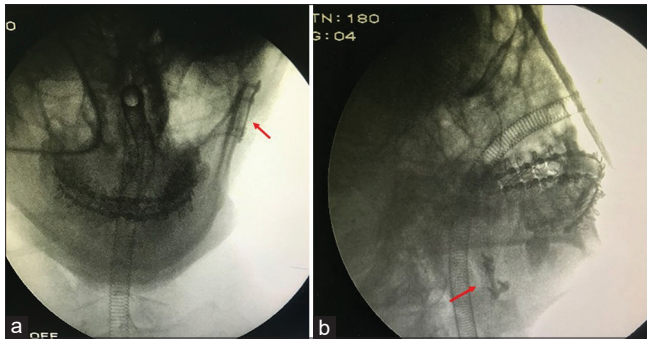


Figure 4: (a) Posteroanterior projection of left mandibular subcondylar fracture after fracture fixation. (b) Lateral oblique projection of left mandibular subcondylar fracture after fracture fixation

any plane due to the complex 3-dimensional surgical anatomy of the region.^[7]

The use of cone-beam computed tomography during surgery enabled immediate monitoring of the reduction of condylar process fractures of the mandible in all three planes. Although this strategy is very useful, the availability and cost of the equipment remain the biggest drawbacks.^[6]

Similarly, the use of endoscopy as an alternative for intraoperative imaging technique is of limited use because visualisation of the posterior border of ramus is difficult. Hence, achieving a perfect reduction of fractured condyle is difficult and it is also very technique sensitive and requires specialised training.^[8]

Here, we present the concept that the combination of C-arm fluoroscopic open reduction and the assessment of mandibular stability, including occlusion, can aid in intraoperative management strategy of these common and often challenging fractures.^[2]

C-arm does emit radiation but only low dose nonfluoroscopic views are used, and the reductions can be completed with <5 images. Thus, the accumulated dose is considerably of reduced amount than what is emitted by a maxillofacial computed tomography scan. Therefore, C-arm is safe with low emission levels, and it gives easily reproducible images as well as on table information without a time lag. In addition, medical staff within a 2-m zone should wear a 0.25 mm lead-equivalent light apron for radiation safety.^[9,10]

In conclusion, applying this technique in cases of condylar fractures would enable the surgeons to give more precise as well as accurate visualisation of fracture segments and that can enhance quality of life while avoiding the use of postoperative intermaxillary fixation due to complications related to improper reduction and fixation of condylar fractures.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have



Figure 5: Intraoperative view

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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