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Research Article

How Often is Post-Operative Radiological Image Ordered in the Management of Mandibular Fractures? A 21-Year Retrospective Study

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Abstract

Background: The routine use of post-operative radiological imaging in the management of mandibular fractures is a contentious issue among researchers and practitioners in oral and maxillofacial surgery discipline.

Objective: To determine the frequency and pattern of postoperative radiological image ordering in the management of mandibular fractures and the clinical characteristics of the fractures in the affected patients.

Material and Methods: This was a retrospective study over 21 years. Information obtained from the hospital register, case files and plain radiographs of the patients were recorded in a pro-forma.

Results: Overall, 4668 patients with 6, 201 mandibular fracture sites were evaluated and post-operative radiological image was ordered for 9 (0.2%) patients with 9 (0.15%) fracture sites affected. All the patients that presented were successfully treated. Post-operative imaging was not routinely ordered immediately after surgery, but when the surgeons see the need, and was done after release of inter-maxillary fixation. Eight (88.9%) patients were male and one (11.1%) was female with age ranging from 26 to 39 years. The radiological images ordered were 55.6% lateral oblique of the mandible, 33.3% reverse Towne's view and 11.1% posterior-anterior of the jaws. The diagnoses made were mal-union in 44.5% patients, occlusal discrepancy in 33.3% whereas 22.2% had delayed union of fractures.

Conclusion: This study suggests that routine ordering of post-operative radiograph during management of mandibular fractures should not be the practice unless there are specific indications for it. Future research work should aim at providing well-defined indications for post-operative radiological imaging during management of mandibular fractures.

Keywords: *Fractures; Mandible; Closed Reduction; Post-Operative; Radiology*

Introduction

Mandibular fracture is one of the common injuries sustained in the oro-facial region, and preoperatively, radiological investigation is frequently required to aid their clinical evaluation and diagnosis before commencement of definitive treatment [1-3]. The treatment of these fractures has shifted in contemporary practice from closed reduction technique to open reduction in a bid to improve post-operative treatment outcome and patient comfort during the recovery phase [4,5]. In spite of this human effort at improving the quality of life of the

affected subjects, complications still occur after treatment of the fractures necessitating the need for post-operative radiological investigation during the recovery phase, even if the method of treatment employed was closed reduction with inter-maxillary fixation or open reduction with internal fixation [6-8].

Although, it is still a contentious issue in spite of the available research work, some practitioners in oral and maxillofacial surgery discipline believes that post-operative imaging should be routinely ordered following open reduction and internal fixation (ORIF) of mandibular fractures in order to assess the adequacy of reduction and fixation because the jaw will be put to function immediately post-operatively [9-11]. On the contrary, Kaeppler., *et al.* [12] noted that routine post-operative radiographs after ORIF of mandibular fractures have little value in the management of such patients, as the decision to re-operate is based on clinical signs and symptoms rather than radiographic appearance, and that the radiographic appearance is not associated with long-term outcomes which also prompted them to suggest that radiographs are valuable only in patients with clear clinical indications, and in view of the risk and cost of radiation even questioned their continued use.

However, the routine use of post-operative radiological imaging in the management of mandibular fractures treated by closed reduction is not common, but may be necessary in certain clinical situations like when the treatment outcome is not clinically acceptable, at the behest of the patient or surgeon to ensure that the treatment was properly done or for medico-legal reasons [13,14]. Such specific conditions when post-operative image may be required include non-union, mal-union and delayed union of fractures, as well as in cases of multiple mandibular fractures, condylar fractures and premature release of inter-maxillary fixation by the patient [15,16].

Although there is evidence which shows that routine ordering of postoperative radiological images during management of mandibular fractures do not affect patient treatment outcomes, no study has yet assessed what the current postoperative radiological image ordering practices are at the study center. Therefore, the study aimed to retrospectively determine the postoperative radiological image ordering practices for consecutive patients diagnosed with mandibular fracture, who were treated by closed reduction in a tertiary health institution. The objectives were to determine the frequency and pattern of postoperative radiological imaging and the clinical characteristics of the fractures in the affected patients over 21-year period.

Materials and Methods

This study aimed to retrospectively determine the postoperative radiological image ordering practices for consecutive patients diagnosed with mandibular fracture, who were treated by closed reduction technique. The objectives were to determine the frequency and pattern of ordering postoperative radiological image and the clinical characteristics of the fractures in the affected patients.

Postoperative complication was defined in this study as a clinical condition that will make the surgeon to carry out another treatment on a patient due to patients' post-operative symptoms, confirmed by clinical and radiological evaluation. The patients presented to the Oral and Maxillofacial Surgery Clinic of the study institution between June 1996 and May 2017. Cases with complete data were included in the study, whereas those with incomplete data and fractures sustained by gunshot were excluded.

Information obtained from the hospital register, case files and plain radiographs of the patients relevant to mandibular fractures were recorded in a pro-forma designed for the study. This include age, gender, medical problem of the patients, mechanism of injury, treating surgeon, type of radiological image ordered, site, number and type of mandibular fracture including the diagnosis made after the post-operative radiological investigation. Other data obtained were the associated mid-facial fractures and the time post-operative radiological investigation was requested during follow-up.

Results

Overall, 4668 patients with 6, 201 mandibular fracture sites were evaluated during the study period. Those who had complications were 297 (6.4%) patients with 308 (5.0%) affected fracture sites whereas post-operative radiological investigation was ordered for 9

(0.2%) patients to aid satisfactory treatment of complications at 9 (0.15%) different fracture sites. Eight (88.9%) patients were male and one (11.1%) was a female. Their ages ranged from 26 to 39 years with mean age, 31.2 years. The medical history of the patients was insignificant and non-contributory to treatment outcome.

The fractures sustained by the 9 patients were caused by road traffic accident (RTA). All the fractures that required post-operative radiological imaging were compound, 4 (44.5%) of the fractures affected the sub-condyle, 3 (33.3%) occurred in the body region, while the remaining 2 (22.2%) involved the mandibular angle. Six (66.7%) patients had multiple fractures involving 3 sites, whereas 3 (33.3%) subjects were diagnosed with 2 fracture sites. Five (55.6%) of the cases were associated with mid-facial fractures; 3 (33.3%) patients had Le Fort 1 and zygomatic complex fractures, one (11.1%) patient sustained Le fort 1, 11 and 111 fractures whereas the remaining one (11.1%) had only zygomatic complex fracture.

All the patients were managed with plain radiographs; 5 (55.6%) lateral oblique of the mandible, 3 (33.3%) reverse Towne's view and one (11.1%) posterior-anterior radiograph of the jaws. The patients were managed by 4 different surgeons; 2 surgeons requested 3 x-rays each, one surgeon 2, while the remaining surgeon ordered only one radiograph.

In all the patients evaluated, the duration of inter-maxillary fixation ranged from 4 to 6 weeks. The period from the commencement of treatment to the ordering of post-operative radiological investigation ranged from 4.2 to 8.5 weeks. Post-operative radiological imaging was not routinely ordered after surgery, unless the surgeons see the need during follow-up, and they were done after the release of inter-maxillary fixation.

The diagnoses made following clinical evaluation and the radiological imaging was mal-union in 4 (44.5%) patients, occlusal discrepancy in 3 (33.3%) cases whereas 2 (22.2%) subjects had delayed union of fractures. These complications were corrected during follow-up by using guiding elastics, occlusal grinding and equilibration in 5 (55.6%) patients (3 occlusal discrepancies and 2 patients with mal-union), re-fracture and IMF was done for 2 (22.2%) subjects, while the 2 cases (22.2%) of delayed union were treated by debridement, IMF with an overhead bandage which the patients wore in each case for 3 weeks. The average follow-up of patients was 3.2 months (range 2.8 to 93.7 months). All the patients that presented were successfully treated during this period.

Discussion

The outcome of this study suggests that post-operative radiological investigation in the management of mandibular fractures treated by closed reduction technique is not routinely ordered in the study institution. This is contrary to some reports that advocate their being used routinely. The authors of these reports opined that the justification for the use of post-operative radiograph are to ensure that apparent problems are detected early and rectified, medico-legal reasons, teaching, audit and for self-assessment by the surgeon [17,18]. Similar to the finding in this study, many studies showed that post-operative radiographs play little role in the management of facial fractures, challenging the protocol of having them routinely requested, although their treatment were unlike the present study by ORIF or a combination of ORIF and closed reduction techniques [19-21]. Literature also suggests that intra-operative reduction and immediate post-operative occlusion were better indicators of adequate reduction and treatment than post-operative radiographs [20-22]. The objective of reduction of mandibular fractures is to rectify jaw deformity that could affect esthetics and ensure that post-operative occlusion is acceptable with regard to function, and these are usually not evident on a post-operative radiograph. Whether the treatment of choice is closed reduction technique, ORIF, open reduction with non-rigid fixation or a combination of these methods, the goal of surgery is to obtain proper occlusion clinically, and not radiographic perfection [15,16].

Immediate post-reduction imaging is a "standard" practice in the management of mandibular fractures of many hospitals. However, the literature suggests that post-reduction imaging in maxillofacial fractures fails to influence clinical decision making significantly [19,20]. The added negative aspects of radiological imaging associated with hazardous radiation exposure, delayed discharge from hospital, and perceived increased economic burden have resulted in a call to abandon this practice [23-25]. The surgeon should note that if as a result of careful clinical examination one decides that a radiograph is not necessary for future management of the patient with mandibular fractures, your decision is unlikely to be challenged on medico-legal grounds [26]. It is also unethical to obtain radiographs for future medico-legal proceedings [19,26]. With the regulations of ionizing radiation in mind, particularly in the case of mandibular fractures, if

the occlusion is clinically acceptable after treatment, there will be no need for post-operative radiograph [19]. Also, some authors believe that teaching was a justification in having post-operative radiograph taken [19,20]. This may be useful in few selected cases, but the patients' consent would be sort if the radiographs are used, in addition to the clinical evaluation. Clinical teaching should be carried out during surgery in the theatre and not in the form of a reflection on a plain film radiograph during ward rounds [21].

Like in most other studies [19-21,27,28] this paper does not recommend that post-operative radiograph should not be taken at all, but that more emphasis should be placed on assessing the clinical status of the patient after treatment and obtain post-treatment radiographs when necessary. This is supported by the earlier reports of Dewi., *et al.* [27] and Courtmanche., *et al.* [28] who stated that post-operative imaging should be reserved for patients with well-defined clinical indications in order to improve the translation of research evidence into clinical practice. In the present study, the reasons for ordering post-operative radiographs were occlusal discrepancies, mal-union and delayed union. The occlusal discrepancies were due to the inability of the patients to inter-digitate the mandibular and maxillary teeth in maximum intercuspation. Mal-union may have been caused by the instability of the fixation since the method used were non-rigid, premature release of the IMF by the patient probably because of its discomfort and want of food, while the delayed union occurred at the mandibular angle which is almost always prone to complication due to the oblique and irregular fracture configuration and particularly in this series because of the method of treatment employed [15,16].

Although there was no significant medical condition that affected the patients in the present study, the presence of co- morbidity, mechanism of injury, site of fracture, antibiotic administration, and planned follow-up has no significant statistical impact on whether a patient had post-operative radiograph [19,20]. Similarly, the demographic characteristics of the patients encountered in this study are not different from those recorded in the existing literature [1-3]. Some authors opined that only patients who had an indicated post-operative radiograph due to multiplicity of fractures were more likely to have decreased complications [7,19]. All the patients in the present study that post-operative radiographs were ordered for had multiple fractures.

There was variation in the number of requests made for post-operative radiographs by the 4 surgeons that treated the patients. This may have been influenced by confounding variables like severity of the post-operative complications, number of cases managed by each surgeon, and the need to urgently arrive at a diagnosis and treat the patient. In addition, a clinician's individual practice was the most significant factor that may determine whether a patient received a routine post-operative radiograph [19,20]. Study by Courtmanche., *et al.* [28] showed that 27% of their patients received routine post-operative radiograph, of which one surgeon accounted for 33%. In the present study only 0.2% of the patients received post-operative radiograph after the release of inter-maxillary fixation (IMF), of which two surgeons accounted for 33.3% each. The surgeon should audit his or herself and should use his or her experience over the years and individualized complication rate to determine whether routine post-reduction imaging is necessary [28]. This audit encourages the surgeon to navigate the health care system responsibly while effectively caring for his or her patient. However, like the present study revealed, earlier researchers have shown that patients treated by closed reduction technique with IMF were more likely not to have post-operative radiograph [24,28].

In this study, several x-ray views relevant to mandibular fractures were requested post-operatively when there was the need. On the contrary, many authors showed that when complication develop and there is the need for imaging, panoramic or orthopantomograph only can be obtained and compared with the baseline radiograph to guide further clinical decision making rather than multiple radiographic views [20,28-30]. This is because this radiograph shows both sides of the jaws simultaneously and consequently will be more useful to the clinician and the radiologist. Multiple radiographic views were used in this series of patients because of unavailability and unaffordability of orthopantomograph by the patients at the study center. Conditions that will make the surgeon return to the theatre include infection, non-union, mal-union, delayed union, objective malocclusion or hardware extrusion [15,16,27,28] some of these clinical conditions were encountered in the present study and were the indications for the post-operative imaging.

The most common site of the complicated fracture in our series was the sub-condyle. In the study by Jain and Alexander [20] the parasymphyseal region was the most commonly encountered fracture site. Complicated mandibular fracture can occur at any site but are commoner at the condylar and angular regions [1,2,15,16].

This study was designed retrospectively and thus may have inherent information bias. Patients with incomplete data were excluded; administrative data were therefore used to obtain long-term follow up information. Computed tomography scan was not used in the management of the patients particularly those with condylar fractures because it was unavailable at the study center during the period of the study. Because post-operative radiological imaging was ordered for few patients, statistical analysis was not done to determine whether there was a relationship between confounding variables and the request for post-operative radiological imaging.

Conclusion

This study showed that post-operative radiological imaging was not routinely ordered for the patients during management of the fractures, except when the surgeons needed them, and these were done in 0.2% of the patients who had complications after the release of inter-maxillary fixation. The routine ordering of post-operative radiograph should not be the practice unless there are specific indications for it. Future research work should aim at providing well-defined indications for post-operative radiological imaging during management of mandibular fractures.

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Conflict of Interest

The author has no conflict of interest to declare whether financial or personal relationships with other people or organizations.

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