PANORAMIC RADIOGRAPHY AS AN AID IN DIAGNOSING MANDIBULAR FRACTURES

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هذه دراسة استعادة لتحديد مدى إمكانية الاعتماد على التصوير الشعاعي البانورامي لتقييم الكسور التي قد تصيب الفك السفلي . تمت الدراسة على ٥٢ مريضاً ، مصابون ب ٦٢ كسراً بالفك السفلي وقد وجد أن ٥٧ كسراً (٩٢ %) قد تم تشخيصه عن طريق التصوير الشعاعي البانورامي بينما أن هناك خمسة كسور (٨ %) لم يتم تشخيصها عن طريق التصوير الشعاعي البانورامي بل عن طريق أخذ صور إشعاعية أخري . كذلك لم يتم تشخيص كسور في الفك السفلي في الصور الشعاعية البانورامية لمرضى لم يتم تشخيصهم إكلينيكيا . أربعة من المرضى لم تؤخذ لهم صور بانورامية عند التشخيص المبدئي للحالات نظراً لوجود صعوبات طبية تمنع ذلك .
أوضحت النتائج أن التصوير الشعاعي البانورامي يعطي معلومات مفيدة لتشخيص كسور الفك السفلي ولكن قد تكون محدودة ، لذلك فإنه يتعين أخذ صور شعاعية أخري إذا تم تشخيص حالة كسر بالفك السفلي إكلينيكياً وكانت نتيجة التصوير الشعاعي البانورامي سلبية .

A retrospective study was undertaken to determine the reliability of the panoramic radiograph (PR) in the evaluation of fractures in the mandible. Among the 62 fractures present in the 52 patients included in this study, 57 fractures (92%) were recognized in the panoramic radiographs, while 5 fractures (8%) were missed and detected in other types of plain films. Four out of the fifty-two patients included in the study had no PR made as the primary diagnostic radiograph was taken for various medical problems. It was concluded that PR provides useful diagnostic information in evaluating mandibular fracture, however, limitations were noted. Other plain films may be needed when PR is negative and there is clinical evidence that a fracture exists.

Introduction

The mandible with its U-shaped bony structure forms the skeleton of the lower facial height. It is a relatively well exposed and prominent portion of the facial skeleton. As a result, mandibular fractures form between 36% to 54% of all facial bone fractures.[1,2]

The key to success for the treatment of fractured mandible is proper diagnosis to detect the site, direction and degree of displacement of each fracture line. However, proper diagnosis depends on detailed history, clinical examination, followed by good and clear radiographic views.[3,4] Selection of the most suitable radiograph to establish a diagnosis at the initial examination with minimum exposure of the patient to radiation is often difficult, as several films are required. In the past, the standard mandibular series that include two lateral oblique views, a posteroanterior view, and a fronto-occipital (Towne's) view were usually requested to aid in the diagnosis of mandibular fractures. In terms of time, cost and radiation risk, this radiographic series was not ideal.[5] With the introduction of panoramic radiography (PR) some of these difficulties were eliminated. PR was introduced as the most suitable screening film for the radiographic examination of the jaws. As a result, several studies were carried out to compare PR with the standard mandibular series radiographs.[6,7,8]

This investigation was conducted to examine the validity of the panoramic radiography in the detection of various types of mandibular fractures.

Materials and Methods

Patients with known fractures of the mandible treated at Hull Royal Infirmary Hospital-England from October 1990 to December 1991 were included in this retrospective study. Data source was the medical records of the patients included in the study. Reports given by radiologists were compared with the final diagnosis obtained from medical records. They were then classified

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into:

a. Positive, clinical and radiographic findings were identical.

b. False negatives, mandibular fracture(s) confirmed clinically and by other types of radiographs, but not observed on PR.

c. False positives, no clinical signs or symptoms of fracture. Fracture was observed on the PR but other radiographs failed to show any fracture.

Other factors considered were age, sex, type of trauma and site(s) of fracture.

Results

Fifty-two patients (35 males, 17 females) with a total of 62 fractures were included in this study (Table 1). The age ranged between 5 and 71 years. All patients had panoramic radiographs made as the initial diagnostic film when first examined at the Emergency Department except for four patients who had other medical conditions. Three of them had fractured femur and the fourth patient had a severe head injury.

When radiographic diagnostic findings were compared on the basis of known surgical findings, 57 fractures (92%) of the 62 fractures were recognized in the PR initially. Five fractures (8%) out of the 62 fractures could not be seen in the panoramic radiographs and the x-ray films were reported as normal. The sites in which fractures were undiagnosed on the PR were the symphyseal, body, angle and the condylar regions (Table 1). Since the radiographic findings did not correlate with the data obtained during the clinical examination of the patients, other radiographic views were requested according to the expected line of fracture. There were no false-positive results involving diagnoses made from the PR. Distribution of causes of fractured mandible is summarized in Table 2.

Table 1: Actual mandibular fractures and as detected by panoramic radiograph by anatomical sites.

Site	Actual number of Fractures	Panoramii Radiograpl
Symphysis/ Parasymphysis	8(12.9)	7
Body	19(30.6)	18
Angle	15(24.2)	14
Ramus	5(8.1)	5
Coronoid Process	2 (3.2)	2
Condyle	13(21.0)	11
TOTAL	62(100)	57

Table 2: Distribution of causes of fractured mandible.

Number of Patients	Type of Trauma
25	Alleged assault
11	Road traffic accident
6	Falls
3	Sports
3	Others

Discussion

In the multisystem trauma patient, the advantage of obtaining a radiographic image to evaluate the entire craniofacial skeleton is obvious. The panoramic radiographs are a single image of facial structures, including both maxillary and mandibular arches and their supporting structures.[9] This is particularly important in case of mandibular fractures since indirect fractures of the mandible are common and there is a need for a technique whereby the entire mandible may be visualized.[10] Superiority of PR to other plain films has been demonstrated in several studies. This includes low radiation dose, ease of imaging, time effectiveness, suitability for patients who are unable to open their mouth and cost effectiveness. PR also shows the relationship of the roots of the teeth to the fracture site and adjacent structures.[9"-'2]

In practical terms, the routine application of the PR is precluded by situations in which multiple injuries exist as was demonstrated in the four patients reported in this study. These patients had complicated medical conditions that made them unsuitable for PR because of the required erect

positioning of the patients. However, several authors recommended using PR as the primary diagnostic radiograph in mandibular fractures. They believed that PR is usually the only view needed, and that the traditional plain films add little to aid the diagnosis. In a study of 88 cases of mandibular fractures, Charya et al.[6] found that 92% were recognized on the panoramic radiographs, while only 60% were evident on the hospital series. They suggested using PR as the principal means for the diagnosis of mandibular fractures. In 272 cases of mandibular fractures, Moilanen[7] found that the panoramic view was diagnostic for 77 %, while the conventional plain film series permitted diagnosis of fractures in 60 % of such cases. They concluded that PR alone is sufficient for the evaluation of a fractured mandible. The results in the present study correspond to the findings of the afore-mentioned authors. PR was diagnostic for 92% of the 62 fractures reported.

The principles of diagnostic radiology require two views at right angles to each other to define fractures accurately and PR does not utilize this principle.[13] False negative errors involved 8% of the 62 fractures, which demonstrated PR limitation. In general, some undiagnosed fractures are due to the technique itself and the resultant film quality. PR does not give optimal anatomical details that could be seen on other radiographs like periapical views. Areas of interest may fall outside the plane of focus or the focal trough, single fracture line can be demonstrated as two, and there is a considerable amount of mag-nification, geometric distortion and overlapped images. [M-9]

Cases 1 and 2 are shown in Figures 1A and 2A. In these 2 cases, the fracture was in the symphyseal and parasymphyseal regions, respectively. Both fractures might have been obscured by superimposition of underlying structures such as the vertebral column. Fractures in these areas are usually difficult to interpret by PR in the absence of dislocation.[15] Clinically, these types of fractures are easy to detect especially if accompanied with dentoalveolar fracture. Periapical films in addition to occlusal films were requested to confirm the diagnosis (Figs. IB and 2B). Reports have indicated that one of the sites in which fractures were most often undiagnosed on the PR were the mandibular angle region.[617] Fractures may be obscured on a panoramic view if the fragments overlap, as

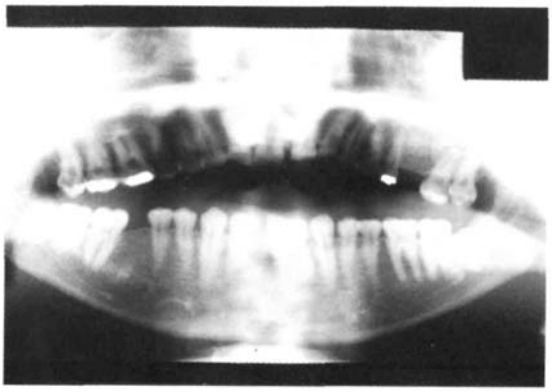

Figure 1A: Orthopantomogram of Case 1 without visible fracture.

Figure 1B: Periapical view of Case 1 demonstrating fracture site in the symphyseal region (arrow).

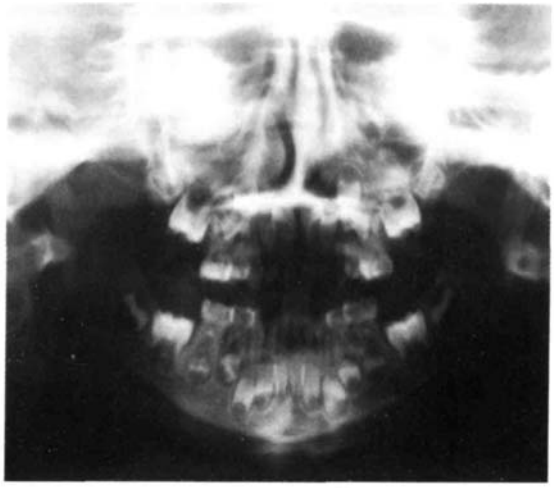

Figure 2A: Orthopantomogram of Case 2 without visible fracture.

Figure 2B: Orthopantomogram of Case 2 without visible fracture.

illustrated in Case 3 reported in Fig. 3A. Posteroanterior view was requested which showed severely displaced fracture of the angle (Fig. 3B). Cade[16] (1995) reported a case of fracture angle of the mandible that was not visible on PR but was clear in periapical films. Ziccardi[17] (1992) suggested that superimposition of soft tissue density, bony developmental cleft, long buccal vessels, or glosso-pharyngeal air space might be interpreted as fractures on the PR giving false positive results in this region. Furthermore, motion during the exposure of a panoramic view can produce a false image exactly mimicking a fracture, hence the term "motion pseudofracture."[18]

Some undisplaced condylar/sulcondylar fractures may be overlooked in PR (Figs. 4A, 5A). PR usually shows displacement of the fractured condylar process in the anteroposterior direction but not in the lateromedial direction. The clinical presentation of Cases 4 and 5 with jaw deviation, limitation during mouth opening and changes in occlusion suggested fractured condylar head. Postero-anterior films were requested for both cases which were diagnostic for Case 4 (Fig. 4B) but did not exhibit a fracture in Case 5.

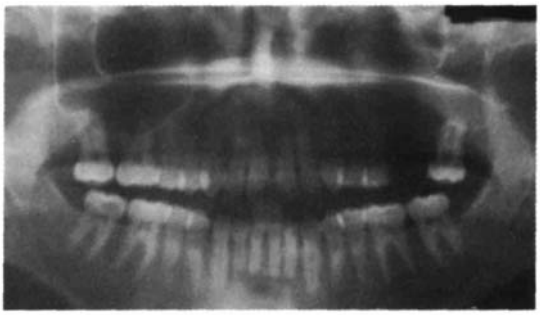

Figure 4A: Orthopantomogram shows no readily discernible mandibular fracture.

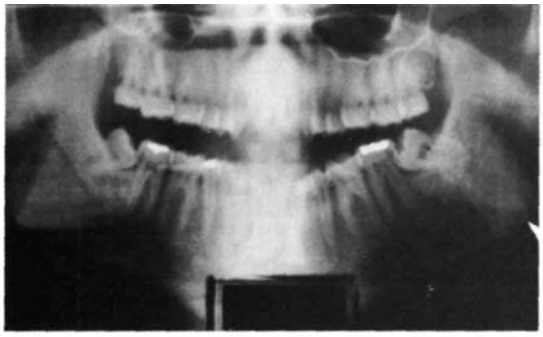

Figure 3A: Orthopantomogram reveals no evidence o fracture.

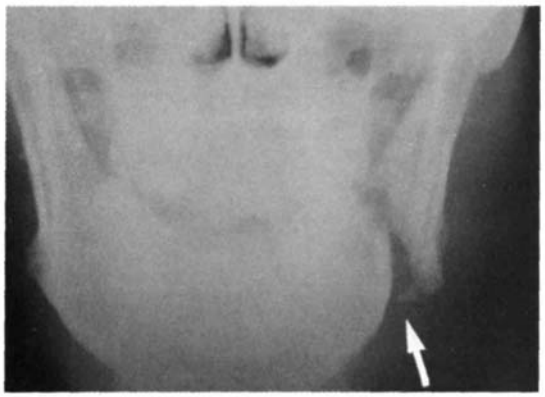

Figure 3B: Dislocated fracture in the left angle of the mandible (arrow) easily detectable at post-anterior projection.

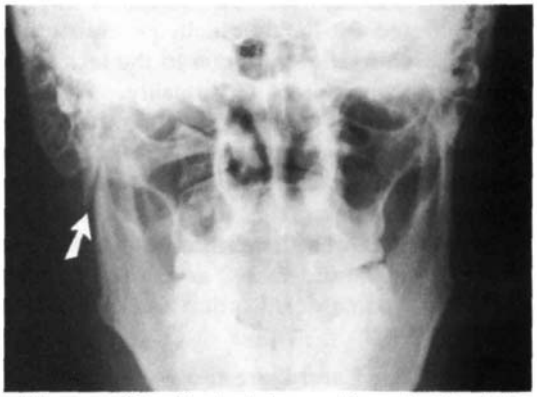

Figure 4B: Post-anterior radiograph illustrating minimally displaced right subcondylar fracture.

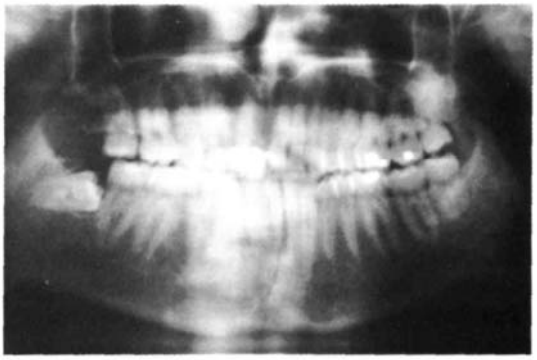

Figure 5A: Double fractures in the mandible: symphyseal fracture and indirect sagittal fracture on the right condyle, however, only the symphyseal fracture was detected in the panoramic view.

As a result, computed tomography (CT) was requested for Case 5 which showed a vertical fracture of the left condyle (Figs. 5B, 5C). McDonnell et al.[18] indicated that no single projection is adequate to visualize the temporomandibular joint radiographically and indicated that if plain films are ineffective then CT can be implied. Finkle et al.[19] in 1985, in an analysis of the diagnostic methods used in maxillofacial trauma, reported that CT was the most accurate test in the diagnosis of facial bone injury. However, CT images are rarely indicated as the initial radiographic method of choice to evaluate the mandible.[2,22]

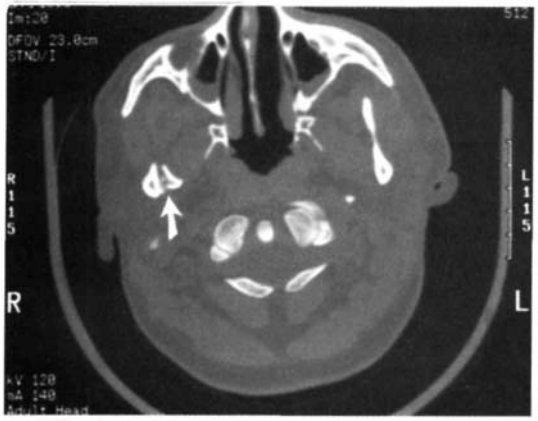

Figure 5B: Axial CT scanning showing a right-side sagittal splitting fracture of the condylar head.

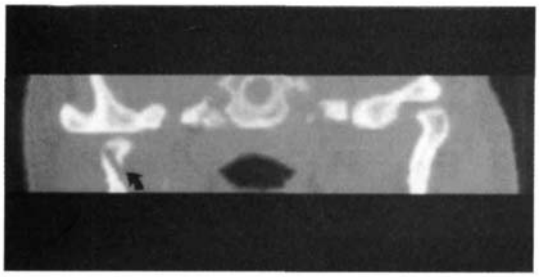

Figure 5C: Coronal projection of the right and left condylar process of the same patient. The fractured condylar process is situated medially in relation to the mandibular fossa.

Conclusion

It can be concluded that even though panoramic radiography is valuable in the evaluation of mandibular fracture, it should not be relied on as the sole measure for diagnosing fractures. Other radiographic views should be used for their particular advantages to evaluate specific sites of the mandible when panoramic radiography is negative and clinically there is a reason to believe that a fracture does exist.

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