Research Square

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Early Plain Film After Volar Plate Fixation for Distal Radius Fractures: Is Reallly Useful?

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Abstract

Background: The value of early postoperative radiographs is generally questioned after volar plate fixation(VLP) for distal radius fractures(DRFs). The purpose of this study was to evaluate the utility of early routine radiographs following volar plate fixation.

Methods:A restropective study was developed on distal radius fractures treated with volar plate fixation between 1 January 2016 and 1 January 2020 in our hospital. We obtain relevant information from patient electronic records including basic patient information and treatment information.Reoperation or further checking after early postoperative radiographs was defined as management change which illustrates early postoperative radiographs influence postoperative treatment.

Results: A total of 213 patients treated with VLP were included. There are 179 patients having early postoperative radiographs in included patients. Two out of 179 patients were altered management,which underwent further imaging with computed tomography(CT) due to pain and swelling.This two patients were in line with Type C(AO/OTA classification). No patient has surgery again.

Conclusion: Early postoperative radiographs can not bring about an adjustment in postoperative management with VLP after DRF.But intra-articular fractures may still benefit from early postoperative radiographs compared with extra-articular fractures.

Introduction

Distal radius fractures are the most common fracture in the hand and forearm fracture, more than 600,000 individuals suffer distal radius fractures each year in the United States[1, 2]. Recently, the percentage of patients having volar plate fixation(VLP) for distal radius fractures(DRFs) is increasing rapidly with superiority including low damage and fast recovery[3, 4]. Meanwhile, Obtaining postoperative radiographs in the postoperative period after VLP is common practice[5]. However, The use of routine early postoperative radiographs provides an example where a service may be overused beyond its cost-effectiveness because it seems meaningless. This may pose an increasing burden on healthcare resources because it can not play a role in the management of patients with VLP[6].

Currently, scholars have no consensus on the early postoperative radiographs on account of there is no clinical evidence to indicate routine postoperative radiographs alter clinical management[7, 8]. Sharma et al. [9] retrospectively reviewed postoperative radiographs after volar locking plate fixation and found that 94% of 172 patients had early postoperative radiographs, which rarely influenced clinical decision-making. Stone et al [10] found that three out of 268 (1%) patients were decided to undergo reoperation at the 2-week visit due to the loss of fixation. Routine 2-week post-operative radiographs rarely led to a change in patient management, which may have added ineffective cost to the health care system. Huffaker et al.[11] suggested the patients with AO type A DFRs(AO/OTA classification) do not require routine postoperative films, but the value of early postoperative radiographs in AO type B and C fractures should be further studied.

In our institution, early routine postoperative radiographs seem to be generally accepted. Recent studies have shown that this may not benefit patients, but increase medical costs and radiation risks[12]. Thus, the purpose of this study was to evaluate the utility of early postoperative radiographs following VLP.

Materials And Methods

Patients

We retrospectively analyzed consecutive patients in a tertiary hospital. All patients who were aged 18 years or older with a distal radius fracture and had VLP fixation within 2 weeks after injury.The exclusion criteria were an absence of follow-up data,pathologic fractures, open fractures, and multiple fractures. We define the early postoperative examination as the examination within two weeks after the operation.In our hospital, All patients were informed to have about 2-week postoperative radiographs after surgery.

Data Collection

We utilized hospital electronic databases to search the recording of patients undergoing VLP for DRFs by diagnosis. the hospitalization number of each patient was used to retrieve the medical history of each patient and sort out the treatment process. furthermore, postoperative clinical information including treatment process was collected from electronic health records, radiographs were gathered by archiving and communication systems (PACS). Existence of radiographs on PACS was exploited to recognize whether early radiographs had been performed. Changed postoperative management was defined as breaking in the routine rehabilitation process after surgery, such as further inspection or further revision surgery. Basic demographic information was recorded: patients age at operation, gender, injured side, type of fracture basing on the Orthopaedic Trauma Association (AO/OTA) classification, treatment strategy after early postoperative radiographs. Because of the retrospective of this study, ethics committee approval was not required. But patients' informed consent was required.

Statistical analysis

Descriptive statistics are reported for baseline data, fracture type. statistical results are reported separately for patients who alter postoperative management and patients who do not alter postoperative management. The process of inclusion and exclusion can be seen in Fig. 1(**A flow chart**).

Table 1
Fracture Classifications, Methods of Fracture Fixation, and Patient Demographics

	Early postoperative radiographs (n = 179)	No early postoperative radiographs (n = 34)
gender		
male	53	9
female	126	25
Age(y)		
Mean age	53±	55±
18–39	36	6
40–64	94	17
65–86	49	11
Fracture type		
AO type A	87	30
AO type B	63	1
AO type C	29	1
Injuried side		
left	106	19
right	73	15

Result

There was a total of 224 patients with volar plate fixation for DRFs between 1 January 2016 and 1 January 2020 in our trauma center. 5 were excluded because of missing follow-up. 3 were excluded because of the postoperative use of cast external fixation and Kirschner wire.2 were excluded because of open fracture.1 was excluded because of bilateral fracture. A total of 213 fractures were included in this study.The mean age was 54 years, and the range was 18 to 86 years old overall. A total of 213 fractures 125(58.7%) were left-sided and 88 (41.3%) were right-sided. Sixty-two fractures occurred in males (29%) and 151 in females (71%).According to AO/OTA classification, there were 109 (51%) extra-articular (A1-3), and 104 (49%) intra-articular (B1-C3) fractures.

Average time from operation to first plain films 12–16 days. Of the 179 patients with early radiographs, 87 patients had extra-articular fractures (49%) and 92 had intra-articular fractures (51%). According to the early postoperative radiographs, the treatment plan of 2 patients needs to be adjusted. 2 patients having

comminuted intra-articular fracture underwent a CT examination due to pain and swelling in the surgical incision area and finally used plaster external fixation to ensure the fracture is stable. This two patients were in line with Type C(AO/OTA classification).

Discussion

The cores of operative treatment for DRFs include keeping reduction and strong fixation[4, 13].Orthopedic surgeons always evaluate the reduction and healing progress of the fracture in the light of postoperative imaging.However, more and more investigators question the significance of early postoperative imaging because this not only may increase the cost of medical management and radiation dose,but also can't display fracture healing progress early[14]. The purpose of this study is to evaluate the worth of routine postoperative radiographs for patients following VLP through a retrospective analysis of patients.

As far as we know, This is the first study assessing postoperative visit x-rays for patients treated with volar locking plates in China.In this study, the effect of early radiographs after VLP was evaluated with a retrospective analysis of 213 patients. We committed to revealing whether early routine plain films will change clinical treatment strategies. In our sample, 179 patients had routine early radiographs after their operation, of which 2 (1.1%) had their clinical management altered. The fracture type of all 2 were consistent with AO C3 fractures, which have the highest risk of complications due to their complexity. These results suggest that early postoperative radiographs offer little clinical information in the assessment and management of operatively fixed DRFs with a volar locking plate, particularly in the extra-articular. In other words, early postoperative radiographs rarely change the postoperative clinical management of patients.

At the same time, we also noticed 94% of patients had extra-articular fractures among patients who did not undergo early imaging,it may be bacause they were told that their fracture is not serious by surgeons in the first visiting.

Our results are consistent with the findings of prior studies. Chaudhry et al.[15] demonstrated that serial radiographs in acute settings do not alter fracture management in minimally displaced fractures. Besides, Teo et al.[16] reported that current literature suggested immediate postoperative radiography can't result in management change in the great majority of patients after orthopedic surgery. Added profound reporting and further prospective comparative research should be encouraged. Furthermore, Johnson et al.[6] showed that 96% of patients did not undergo further treatment after early plain films. Based on their study, this may provide a basis for reducing early postoperative imaging examinations.Weil et al.[17] demonstrated only 1.5% of routine radiographs affect post-operative management after VLP for DRFs, high medical costs associated should be weighed, many radiographs are taken on routine without altered clinical decision-making and can be removed. Schultz et al. [7] found early postoperative radiographs had no obvious effect on patient satisfaction, but it may play an important role in the surgeon's explanation of their injury.

These studies concluded that early routine radiographs did not significantly influence clinical decision making, but did increase health care costs and radiation exposure. our study performs all 2 patients who had AO type C fractures(AO/OTA classification)were altered treatment,it mays be related to AO type C fractures resulted in the highest risk of complications.Although current research shows that early postoperative examination is of little significance, we consider it is not advisable to arbitrarily reduce early postoperative inspections.We believe that decisions should be made on a case-by-case basis based on the individual risk of each patient.This emphasizes the importance of risk stratification, and routine early postoperative X-ray examinations for some patients with DRFs. By the current results, DRFs patients with type C (AO/OTA classification) need more early postoperative radiographs.

There are some limitations in our research. First of all, we neither introduced a functional rating scale to evaluate the postoperative situation nor did we investigate patient satisfaction, whether to undergo revision surgery may not be enough to explain the problem. Secondly, this study is retrospective and may limit the interpretation of data, a prospective study could easily be developed to increase the numbers and reliability of the data. At last, The small sample size may make it difficult to obtain reliable conclusions.

Conclusion

Although the practice of evaluating the quality of reduction by early postoperative radiographs at the postoperative follow-up is very common, we find that early postoperative radiographs do not bring about an adjustment in postoperative management, rather depose a financial burden on the medical insurance system and increase radiation risk. Moreover,intra-articular fractures may still benefit from early postoperative radiographs compared with extra-articular fractures.Thus, we call for the reduction of unnecessary postoperative radiographs in the clinical visit.

Abbreviations

DRFs distal radius fractures

VLP volar plate fixation

Declarations

Availability of data and materials

The data and materials contributing to this article may be made available upon request by sending an e-mail to the first author.

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Contributions

GZ conceived the study, participated in its design. WJ helped in collecting the clinical data and drafted the manuscript. All authors read and approved the final manuscript.

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Ethics declarations

Ethics approval and consent to participate

The ethics committee of Wannan Medical College approved the study.

Consent for publication

Consent

Competing interests

The authors declare that they have no competing interests.

References

1. Nellans, K.W., E. Kowalski, and K.C. Chung, *The epidemiology of distal radius fractures.* Hand Clin, 2012. **28**(2): p. 113-125.
2. Chung, K.C. and S.V. Spilson, *The frequency and epidemiology of hand and forearm fractures in the United States.* J Hand Surg Am, 2001. **26**(5): p. 908-15.
3. Bergsma, M., et al., *Volar plating in distal radius fractures: A prospective clinical study on efficacy of dorsal tangential views to avoid screw penetration.* Injury, 2018. **49**(10): p. 1810-1815.

4. Teunis, T., et al., *Evaluation of radiographic fracture position 1 year after variable angle locking volar distal radius plating: a prospective multicentre case series.* The Journal of hand surgery, European volume, 2017. **42**(5): p. 493-500.
5. Khan, M., S. Noordin, and P. Hashmi, *Intra-articular distal radius fractures: Postoperative roentgenographic and functional outcomes.* The Journal of the Pakistan Medical Association, 2016. **66**(3): p. 275-279.
6. Johnson, S.P., et al., *Use of Postoperative Radiographs following Operative Fixation of Distal Radius Fractures.* Plast Reconstr Surg, 2016. **138**(6): p. 1255-1263.
7. Schultz, B.J., et al., *Early Postoperative Radiographs Have No Effect on Orthopaedic Trauma Patient's Satisfaction With Their Clinic Visit.* Journal of the American Academy of Orthopaedic Surgeons, 2020. **28**(3): p. e125-e130.
8. Phelps, K., et al., *Utility of Routine Postoperative Radiographs After Fixation of Lower Extremity Fractures.* J Am Acad Orthop Surg, 2018. **26**(22): p. 799-808.
9. Sharma, V., et al., *The Role of Early Post-Operative Radiographs Following Distal Radius Fracture Fixation with a Volar Locking Plate: Time for Change?* J Hand Surg Asian Pac Vol, 2019. **24**(4): p. 435-439.
10. Stone, J.D., et al., *Utility and cost analysis of radiographs taken 2 weeks following plate fixation of distal radius fractures.* J Hand Surg Am, 2015. **40**(6): p. 1106-9.
11. Huffaker, S., B.E. Earp, and P.E. Blazar, *The value of post-operative radiographs in clinical management of AO type A distal radius fractures.* J Hand Surg Eur Vol, 2015. **40**(8): p. 790-795.
12. Christiano, A.V., et al., *Second physician review of radiographs after wrist and ankle reductions offers limited utility to clinical management.* Emerg Radiol, 2020. **27**(2): p. 191-193.
13. Seki, Y., et al., *Distal locking screw length for volar locking plate fixation of distal radius fractures: Postoperative stability of full-length unicortical versus shorter screws.* Hand Surg Rehabil, 2019. **38**(1): p. 28-33.
14. Oehme, F., et al., *Are Routine Radiographs Needed the Day After Open Reduction and Internal Fixation Surgery for Distal Radius and Ankle Fractures: Study Protocol for a Prospective, Open Label, Randomized Controlled Trial.* JMIR Res Protoc, 2017. **6**(8): p. e159.
15. Chaudhry, S., E.M. DelSole, and K.A. Egol, *Post-splinting radiographs of minimally displaced fractures: good medicine or medicolegal protection?* J Bone Joint Surg Am, 2012. **94**(17): p. e128.
16. Teo, T., et al., *Do Immediate Postoperative Radiographs Change Patient Management After Fracture Fixation? A Systematic Review.* J Orthop Trauma, 2018. **32**(5): p. 211-215.
17. Weil, N.L., et al., *Routine follow-up radiographs for distal radius fractures are seldom clinically substantiated.* Arch Orthop Trauma Surg, 2017. **137**(9): p. 1187-1191.

Figures

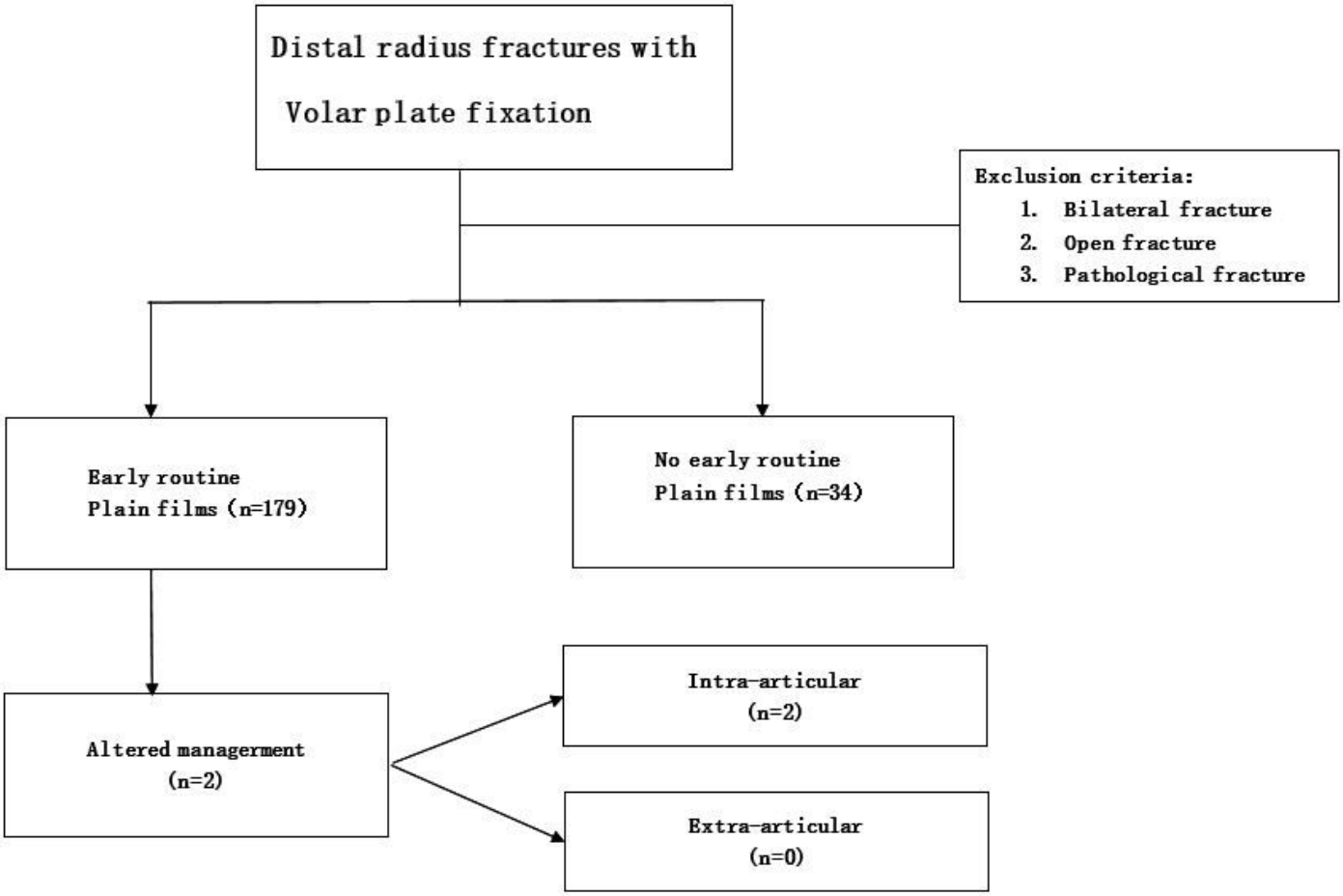


Figure 1

flow chart of study