

Intrafocal Pinning in Distal Extraarticular Radius Fracture: A Retrospective Study Based on Patient Age

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Background: Percutaneous intrafocal pinning is one of the many surgical options for extraarticular distal radius fracture with minimal comminution. This study aims to describe the role and indications of intrafocal pinning.

Methods: This monocentric, retrospective study included 49 patients who underwent intrafocal pinning for distal radius fractures in 2013 in our French hand surgery department. All the patients underwent posteroanterior and lateral x-ray on days 2 and 45 to measure radial inclination, distal radioulnar index, and volar tilt.

Results: The mean age of the patients was 45.4 years, with women representing approximately 61.2% of the sample (n = 30). The patients were divided into three groups: group A (17–50 y), 26 patients; group B (50–70 y), 15 patients; and group C (>70 y), eight patients. We documented on x-ray images, 21 secondary displacements, including seven in group C. There were three displacements (all in group C) and one surgical revision within 15 days for a previous displacement. The distal radioulnar index increased in all three groups.

Conclusions: The percutaneous intrafocal pinning fixation technique exposes a high risk of complications, especially for those older than 50 years, for whom this technique should be avoided. Overall, due to the frequency of secondary displacements encountered, our first-line treatment favors plate osteosynthesis for all patients. Pinning fixation should only be considered with caution in younger patients if plate osteosynthesis is not possible, but it requires a strict 6-week immobilization. The fracture morphology must also be considered. (*Plast Reconstr Surg Glob Open* 2024; 12:e6229; doi: [10.1097/GOX.00000000000006229](https://doi.org/10.1097/GOX.00000000000006229); Published online 15 October 2024.)

INTRODUCTION

Distal radius fractures are among the most common fractures in orthopedic surgery,^{1,2} with a significance in patients

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17–64 years of age.³ According to a recent report, the incidence of these fractures is increasing annually due to the overall potential for patients to have a longer life expectancy with comorbidities such as osteoporosis.³ Although older persons have a higher risk for distal radius fractures, distal radius fractures still have a remarkable impact on the daily functionality of younger adults, as they directly affect wrist and hand function.⁴ The extension in life expectancy increases the need to maintain wrist function to preserve the fragile autonomy of older patients. The treatment of confirmed distal radius fractures involves pain management, immobilization, and assessment for open fractures or neurovascular complications. Operative and nonoperative treatments have been advocated with no consensus on the optimal treatment.⁵ Although the surgical indication remains debated for older patients,⁶ we believe that indications should be selected on a case-by-case basis depending on the functional demand of the patient.

Thus, for young patients, some studies reported no difference between surgical and nonsurgical treatments in terms of functional outcomes,^{7,8} a recent systematic review and meta-analysis found that surgical treatment improved medium-term functional outcome and grip strength.⁹ Nevertheless, surgery is increasingly being offered for

Disclosure statements are at the end of this article, following the correspondence information.

distal radius fractures despite the higher costs associated with treatment and limited evidence on functional outcomes.¹⁰

Pinning was the first proposed operative method, and it has undergone many changes during the last few years.¹¹ Other techniques such as external fixation and plate fixation have gained ground,¹¹ including at our institution where it was the main technique performed before 2013. External fixation and percutaneous pinning were considered to be the treatments of choice, but intrafocal pinning has been reported to be associated with good or excellent mobility and normal grip strength.¹² Although many surgeons use osteosynthesis with Kirschner-wire pinning, this technique does not prevent secondary displacement (especially in osteoporotic patients), prompting some investigators to propose intrafocal pinning, which limits secondary displacement unlikely due to the bumping of the distal fragment on the pins.¹² Nevertheless, there is a paucity of evidence to inform on the role of intrafocal pinning in distal radius fractures.

In view of the different risk factors and variable bone quality according to age, and in view of the nonconsensual data in the literature, we can ask ourselves whether age seems to be a prognostic factor for the indication of intrafocal pinning. The purpose of this study is to evaluate the risk of secondary displacement of distal radius fractures and the rate of reintervention managing of these fractures by intrafocal pinning according to three different age groups.

MATERIALS AND METHODS

This monocentric, retrospective clinical study was conducted in 2013 at our French orthopedic traumatology and hand surgery department. Our inclusion criteria were patients with extraarticular fractures of the distal radius without or with only one single intra-articular refracture line, aged at least 16 years and without upper age limits, who had undergone surgical treatment with pinning between 2000 and 2013. Exclusion criteria were the absence of a complete follow-up of at least 45 days and the presence of several articular refracture lines (>1). Seventy-one patients with distal radius fractures were offered intrafocal pinning at our department. Among these patients, 15 were excluded (because they presented more than one articular line fracture, although they were operated on by intrafocal pinning) and seven were lost to follow-up. Overall, intrafocal pinning was performed on 49 patients. All the patients had posterior, anterior, and lateral x-ray views of the wrist on the second and 45th day to measure radial inclination, distal radioulnar index, and volar tilt. Secondary fracture displacement was defined by the senior surgeon as a displacement of the distal radius fracture that resulted in an unacceptable position, after an adequate baseline position in nonoperatively treated patients.

Surgical Technique

The Kapandji technique was the predominant technique used for fixation.¹² The intervention was performed

Takeaways

Question: What are the right indications for using intrafocal pinning for distal radius fractures?

Findings: The percutaneous intrafocal pinning fixation technique exposes a high risk of complications, especially for patients older than 50 years, for whom this technique should be avoided. Due to the frequency of secondary displacements encountered, our first-line treatment favors plate osteosynthesis for all patients.

Meaning: This article refines the indications of intrafocal pinning for distal radius fractures.

under general anesthesia or regional anesthesia of the brachial plexus. Fracture reduction was achieved by using 5–10 kg of traction. After checking that reduction was maintained on fluoroscopy control, the surgeon introduced a pin through the radial styloid process, crossing the fracture focus in an intrafocal way. The pin was pushed to the middle of the fracture gap and pulled upwards to restore radial inclination. Fixation was secured by driving the pin through the ulnar cortex of the radius. The process was repeated with a pin introduced dorsally to maintain volar cortical alignment. In all our patients, with or without dorsal comminuted fractures, a third dorsal pin was used as recommended¹³ (Fig. 1). All patients had their arms immobilized for 6 weeks (wrist immobilization splint).

Statistical Analysis

Data were collected by reviewing charts from the hospital's electronic patient record, and descriptive statistics were used to analyze the data. Patients were stratified by age into three groups: group A (17–50 y), group B (50–70 y), and group C (>70 y). These different age groups have been defined arbitrarily, from the experience of the senior author. Statistical analyses were performed on Prism 9 (GraphPad Software) using an unpaired Student *t* test (each set of data has been averaged). A *P* value less than 0.05 was considered statistically significant. Categorical variables are expressed as frequencies and percentages.

RESULTS

General and Clinical Characteristics

Among 71 patients selected, 15 were excluded and seven were lost to follow-up. Overall, 49 patients with extraarticular fracture were included.

The mean age of the patients was 45.4 years, with women representing approximately 61.2% of the sample (*n* = 30). When stratified by age, the number of patients in each group was as follows: 26 in group A, 15 in group B, and eight in group C. An additional articular fracture line was reported in seven patients, whereas pure extraarticular fractures, without articular fracture line were observed in 41 cases. Of the 49 patients included in this analysis, 18 had ulnar styloid fractures. All patients had their arms immobilized for 6 weeks (wrist immobilization splint). The frequency of comminuted fractures in the three groups was as



Fig. 1. Clinical case of a 55-year-old patient with distal radius fracture with posterior displacement in whom fixation with the three pins technique was used with minimal comminution. A, Preoperative profile radiograph showing a distal radius fracture with posterior displacement. B, Front x-ray showing a fixation with the three pins technique. C, Postoperative profile radiograph showing a minimal comminution.

follows: group A, 82%; group B, 86%; and group C, 100%. In 47 patients, fractures of the distal radius were extraarticular with posterior displacement. Profile x-ray views showed posterior comminution in 32 patients, whereas anteroposterior comminuted fractures of the radius were observed in 10 patients. Only seven patients did not have a comminuted fracture (including five in group A). Our statistical analysis showed a significant difference between group C and group A and group C and group B ($P < 0.05$). However, No statistical difference was found between groups A and B ($P > 0.05$).

In 42 patients, intrafocal pinning was performed using three pins (posterointernal, posteroexternal, and lateral). Three patients had a posterointernal wire and four had two posterointernal and external wires. Nine patients also had radial styloid pinning. The average length of hospital stay was 3.3 days (range, 2–11 d). All patients wore an antebrachial palmar orthosis for 45 days.

The Kapandji technique was performed in 37 patients, including 18 in group A, 14 in group B, and five in group C. In five patients (including four in group A and one in group C), two pins were drilled posteriorly, and in three cases, one pin was introduced through the styloid process. In three patients (all in group A), one posterointernal pin and one styloid pin were placed. The “KapanStaing” method was performed in four patients (all in group C) (Fig. 2). This technique is a closed pin osteosynthesis that combines one or two dorsal intrafocal pins according to Kapandji and one or two external pins in the styloid process of the radius according to Castaing (Fig. 3). This technique results in less anterior “hyperreduction” and is more stable in much older patients with a highly displaced fracture.¹⁴ The average angle of the pins for all patients in the sample, that is, the average angle measured between the axis of the radius and the axis between the intrafocal pin(s) of the isolated Kapandji, was 38.9 degrees (range, 18–60 degrees). Physiotherapy was offered to all patients after surgery and started on day 45 in all cases.

Complications

The most common complications included secondary displacements (Fig. 4), which occurred in approximately 43% of the cases ($n = 21$); nine were anterior displacements. Group C patients were the most affected, with 88% of the patients ($n = 7$) presenting displaced fractures and 38% having fracture displacement ($n = 3$). Approximately 47% of group B patients had secondary displacement versus 31% in group A. A second procedure was performed 15 days after pinning in one case of anterior displacement, with a conversion to plate osteosynthesis. The other patients with secondary displacements had a tolerable degree (<20%) of displacement, and no surgical management, after discussion with the patient and orthopedics colleagues, was considered favorable to the benefit/risk ratio. No pin infections or tendon ruptures were recorded on these retrospective data.

Clinical and Radiologic Outcomes

The distal radioulnar index increased in all three groups. A summary of radiologic outcomes is depicted in Table 1.

In all cases, the pins were removed after 6 weeks. On day 90, approximately 50% of the patients complained of stiffness and pain. Physiotherapy was continued for 17 patients. Patient follow-up was discontinued at 6 postoperative weeks for 20 patients and 12 postoperative weeks for the other 29 patients.

DISCUSSION

Our study shows that the percutaneous intrafocal pinning fixation technique exposes a high risk of complications, especially for those older than 50 years, for whom this technique should be avoided.

Percutaneous intrafocal pinning was an advocated surgical solution for the treatment of distal fractures of the radius because it is less invasive and comparatively faster



Fig. 2. Clinical case of a 53-year-old patient with distal radius fracture with posterior displacement and fixation with the KapanStaing technique. A, Preoperative front x-ray showing a distal radius fracture. B, Preoperative profile radiograph showing a distal radius fracture with posterior displacement. C, Postoperative front x-ray showing a fixation with the KapanStaing technique (day 3). D, Postoperative profile radiograph showing a fixation with the KapanStaing technique (day 3).

to perform than fixation methods such as plating. Before 2010, percutaneous intrafocal pinning was mostly offered to patients who were treated for distal radius fractures at our institution. However, the use of percutaneous intrafocal pinning declined after 2010 in favor of anterior plating, due to high displacement rates encountered. In

fact, in 2013, a total of 147 patients followed up at our institution had fixation with a plate versus 71 who had intrafocal pinning. However, this conclusion is from our center experience and does not reflect the reality of all centers who found that closed reduction and percutaneous pinning appears to be superior to other treatment

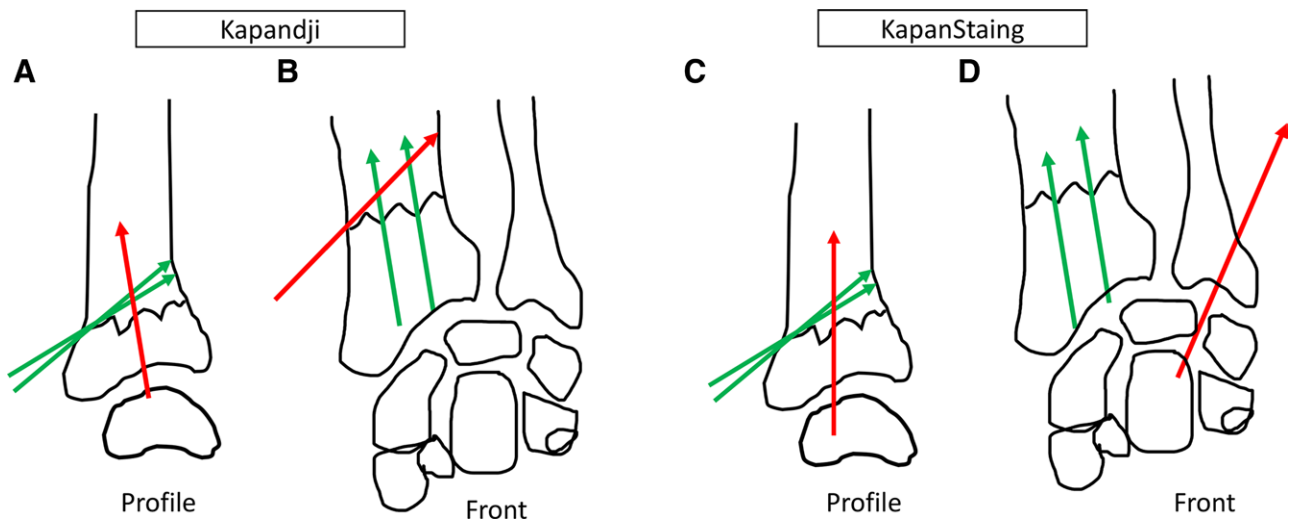


Fig. 3. Diagram showing the difference between a Kapandji intrafocal pinning technique and the KapanStaing pinning technique. A, Profile view showing a fixation with Kapandji technique. The dorsal intrafocal pin is in green according to Kapandji. B, Front view showing a fixation with the Kapandji technique. C, Profile view showing a fixation with the KapanStaing technique. The red pin is in the radial styloid process according to Castaing. D, Front view showing a fixation with the KapanStaing technique.



Fig. 4. Clinical case of 61-year-old women with Kapandji pinning treatment, complicated by anterior displacement. A, Preoperative profile (left) and front (right) radiograph showing a distal radius fracture with posterior displacement. B, Profile (left) and front (right) x-ray showing a fixation with the three pins technique. C, Postoperative profile (left) and front (right) radiograph showing a secondary anterior displacement at 15 days. D, Postoperative profile (left) and front (right) photograph showing reduction of the secondary displacement by osteosynthesis plate.

Table 1. Summary of Radiologic Outcomes

	Patients <50 y	Patients between 50–70 y	Patients >70 y
RT D2 postoperative	20.5	20	20
RT D45 postoperative	20.5	20	23.5
DRI D2 postoperative	-1.1	0.1	0.6
DRI D45 postoperative	-0.75	0.3	3.6
Volartilt D2 postoperative	7.5	8.75	7.0
Volartilt D45 postoperative	6.0	8.2	9.0

RS, radial slope; RT, radial tilt.

options,^{15–17} and our analysis did not focus on the fracture morphology aspect.

According to some reports,^{18,19} fixation by volar plating is superior to other surgical techniques, such as external fixation, in the treatment of older patients with distal radius fractures. However, no specific recommendations have been proposed for the treatment of specific fracture types due to a paucity of convincing evidence, especially in function of the different age groups.^{20–22} Although no practice guidelines exist for the treatment of distal radius fractures, orthopedic surgeons generally prefer open reduction and internal fixation (ORIF) over closed reduction and percutaneous intrafocal pinning, although ORIF does not always appear superior in terms of outcomes^{16,23} and has been reported by some investigators to be comparable to percutaneous intrafocal pinning.²⁴ Moreover, it is important to keep in mind that findings from previous studies suggest that closed reduction and percutaneous pinning is superior to cast immobilization.^{15,25} However, early range of motion could be achieved by an ORIF, compared with 6 weeks of immobilization required by pin therapy.²³

Although previous studies have suggested that intrafocal pinning was a satisfactory method in restoring radiographic measures,^{26,27} other investigators have suggested that radiographic parameters were not associated with patients' self-reported functional capacity.²⁸ Interestingly, in our cohort, the radiographic criteria are not optimal postoperatively, but the number of reinterventions is very low (one of 49). This suggests that perfect reduction of radiographic criteria does not seem to be mandatory for patient satisfaction. Furthermore, there is limited evidence from the medical literature regarding the role of radiographic alignment in the management of older patients with distal radial fractures.^{9,29–32}

In our study, all the patients reported stiffness and pain on day 45 postoperative, but the proportion of patient self-reported stiffness and pain decreased to 50% on day 90 postoperative. However, the short follow-up might underestimate the stiffness outcome, and caution is needed in the interpretation of the long-term outcome. Contrary to our finding, some researchers found that approximately 80% of their patients who had closed reduction and percutaneous pinning showed good to excellent range of motion during their last follow-up visit.²⁷ Similar results were reported by other authors who concluded that closed reduction and percutaneous pinning was associated with excellent range motion.^{16,27,33–35} Our results of percutaneous pinning therefore seem to be less favorable compared with other data in the literature and have led us to abandon this technique in favor of plate osteosynthesis. It is

important to consider that in older patients, cast immobilization can produce comparable functional results to wire fixation despite worse radiological outcomes.³⁶

Of the 49 patients included in this study, 21 (43%) had secondary displacements, with patients older than 70 years (group C) being the most affected. Given that secondary displacements were frequent in older patients and because of the poor bone quality, we believe that intrafocal pinning may be more beneficial than cast immobilization alone if an ORIF is not possible but should only be considered for patients less than 50 years old who present a noncomminuted, extraarticular fracture and are willing to complete a close follow-up and a strict immobilization. In prior studies, superficial infections were reported as the most common complications, occurring in 1.7%–9.5% of patients who had closed reduction and percutaneous pinning for a distal radius fracture.^{33,37} Although pin migration has been reported to cause secondary displacement,³⁸ this was not the case in our cohort.

Of note is that there is no consensus among surgeons regarding the requirement for and the fixation type in patients with distal radius fractures.^{20–22,35} Patients generally do not prefer a specific fixation technique,³⁹ and some studies show that less invasive treatment methods are associated with subjective outcomes in some fracture types.^{40,41} Conversely, one randomized clinical trial showed that the early postoperative functional outcomes appeared to be in favor of ORIF, albeit no significant differences were found in a 2009 prospective study between ORIF and closed reduction and percutaneous fixation.⁴² It is important to keep in mind that, worldwide, one of the major factors in the selection of percutaneous pinning or cast immobilization alone is the high cost of plates and screws.

In our practice, we prefer to use palmar plate fixation for radius management. However, when conditions are unfavorable (damage care control, etc), intrafocal percutaneous pinning is a therapeutic solution that may be of interest, particularly for patients younger than 50 years of age. For patients older than 70 years of age, although the clinical results do not correlate with the radiographic criteria, we advise against intrafocal pinning, preferring other methods of fixation or cast immobilization after reduction. This study has limitations that should be addressed. First, it has all the limitations inherent to retrospective studies. Second, its small sample size (especially group C) makes it challenging to draw relevant conclusions. In addition, we did not perform accurate joint range measurements; however, joint range of motion measurements or functional outcomes were not part of our evaluation and study

objective (which was to evaluate complication rate, radiographic displacement, and reintervention rate). In addition, although the number of secondary displacements appears to be significant, our chart follow-up is not extensive enough to evaluate the occurrence of “adaptive carpus.” Indeed, although intrafocal pinning seems to lead to correct functional results, we believe that the high rate of secondary displacement is a risk for developing a long-term carpal biomechanical disorder. Longer follow-up would be necessary to confirm this assumption. Moreover, the impact of the variation between KapanStaing and KapanStaing techniques on the final conclusions have not been evaluated. A study evaluating the real impact of the KapanStaing technique on reduction stabilization could be interesting.

Finally, the interventions were performed by four different surgeons, making it difficult to state that the procedures were similar, as there is surgeon variability and other factors that can influence this. Last but not least, the fracture morphology was not considered but could be a bias in the result interpretation. Our outcome interpretation must therefore appeal to caution, given the lack of fracture morphology analysis.

CONCLUSIONS

The percutaneous intrafocal pinning fixation technique exposes a high risk of complications, especially for those older than 50 years, for whom this technique should be avoided. Overall, due to the frequency of secondary displacements encountered, our first-line treatment favors plate osteosynthesis for all patients. Pinning fixation should only be considered with caution in younger patients with extraarticular distal radius fracture with minimal comminution if plate osteosynthesis is not possible, but it requires a strict 6-week immobilization and a close follow-up. The fracture morphology must also be considered when choosing the most appropriate treatment.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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