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Trans-styloid associated to intrafocal pinning for distal radius fracture with posterior tilt

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Abstract
Introduction: The objective of this study was to evaluate radiographic and functional results after trans-styloid associated with intrafocal pinning of distal radius fracture
Materials and Method: This retrospective study was about patient's records operated from February 2016 to April 2018 for posterior displaced distal radius fracture using trans-styloid and intrafocal pinning. Patients were cared of in Orthopedic Unit of CHP Aneho.
Check up for functional evaluation was done at six months after surgery. Castaing Radiological and functional scorings were used successively after surgery and at check up at six months.
Thirty patients with thirty-one broken wrist were recorded, 18 men and 12 women. We found 19 extraarticular and 12 partial articular posterior displaced distal radius fractures. Complications were searched.
Results: We obtained very good results in 19%, good in 55%, medium (26%) with Castaing radiologic scoring. At check up at six months, functional results were medium to very good in 77% using Castaing functional scoring.
Discussion: Distal radius pinning is still used in adult's traumatology. Trans-styloid pinning assured better stability until fusion at 06 weeks. Using of fluoroscopy can help for better reduction in articular fractures.
Conclusion: Trans-styloid with intrafocal pinning of distal radius fracture assured medium to very good results. Trans-styloid pinning must be orderly in this type of surgery.

Keywords: Mixed pinning, k-wire, distal radius, fracture

Introduction
Since the extrafocal pinning described by Lambotte in 1908 [1], several techniques for pinning the distal radius have been used and have evolved over time [2, 3, 4, 5, 6, 7, 8, 9]. The variation in methods was based on the limitations and complications of the older techniques. Kapandji [2], in describing his original technique, used two intrafocal wires without additional immobilization. He revised this technique ten years later by adding a third dorsomedial pin and extending the indications to fractures with a joint component [3, 4].
The results of this technique are acceptable but are not without complications such as superficial infection, tendon rupture, nerve damage and hypercorrection [2, 7, 8].
Despite the appearance of new implants of osteosynthesis of the distal radius [10, 11, 12], the use of k-wires is still common throughout the world, especially in sub-Saharan African countries [13, 14]. The objective of this study was to evaluate the radiological and clinical results of posteriorly tilted distal radius fractures treated by mixed pinning in a provincial hospital in Togo.

Patients and method
Patients
The patients were admitted in consultation or in surgical emergency. The surgical management was done between February 2016 and April 2018 in the orthopedic unit of the Centre Hospitalier Prefectoral Aneho The average age of our patients was 32 years (16- 55 years).

The fractures were of the distal radius with posterior tilt: 19 extra-articular fractures and 12 fractures with an articular component. Thirty patients were operated on, including one bilateral case. They were 18 men and 12 women. There was a Gustilo Anderson type I skin opening on the ulnar side in two cases. According to the MEU classification [15], we noted the lesions M1(n=15; 48.5%) M2 (n=09; 29%) M3 (n=05; 16%) M4(n=02; 06.5%). E lesions identified as E1 (n=13; 42%) E2(n=09; 29%) E3 (n=09; 23%). Associated ulnar lesions were classified as U0 (n=15; 48.5%) U1 (n=11; 35.5%) U2 (n=05; 16%).

The average time between the trauma and the surgical procedure was 06 days (1-15 days). Trimming and suturing were performed upon admission to the emergency room in case of open fracture and antibiotic prophylaxis with amoxicillin and clavulanic acid was instituted for 7 days. An analgesic splint was applied in all cases while awaiting surgical treatment.

Therapeutic procedure

The procedure was performed under general anaesthesia and without fluoroscopic control. Two senior surgeons were operators. The tourniquet was not used. The procedure started with a reduction by external maneuver: traction, dorsal pressure, then palmar flexion and ulnar tilt (Figure 1). The quality of the reduction was assessed by the correction of the posterior tilt and Laugier's line. The maneuver was repeated as many times as necessary to achieve a clinically satisfactory reduction. The lateral pin was first placed.

After skin spearing, a micro Halstead forceps was used to spread the tendons to the focus. The forceps were then opened to allow the introduction of a 20/10 kirschner wire cut to 5 cm in length. A drill was used to advance the wire at a 45° angle. The wire was inserted into the opposite cortex. The same procedure allowed the introduction of a dorsolateral, dorsomedial, and finally styloid wire.

The flush cut pin was buried under the skin. A skin suture was made with a greasy dressing. The ulnar styloid fracture was treated with a transosseous suture using Vicryl 1.

A plaster or resin cuff was applied for a period of 06 weeks. An X-ray was taken on the first day and on the 45th day. The cast was removed after this period, followed by the removal of the pins under local anaesthesia. Physical therapy was performed until the 3rd-month check-up.

Evaluation criteria

Castaing's functional and radiological scores were used for evaluation (Tables 1 and 2).

Angular measurements were taken on immediate postoperative radiographs. Patients were called in at 06 months postoperatively for evaluation. Patients were called in at 6 months postoperatively for evaluation. Late complications such as lesions of the sensitive branch of the radial nerve, loss of reduction, hypercorrection, pin migration, distal radioulnar diastasis, superficial infection and algo-dystrophic syndrome were recorded.

Table 1: Castaing's functional score

Score	Pain	Streng	Mobility
1.	No	Normal	Normal
2.	Lightweight, does not interfere with work	Slightly reduced	Flexion extension: 90°. Pronosupination: 160°.
3.	Work is possible but disrupted	Very reduced	Flexion xtension: 60° Pronosupination: 110°
4.	Current Gestuality; Impossible work	Impossible	Flexion extension: 45° Pronosupination: 90°
5.	Discomfort during usual activity	Impossible	Flexion extension: 30° Pronosupination: 60°
6.	Unusable hand	Unusable hand	Stiff wrist

Table 2: Radiological score according to Castaing

Quotation	FRT	SRT	RUI
4	> or = 23°	3° to 10°	>or = +2mm
3	19° to 22°	+2° to -5°	+2mm to -2mm
2	15° to 18°	-6° to -10°	-3mm to – 5mm
1	< 15°	>-10°	< or = -6mm

FRT: Frontal Radial Tilt. SRT= Sagittal Radial Tilt.
RUI= Radio-Ulnar Index. Very good (restitution ad integrum):
All indices normal to 4. Good (mild anatomical deformity):
Subnormal indices> or =3. Fair (noticeable anatomic deformity):
One index at 2; the rest> or= 3. Poor (significant anatomic deformity):
One index at 1 or several at 2.

Statistical method

Data were collected using epi info software and analyzed with R software version 4.1.1.

Results

Immediate postoperative radiological measurements were performed with a goniometer. Frontal and lateral radiographs were taken preoperatively and postoperatively (Figures 2 and 3). According to Castaing's radiological score, the results were very good (n= 06 cases; 19%), good (n= 17 cases; 55%), fair (n= 08 cases; 26%), and poor (n=0).

Seven patients had an additional trans-bone suture of the ulnar styloid. Bone healing was achieved after 06 weeks in all patients.

Twenty-four patients responded to the last follow-up at 6 months.

The functional score according to Castaing for the patients reviewed at the 6th month showed average to very good results: Very good (n=05 cases; 16%) Good (n=15; 48%) Average (n=04; 13%)

Late complications were hypoesthesia of the dorsal aspect of the first digital commissure in 01 case, loss of reduction with loss of height of the distal radio-ulnar index finger of 1mm in 03 cases. Radioulnar diastasis was noted in 05 cases. No pin migration or algo-neuro-dystrophic syndrome was noted.

Discussion

Anatomic reduction and stable fixation allow for a good result

in patients with high functional demands. The amplifier would help to better control the reduction and the positioning of the pins. It was not available in our center. For Kapandji [2, 3], its use was not essential. Ayouba [14] *et al*. did not use it and had good results for extraarticular fractures.

Nevertheless, this tool would have been of considerable help for the placement of the pins, especially for lesions with articular extension. To overcome this difficulty, the surgical procedure followed as described allowed for a satisfactory clinical reduction before pinning.

General anesthesia was used for the procedure in all our patients, as suggested by Kapandji [3] *et al*. It ensured not only the patient's comfort but also that of the surgeon, in order to perform the reduction maneuver without resistance from the patient; on the other hand, the removal of the wires was done under local anesthesia.

For Brand [4] *et al*. local anesthesia in the initial phase did not ensure anesthesia of the opposite cortex and periosteum and muscle relaxation.

The planning of the procedure under general anaesthesia and the delay in consultation forced a delayed surgery. This was not the case for Bah [13] and Ayouba [14] *et al*. who, by proceeding under local anaesthesia, ensured that the operation was performed within 24 to 72 hours after the trauma.

Radiological reduction was satisfactory despite the absence of fluoroscopic control. The use of a slow-speed surgical drill allowed the implant to be driven into the opposite cortex without loss of reduction. For Kapandji [3], the disadvantage of the motor was that the pins always protruded too far. With a little practice, the operator could "feel" the opposite cortex being crossed; the important thing is to pass through in one go. A multiple pass would expose the risk of weakening the opposite cortex. Brand [4] used a motor or an American handle depending on availability.

This reduction was little changed at the last check-up, which indicates the interest of the styloid pin, which ensures better stability of the assembly. Gravier [7] *et al.* had found similar results. Additional systematic styloid pinning should be strongly recommended. Ayouba [14] *et al*. had a loss of reduction in 28% of the cases when only intrafocal pinning was performed.

In addition, the relatively young profile of our series associated with styloidal pinning could also explain the better holding of the pins and the absence of migration.

The functional result was average to very good at the last follow-up at 06 months. The follow-up of physical therapy and the young profile of our series would have contributed to this result. This confirms our view that pinning is indicated for these fractures with joint extension. Additional immobilization would therefore contribute to the preservation of reduction until consolidation.

A significant comminution cannot be corrected globally without fluoroscopic control and the anterior locked plate which is increasingly used especially in developed countries [16, 17, 18]. The limitation in our context is the technical platform and the cost of these implants.

A good mastery of mixed pinning would therefore be an asset for the treatment of these frequently encountered lesions. Durrans [19] *et al*. propose also pinning for non-osteoporotic patients who can tolerate a delayed return to work.

a: traction reduction of posterior tilt by palmar flexion
b: Reduction of external translation by ulnar tilt
c: Placement of the four K-wires

Fig 1: Stages of reduction by external maneuvers and pinning

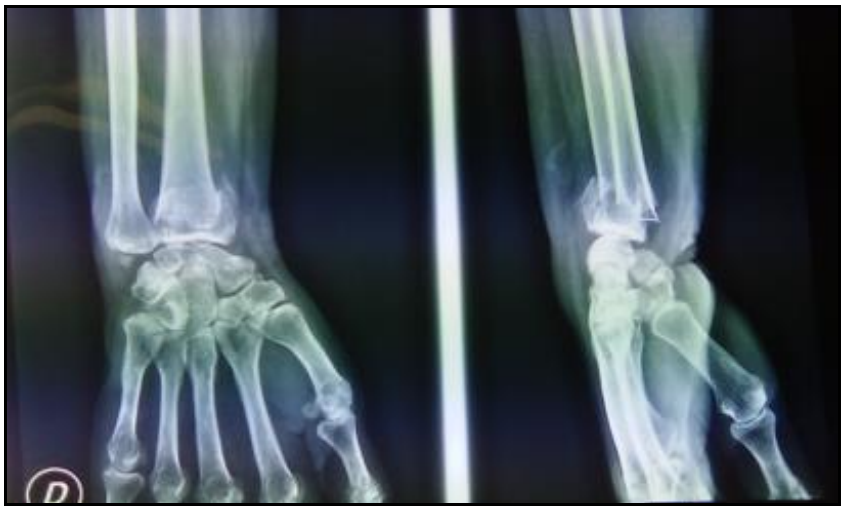

Fig 2: Wrist X-ray showing a posteriorly tilted right distal radius articular fracture in a 50-year-old female patient.

Fig 3: Control radiograph showing reduction and osteosynthesis of the fracture in Figure 2 by mixed pinning, ulnar styloid trans-osseous suture, and plaster cuff immobilization.

Conclusion

Mixed pinning of posteriorly tilted distal radius fractures without an image intensifier in a peripheral hospital gave good and fair functional results in 77% of cases.

We recommend this procedure with the use of the image intensifier to increase the quality of reduction and functional recovery, especially in fractures with a joint component in young patients.

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