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INTRA-ARTICULAR FRACTURES OF DISTAL RADIUS;

OUTCOME OF TREATED WITH BRIDGING (STATIC) EXTERNAL FIXATOR

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ABSTRACT…Objective: To assess the radiological and functional outcome of external fixator in the treatment of intar-articular fractures of distal radius. **Study design:** Descriptive case series. **Place and duration of study:** Orthopaedic unit District Headquarter Hospital Temargarha Lower Dir from March 2013 to March 2014. **Material and methods:** Twenty five patients of intra-articular fracture distal radius fulfilling the inclusion criteria were treated with AO external fixator by ligamentotaxis. Preoperative and postoperative radiograph measurements were taken of radial inclination, radial tilt, and radial length, and fractures were classified according to the AO system. The fixator was removed after 6-8 week and functional assessment was done using Gartland and Werely point system at monthly interval for six months. Results: Eighteen male (72%) and 7(28%) females mean age 43.1 years with intra-articular distal radius fractures were treated with external fixator. Preoperative mean radial inclination(10.5 degree) radial tilt(29 degrees dorsal) and radial length(6.3 mm) were reported postoperatively as 18.8 degrees,8 degrees volar and 10 mm respectively at final follow up visit. The functional evaluation by Gartland and Werley's point system reported excellent (60% patients) ,good(20%) and fair(12%) at final follow up visit. One (4%) patient could not achieve union while one (4%) malunion was reported. **Conclusions:** Bridging external fixator(static) yields excellent radiological and functional results in majority of intra-articular distal radius fractures.

Key words: Intra-articular fracture distal radius, External fixator, Ligamentotaxis.

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INTRODUCTION

Fractures of the distal radius are common and account for an estimated 17 % of all fractures diagnosed[1,2]. When a distal radius fracture occurs, it contributes to considerable disability, increased dependence for the injured patient and causes a major challenge for health care systems. Therapeutic alternatives for distal radius fractures differ greatly throughout the world but mainly include internal (IF) and external (EF) fixation[3]. The concept of using an external fixator device to treat wrist injuries was first introduced by Ombredanne in the 1920s for use in adolescent distal radius fractures[4]. The external fixator provides a simple and reliable means of treating unstable intra-articular fracture of the distal radius according to the concept of Ligamentotaxis and its principles that was proposed by Vidal[5]. Ligamentotaxis is the term used to emphasize that, for traction to be effective it must be balanced by counter traction provided by ligaments and soft tissue surrounding the bone[6]. The pull and the counter pull restore the length and guides alignment of the fracture fragments, which are otherwise difficult to control[7]. Fractures of the distal radius can be stabilized with external fixator, either bridging or non-bridging[8]. Bridging external fixation augmented (with or without additional Kirschner wires) is a less demanding, less invasive and faster procedure[9]. There is the additional advantage of not devascularizing bony fragments and not creating a surgical wound[10]. A number of studies have shown favorable results after external fixation of fractures of the distal part of the radius[11]. The

purpose of this study was to assess the radiological and functional outcome of bridging (static)external fixator in the treatment of intar-articular fractures of distal radius. It is hoped that the findings will improve our understanding of the treatment of intra-articular distal radius fractures.

MATERIAL AND METHODS

This study was conducted at Orthopaedic Unit District Headquarter Hospital Temargarha Lower Dir from March 2013 to March 2014 and comprised 25 patients of both gender having (1) an intra-articular fracture distal radius radius(AO type C=C1, C2, C3) (2) reported within 7 days of injury (fresh fracture); (3) had an age 18 years and above (4) gave informed consent for operative care.

Patients were excluded if they had (1)open or bilateral fractures(2) pathological fracture(3) fracture of the scaphoid or scapho-lunate dissociation of the same wrist (4) pre existing inflammatory or degenerative arthritis of the injured wrist, ipsilateral elbow, or shoulder (which would affect the functional outcome). The Ethics Committee of the hospital approved the study and informed consent was obtained from all patients. All fractures were classified as per the AO classification[12]. Radiographs in anterioposterior and lateral views were used to measure preoperative radial inclination ,radial tilt and radial length as described by Kreder[13]. The operative technique was standardized. All surgeries were performed under general anesthesia and within 24-48 hours of admission. The status of the operating surgeon was similar in all cases, with most cases operated by senior registrar. The small AO external fixator, unilateral single plane was used in all cases. Supplementary K-wires were not used routinely. The bridging external fixators (static) were placed using 2 parallel pins in the base of the second metacarpal, and 2 into the shaft of the radius by an open technique using "stab" incisions with the forearm in neutral rotation. Reduction was performed with longitudinal traction or Agee's technique[14]. Articular displacement was reduced by closed means. One dose of preoperative antibiotic (Intravenous Cefuroxime) and three days postoperatively (Intravenous Ceftriaxone) were used in all cases.

Postoperative radiographs were taken within 24 hours of surgery. The operated arm was kept elevated for the first 48 hours. All patients had compression bandages around the pins. The patients were discharged on 2nd postoperative day and advised active movements of fingers and reviewed monthly. At each follow up, radiography was repeated. A record was kept of the radial inclination, radial tilt, and radial length. The fracture union was assessed clinically by absence of tenderness and radiologically the bridging callus formation. No dynamization was done in any case. The external fixation was removed after 6-8 weeks, in the outpatient clinic without anesthesia, and wrist mobilization began supervised by a physiotherapist . Additional splintage was given for 1-2 weeks after the fixator removal in few cases. The range of movements was recorded and any deformity was assessed compared with uninjured side. All cases were followed at an interval of one month for six months. Criteria for results at monthly intervals include deformity, subjective evaluation, range of movements and complications according to modified Gartland and Werley scoring system.(Table -I)[15]. The range of movement was measured using a standard goniometer. Both wrists were assessed and the uninjured wrist was used as a control. The data was analyzed using SPSS (version 12) and represented in tables where necessary.

RESULTS

Twenty five patients of intra-articular distal radius were treated with bridging (static) AO external fixator. There were 18(72%) male and 7(28%) female with mean age 43.1 year (18-65 years). The dominant hand was affected in 16 (64%) of the patients while non dominant in 9 (36%).The mode of injury was road traffic accident (48%, n=12), fall(36%, n=9) and physical assault (16%,n=4). Types of fractures were AO C1 (44%,n=11), C2 (36%,n=9) and C3 (20%,n=5). The injury to surgery time ranged from one to five days (mean three days).

	DESCRIPTION	Points
Deformity	Prominent ulnar styloid	1
	Radial deviation	1-2
	Dinner fork deformity	1-3
	Maximum	6
Subjective evaluation	No pain, no limitation of motion	0
	Occasional pain, some limitation of motion, weakness, pain, limitation of motion	4
	Activities restricted	6
	Maximum	6
Range of motion	Limitation of motion<20%	0
	Limitation of motion<50%	2
	Limitation of motion>50%	6
	Stiffness of wrist	6
	Maximum	6
Complications	None or minimal	0
	Slight crepitation	1-2
	Sever crepitation	3-4
	Median nerve compression	1-3
	Pulp-palm distance 1 cm	3
	Pulp-palm distance > 2cm	5
	Pain in distal radio ulnar joint	1-3
	Maximum	15
Excellent		**0-2**
Good		**3-7**
Fair		**8-18**
Poor		**19-33**

Table-I. Modified Gartland and Werley scoring system

Preoperative and postoperative mean radial inclination, radial tilt and radial length is shown in table-II.

Time	Radial Inclination (degrees)	Radial Tilt (degrees)	Radial (Length (mm)
Peoperative	10.5	29 (dorsal)	6.3
Just after surgery	17.7	9 (volar)	9.5
At final follow up	18.8	8 (volar)	10

Table-II. Preoperative and postoperative mean radial inclination ,radial tilt and radial length.

Fixators were removed when the fracture was deemed to be healed radiographically. The average length of fixation for the whole group was 45 (42-56) days. The functional evaluation by Gartland and Werley's point system after removal of external fixator was excellent (44%,n=11), good(24%,n=6),fair(20%,n=5) and poor(12%,n=3). At six months follow up visit the score improved as excellent (60% patients) ,good(20%) and fair(12%). The most common complication documented was minor pin track infection, occurring in nine patients (36%). All, however, resolved quickly with local and oral antibiotic treatment. Pin loosening occurred in two cases (8%), but premature removal of the external fixator was not required in either case. One (4%) patient could not achieve union while one (4%) malunion was reported (Radial inclination 9 degrees, radial tilt 23 degrees, radial length 5mm) Reflex sympathetic dystrophy and median nerve compression was not documented in any of the twenty-five patients in our study.

DISCUSSION

The distal radius fracture has been an orthopaedic conundrum since its description by Colles[16] in 1814. External fixation, with use of the principle of ligamentotaxis for reduction of the fragments[5,14] has gained wide acceptance for the treatment of unstable fractures of the distal part of the radius. Dynamic and static external fixators both achieve good outcomes for patients with unstable distal radius fractures with comparable complication rates[17]. We achieved good to excellent functional results in 80% of the patients treated with bridging external fixator in our study. Anvekar and

Nimbargi[18] treated 40 intra-articular fractures of distal radius with static external fixator and documented that ligamentotaxis consistently results in a favorable outcome in the management of intra-articular fractures of distal end radius. They achieved 70% good and excellent results using modified Gartland and Werley scoring system. Similarly in another prospective study of 132 patients with an average age of 35 years, unstable intra-articular fractures of the distal radius were treated by external fixator. There were few complications and 83% of patients had good or excellent results[19]. Kapoor and Agarwal[20] compared three treatment modalities of distal radius fractures i.e., closed reduction and plaster immobilisation, external fixation and open reduction and internal fixation, and were followed for an average of 4 years. In the final functional assessment (Sarmiento) the results were (1) plaster 43% good and excellent, 50% fair and 7% poor, (2) external fixator 80% good and excellent, 20% fair and poor results, (3) open reduction and internal fixation 63% good and excellent, 26% fair, 11% poor. They recommend that displaced severely comminuted intra-articular fractures should be treated with an external fixator. In another study twenty four consecutive patients were treated with small AO external fixators by Anderson and Lucas[21] and concluded that although postoperative complications following distal radius fractures treated with external fixation are common, their effect, however, on long term functional results and patient satisfaction is negligible, with the exception of those patients with complications intrinsic to the fracture itself, i.e., nonunion, malunion or carpal malalignment. Margaliot and Hasse[22] conducted a meta-analysis of studies published between 1980 and 2004 on external and internal fixation of distal radial fractures. They concluded that there was not sufficient evidence to support the use of ORIF (open reduction and internal fixation) over external fixation.

The incidence of malunion and nonunion in our study was 8%. Perhaps these complications may have been avoided by employing the use of Kirschner wires, bone graft or some form of internal fixation such as suggested by Pennig and Gausepohl,[23] who commented that supplementary internal fixation is justified whenever there is significant comminution of two or more cortices in the anteroposterior and lateral radiographs. Minor pin tract infection was reported to be 36% in our study. Interestingly, Raskin and Melone[24] reported no pin track infections in their study. They attribute this to their method of pin site care. Instead of exposing the pin sites daily, they covered the external fixator frame with sterile gauze at the skin contact interface, which obviated the need for daily pin site care. Rather, the pins were exposed only during scheduled dressing changes at the surgeon's office, approximately four times during an eight-week period.

The major strength of our study is the 100% follow-up rate. However, the strength of our results was limited by small sample size and shorter follow up period in our study. Larger high-quality clinical trials are needed to confirm the utility of bridging external fixators in intra-articular distal radius fractures. For better results, we need to more carefully consider the issues of long-term outcomes and intraoperative and preoperative factors and report them in a reliable, consistent and standardised manner.

CONCLUSIONS

Bridging external fixator(static) yields excellent radiological and functional results in majority of intra-articular distal radius fractures. It is a stable fixation which permits movements of fingers, elbow and shoulder and is safe & simple procedure acceptable by the patient. We therefore recommend it as a treatment of choice for patients with intra-articular distal radius fractures.

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