ORIGINAL ARTICLE

OUTCOME OF THE DISTAL RADIUS FRACTURES MANAGED WITH ACROSS WRIST EXTERNAL FIXATOR VS BUTTRESS PLATE

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Background: Distal radius fracture is one of the most common injuries presented to emergency department and can be presented in any age group. In young patients the most common cause is Road Traffic Accident (RTA), while old patient history of fall is the most common cause. Different surgical options are available to treat this injury. This study **aims** to compare the outcome of volar buttress plate vs across wrist external fixator for Arbeitsgemeinschaft für Osteosynthesefragen (AO) type C2/C3 fracture of the distal radius. **Methods:** A retrospective comparative study between July 2020 to June 2021 at Ghurki Trust Teaching Hospital was done and a total of 50 patients who underwent surgical intervention for AO C2/C3 fracture of the distal Radius, were included. The follow-up period was 12 weeks. QuickDASH score was used to find out patient's functional outcomes. Functional outcome was analyzed between the two groups using Mann-Whitney U test, using SPSS version 21. **Result:** There was no significant statistical difference between the functional outcome of patients with distal radius fracture treated with across wrist external fixator vs volar buttress plate, in term of QuickDASH score. Furthermore, age and gender also were having no effect on functional outcome in our population. **Conclusion:** Across wrist external fixator is a reasonable option for AO C2/C3 type fractures of the distal radius with comparable results with volar buttress plate. It is the procedure of choice in high volume tertiary care hospitals like Gurki Trust Teaching hospital as it saves time, have similar functional outcome score, no need to re-open for removal of implant, less chances of tendon rupture as compared to volar buttress plate for distal radius fracture.

Keywords: Across wrist external fixator; Buttress plate; Distal radius fracture

Citation: Ali R, Ilyas A, Riaz H, Faheem U, Khan J. Outcome of the distal radius fractures managed with across wrist external fixator vs buttress plate. J Ayub Med Coll Abbottabad 2023;35(1):32–6.

DOI: 10.55519/JAMC-01-10605

INTRODUCTION

Traumatic injuries are considered to be one the most common causes of orthopaedic injuries, resulting in fractures of limbs, Pelvis, and vertebrae or soft tissues injuries that include ligamentous sprain and musculotendinous strains. Among these injuries seen by orthopaedic surgeons, the most common are fractures of the limbs especially the distal radius followed by the proximal femur fracture. The distal radial fracture has been studied frequently and is most frequently seen in the elder population. It is the second most common injury over 65 years, the complexity of these fractures is directly proportional to the Bone Mineral Density (BMD) and clinical outcome are inversely proportional to BMD.[1–4]

Distal radial fractures (DRF) create a greatest challenge to operating surgeons. In terms of management, multiple options are present that include both surgical and conservative.[4] The surgical options include bridging and non-bridging external fixation, various procedures of open reduction and internal fixation (ORIF) and arthroscopy-assisted external fixations. Regarding the non-operative treatment methods closed reduction and immobilization with casting were supposed to be standard procedures regardless of the complexity, varieties, and stability of the fragments of the fractures. Due to these traditional ways more, complex type of fractures was treated in the same way in the past which leads to poor outcomes and several complications that include joint stiffness, deformity, and disability. To restore the wrist anatomy open procedures and fixation with buttress plate are more suitable than casting or immobilization procedures but they are often associated with long-term complications such as wrist pain, infection, scar, tendons rupture, stiffness, complex regional pain syndrome and may need implant removal.[5–9] A great controversy has been developed some say operative treatment is superior to other treatment such as closed reduction while others prefer closed reduction over the operative treatment especially with regards to older adults.[10,11]

An external fixator is a frame that stabilizes and holds the parts of broken bones in a position. In the external fixator, small incisions in the skin are made and screws or pins are placed into the bones, these pins or screws are attached to a bar outside the skin. To salvage the situation, an external fixator plays a dual role by helping in managing the fractures fragments as well as

injuries of the soft tissues with minimal complications.[12] In contrast to the external fixator buttress plate shows superiority over the other procedures in terms of achieving anatomic correction and reduction of the fracture furthermore the buttress plate allows early recovery and recovery of wrist functions that help in the reduction of the disability and complications.[3] Other limitations of external fixator are wrist joint and finger's stiffness, injury to the sensory part of radial nerve, loss of reduction, and pin tract infections.[13]

The main aim of this study was to assess the functional outcome of the DRF treated with across wrist external fixator vs buttress plate.

MATERIAL AND METHODS

A retrospective comparative study approved by the research and ethical committee of Ghurki Trust Teaching Hospital Lahore was done between July 2020 to June 2021. A total number of 50 patients were selected, 25 from the external fixator group and 25 from the buttress plate group after matching the inclusion criteria of age between 16-65 years, acute fracture of the distal radius with no previous surgical interventions with complete data. The exclusion criteria were systemic diseases, old fracture, local disorder (rheumatoid arthritis, infection), fracture with neurovascular compromise, patient unable to follow, and missing or incomplete data.

Both surgical procedures were performed in a single institute, under General Anaesthesia (GA). The initial reduction manoeuvre is done followed by slight traction for reduction & alignment. For Across Wrist External Fixator (AWEF), two 3.5 mm Schanz pins were used for the radius shaft and two 3.5 mm Schanz pins for the 2nd metatarsal. The metacarpal and radius Schanz were interconnected with two connecting rod and all the nuts were tightened after reduction of fracture and checked in C-arm in anteroposterior (AP) and lateral view. In all cases, the reduction was achieved using closed reduction and manual traction method. A sterile pin-tract dressing was done after completion of procedure. After 6–8 weeks, the external fixator was removed in all patients after confirming radiological union. Postoperative physio care was given a range of movement exercises for upper extremity joints, i.e., shoulder elbow, and fingers to prevent joint stiffness and improve blood circulation and healing.

For the Buttress plating technique, the patient was kept supine on the operating table, and the affected upper limb extended over a radiolucent hand trolley attached with operating table. The surgery was done under GA in all patients. IV Cefazoline 2 gm were given for preoperative prophylaxis, 30 minutes before inflating tourniquet. After exsanguination using Esmarch bandage tourniquet was inflated at 250 mmHg pressure. A longitudinal skin incision of 6–8 cm was given across the volar aspect of the distal radius using modified Henry approach. For haemostasia cautery was used. The reduction manoeuvre was done using both direct vision as well as with the help of fluoroscopy. The 3.5mm pre-contoured locking plate was then applied in buttress mode. After proper reduction, proximal locking screws of 3 mm were applied under C-arm. Proper irrigation of the wound was done with 1L saline. The Pronator quadratus was placed back to its place and subcutaneous and skin closure was done. Proper sterile dressing was done at the end of the procedure. Postoperatively an arm sling was applied. Patients were treated with intravenous Cefazoline for 2 weeks and oral antibiotics for further 4 weeks. Suture was removed after 2 weeks. Physiotherapy in form of active finger movement was started from first post operative day and ROM were advanced over the next 2–4 weeks progressively. At 6 weeks, after the clinical and radiographic status, activity was advanced to include strengthening exercises. Functional outcomes were determined after 3 months in the follow-up clinic, using QuickDASH score, using a questionnaire for it, where 0 indicates normality and 100 score major disability.

The Kolmogorov-Smirnov test and Shapiro-Wilk were applied and both indicate that the data for age and QuickDASH score as shown in Table-1. Mann-Whitney U was used for comparison of non-parametric qualitative (Ordinal) variable, i.e., type of surgy with Quantitative variable, i.e., QuickDASH score, the statistical analysis was done using SPSS Software version 21.

RESULTS

A total of 50 patients with DRF were included in this study of which 46 were male and 4 were female patients from July 2020 to June 2021. 50 patients were studied with a mean age of 33.68 years±13.47 SD. Out of these 50 patients, 25 sustained DRF due to fall while the remaining sustained their fracture from having a motorcycle accident. Most of the injuries that were studied were found to be on the dominant hand at 64% rather than the non-dominate hand at 36%. In our study 25 out of 50 were fixed with buttress plate and 25 with across external fixator. For frequency distribution of buttress plat and external fixator, the group see table-2

Among the DRF treated with buttress plat, 10 patients (40%) were having excellent results, and non with poor results in comparison with the external fixator group which showed excellent results in 12 (48%) patients and poor results in 1 (4%) patient. Details are given in table-2. The Median QuickDASH score was 6.81±6.18 SD and 6.82±10.36SD for the buttress plate and external fixator group retrospectively. Mann-Whitney U test shows no significant difference between the association of type of surgery with the outcome and also the age of the patient with the outcome (p=0.953)

and (p=0.446) respectively. The complications were regularly checked and 4 out of 50 patients 2 with buttress plate and 3 with external Fixator develop a mild infection, which was managed through oral antibiotics and proper wound care management. Infection was seen to have been subsided on the next week of follow up and no complications regarding the infection were noted till the follow-up weeks.

Table-1: Tests of normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	P- Value*	Statistic	df	*p*-value *
Age	.140	50	.015	.924	50	**.003**
Quick DASH Score	.171	50	**.001**	.849	50	**.000**

* *p*-value <0.005 is significant

Table-2: Demographics

Type of surgery		Buttress plate		External fixator			
		Frequency	Percentage	Frequency	Percentage	Total	Percentage
Gender	Male	25	100	21	46	46	92
	Females	0	0.	4	8	4	8
Side	Right	14	56	18	64	32	64
	Left	11	44	7	36	18	36
Outcome (QuickDASH score)	Excellent (0-5)	10	40	12	48	22	44
	Good (6-15)	4	16	7	28	11	22
	Satisfactory (16-35)	11	44	5	20	16	32
	Poor (>35)	0	0	1	4	1	2

Table-3: Descriptive statistic

Type of surgery	Variable	Minimum	Maximum	Mean	Median	Std. Deviation
Buttress plate (n=25)	Age	18	65	36.44	30	14.05
	Outcome	.00	20.45	7.54	6.81	6.18
External fixator (n=25)	Age	16	57	30.92	34	12.54
	Outcome	.00	38.60	9.41	6.82	10.36
All Patients (n=50)	Age	16	65	33.68	32	13.47
	Outcome	.00	38.60	8.48	6.81	8.49

Table-4: Statistical analysis using Mann Whitney test

Variable	Median	SD	Mann Whitney U test	*p*-value *
Age (years)	32	13.47	217	0.446
Outcome	6.81	8.50	309.50	0.953

* *p*-value <0.005 is significant

Figure-1: Volar Buttress Plate: A) and B) Pre-op AP and lateral view showing AO type C2 fracture of the distal radius. C) and D) post operative radiographs showing good restoration of radial height, joint congruence, palmar tilt with optimum size and position of screws and plate

Figure-2: Across wrist external fixator: A) and B) pre op AP and lateral view showing AO type C2 distal radius fracture C) and D) post op x-rays with good restoration of the radius height, articular surface and palmar tilt. E) Clinical picture of the patient post operatively with external fixator

DISCUSSION

Different surgical intervention was proposed for intraarticular distal radius fracture. But optimal treatment choice is still a controversial issue among high-class orthopaedic surgeons. We did a comparative study across external fixators and buttress plates in type C2/C3 OA distal radius fracture. Our study had a male predominance with 92% patients were male. The increase incidence among the males could be attributed to a more active workgroup with more involvement in high energy trauma and high-velocity injuries of RTA and the dominant hand was involved in 64% of cases. The relatively more predisposition could be attributed to a more protective and early defence mechanism when falling on the right side or using the right hand.[13] The age distribution among the two groups was not significantly different in our study and median age was 30 and 32 years for buttress plate and external fixator group respectively. According to our study, there is no significant statistical difference in outcome between across the wrist external fixator and buttress plate for distal radius fracture. In addition, there is no significant effect of age, gender and side involved on the outcome of the patients in term of QuickDASH score, this was in concordance with Thomas *et al*.[14]

Most of the literature shows more stiffness and poor functional outcome with external fixator group but long term follow-up shows no significant difference in both stiffness and functional outcome.[14,15] In our study we followed patient for 3 months and even this short-term follow-up showed no significant stiffness and good functional score. Chances of tendon rupture is more common with buttress plate group but no such complication has been reported in our study group.

CONCLUSION

Across wrist external fixator is a reasonable option for AO C2/C3 type fractures of the distal radius with comparable results with volar buttress plate. It is the procedure of choice in high volume tertiary care hospitals like Gurki Trust Teaching hospital as it saves time, have similar functional outcome score, no

need to re-open for removal of implant, less chances of tendon rupture as compared to volar buttress plate for distal radius fracture.

Study limitations:

- Accuracy of data collection
- Surgical preference by the orthopaedic surgeons
- Pre-injury patients baseline radiological parameters
- A small sample size leads to type–II statistical error.

AUTHORS' CONTRIBUTION

RA: Conceptualization of the study design and write-up. AI: Data collection. HR: Data interpretation. UF: Data collection JK: Data analysis. NA, AA: Proof reading.

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Submitted: January 19, 2022	*Revised: September 25, 2022*	*Accepted: September 25, 2022*

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