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Assessment of upshots of the DCP vs the intra-medullary nail in fracture shaft of humerus

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ABSTRACT

Aim: This study aimed to compare the outcomes of the humerus diaphyseal fractures which is treated with a dynamic compression plate (DCP) and the intra-medullary nail (IMN).

Methods: The 47 patients who had diaphyseal fractures of humeral shaft had been treated with the reduction openly and fixation internally with either IMN or DCP after being randomised prospectively. The following criteria had to be met for a patient to be included: unstable fractures, polytrauma, compound fractures of grade I or IIa, and on time failure of the treatment conservatively. The study excluded the patients with the fractures pathologically, open fractures of grade III, refractures, and previous, untreated humerus fractures. Internal fixation was performed on 23 patients using IMN and 24 using DCP. All cases involved reaming antegrade nailing. Anterolateral or posterior approaches were used for DCP. The outcome was evaluated based on the time of union, rate of union, the functional outcome, and the incidence of complication. Utilizing the ASES (American Shoulder and Elbow Surgeons') Score, functional outcome was evaluated.

Results: There is nope discernible alteration in the ASES scores amongst the two groups when results of the independent samples t test were compared ($P>0.05$). When comparing IMN with DCP, it was discovered that the average union time was substantially shorter for IMN ($P<0.05$). Both groups' unionisation rates were discovered to be comparable. Infection-related complications were shown to be more common with DCP than IMN, although arm shortening (1.5–4 cm) and shoulder mobility restrictions because of nail impingement were found to be more common with IMN than DCP.

Conclusion: However, after the nail was taken out and the fracture had healed, this got better for everyone. This study demonstrates that IMN gives a quicker time of union and a low risk of significant consequences like the infection, making it surgically better choice for treatment of the fractures of humeral diaphyseal. Regarding rate of union and functional outcome, there doesn't seem to be any distinction between the two groups.

Keywords: Dynamic Compression Plate, fracture, DCP, intra-medullary nail, fracture of humerus

INTRODUCTION

A predicted union rate of greater than 90% applies to the mainstream of the uncomplicated fractures of humeral shaft that could be treated non-operatively. [1–3] The techniques include the shoulder spica cast, functional brace, hanging cast, and Velpeau dressing.[4,5]

Open fractures, pathological fractures, segmental fractures, fractures with the associated vascular injuries, humerus fractures in the polytrauma patients, bilateral humerus fractures, radial nerve palsy following manipulation of fracture, fractures with the unacceptable alignment, neurological loss following penetrating injuries, and the failure of the conservative treatment are the indications for the surgery.[6] DCP

and intra-medullary nails are most common surgical techniques used (IMN). The utilization of the DCP necessitates a lengthy procedure that involves separating the bone from soft tissues, problems since the radial nerve is close by in usual field of the dissection, also the least secure fixation, particularly in the osteoporotic bones. [7] The use of the IMN nail has become more common due to recent technological advancements and strong marketing. [8] A study advise using the IMN, which can be placed either retrogradely from the elbow or antegrade from the shoulder, to treat diaphyseal fractures of the humerus. [9,10] Theoretically, fixation with IMN needs the surgery (less invasive), has a biomechanical benefit, serves as the device of load sharing, provides shielding of less stress, reduces the risk of the refracture following the removal implant, and can produce auto-graft by reaming.

MATERIALS AND METHODS

The planned study is conducted between 2021 and 2022 in the Department of Orthopaedic Surgery at Medical College. 47 consecutive patients having humerus shaft fractures who needed surgical stabilisation during this time were randomly assigned to receive either DCP or IMN fixation using a sealed envelope.

The operative surgeons have knowledge of both techniques. The fractures were situated 3 cm proximal to the olecranon fossa or 2 cm distal to the surgical neck.

The following selection criteria were used:

- Polytrauma
- Patients with open fractures of grades IIa and I.
- Unstable fractures
- The early let-down of the treatment conservatively

All the patients were the adults with developed skeletons.

Patients listed below were ineligible:

- Pathological fracture victims
- Patients with complex fractures of grade 3
- Patients with humerus fractures that have gone untreated
- Patients with head injuries who were unwilling to cooperate
- Those who have humeral refractures

The patients were surgically treated by IMN or DCP after being randomly assigned.

A posterior or anteromedial route was used to implant the DCP. According to the type of fracture, different lengths of the AO 4.5mm the 8 DCP plates were employed.

Every patient had 8 to 10 cortices the proximal and the distal to fracture fixed.

Due to the surgeons' greater expertise with the technique, only antegrade nailing was performed when the Russell Taylor IMN was employed. In every instance, reaming and proximal and distal locking were performed. All patients underwent the procedure while under general anaesthesia.

Follow-up

At induction and for the following 48 hours, prophylactic antibiotics were given to all patients.

After 48 hours, all patients received their discharge.

In all patients, the removal of stitch was done after ten days.

The lower and upper arm muscles were worked isometrically starting on the first day.

At six-weeks, 3-, 6-, and 12-months, all the patients underwent follow-up care in outpatient clinics.

Each appointment included a clinical and radiological evaluation. A minimum of six months was set since by then the fracture would have healed and functional progress would have begun to plateau.

Following consolidation of fracture, which typically occurs after the twelve months, the implants were removed.

The functional outcome, capacity to return to prior employment after six months, union time, union rate, and complication incidence were used to evaluate the results. Utilizing the ASES Score, functional result was evaluated.[11]

In seven cases of the group B and twelve cases of the group A (IMN), autogenous iliac bone grafting was carried out (DCP).
The independent samples t test was utilised to analyse the results.

RESULTS

Of the 47 patients, 24 received DCP and 23 underwent IMN for internal fixation. The two patients have lost by IMN group to follow-up. Therefore, final evaluations for the twenty-four patients in DCP and the 21 patients in IMN group were completed.
Age: The age of patients (mean) who underwent the fixation of DCP was the 35-years (where SD -11.5) (P>0.05) and 39 years (SD -12) for those who had IMN fixation, respectively.
Sex: In the group A (IMN), there are the twenty males and the three females while in the group B (DCP), there are nineteen males and five females see Table 1

Table 1: Characteristics of the two-groups on baseline.

Variable	(DCP) Group-B	(IMN) Group-A
Injury Duration in Days	38	45
Age in Years	35	39
Female	5	3
Male	19	20

Table 2: Fracture type.

Fracture type	DCP	IMN
X	4	4
Y	6	7
Z	14	12

Injury mode: The majority of patients seventeen in the group A and sixteen in the group B (66.6%)—were hurt in auto accidents. Falling to the ground caused injuries more frequently than anything else. Table 2
Injury duration: Since cautious procedures had been used at first, most of the patients in both groups were older than seven days but all were under three months old. While it was 38 (SD -19) days for group B (DCP), it was 45 days for the group A (IMN); P>0.05. The two patients have lost by IMN group to follow-up. Consequently, final evaluations for the 24 patients in DCP group and the twenty patients in IMN group were completed.
Follow-up: In both groups, average follow-up time was the 14.3 months.

Functional outcome

Except for the three patients from the group A and the three patients from the group B who had suffered non-union, all the patients from both the groups are able to restart to their jobs within the six-months. Consequently, functional outcome is favourable in the 86.7% of cases in the group A (IMN) and the 87.5% of cases in the group B (DCP). The mean ASES score did not differ statistically significantly in between two groups [P>0.05]

Fracture union

18 (85.7%) of the 21 patients in group A (IMN) who were available for follow-up and the twenty-four patients in the group B (DCP) were united, compared to 21 (87.5%) and 21, respectively. In contrast to group B's 8.9 weeks, group A's average union time was 6.3 weeks (P<0.001). Between two groups, there

is nope discernible difference in occurrence of non-unionization or the unionisation rate. When compared to DCP, patients with IMN had a considerably shorter union time.

Complications

Five of the group B patients under DCP's care (20.8%) became infected. Two of them had superficial infections that were successfully treated with antibiotics and saw quick recovery times. Three of the patients in this group experienced chronic sinusitis and deep-seated infection. Once the union of fracture was established, removal of plate would be, and tract of sinus was resected. The tract of sinus eventually recovered, but the unattractive scar over arm remained.

Only one patient from group-A experienced an infection that led to the non-union. The nail was taken out, then the nail and bone transplant were put back in after the infection had abated.

Compared to one (4.1%) individual in group B, seven (33.3%) patients in group A (IMN) experienced a 1.5–4 cm shortening of an arm (DCP).

In comparison to three (12%) of the DCP group, non-unionization happened in three (14.3%) IMN employees. Because proximal incision lengthened from 6 to 7 cm beyond process of acromion, one patient with IMN experienced axillary nerve damage. In the DCP group, one patient (4.1%) sustained radial nerve damage. Due to nail impingement, four individuals with IMN were unable to fully abduct their shoulders. Once the fracture had healed, they were treated by removing the nail.

Table 3: Results.

Variable	(DCP) Group-B	(IMN) Group-A (%)
To Previous jobs returning ability	87.5	85.7
Union time	8.9 (weeks)	6.3 (weeks)
Nerve injury	1-radial	1-axillary
Shoulder abduction's restriction	0	19
Infection	20.8	4.5
Implant Failure	0	4.5
Union rate	87.5	85.7
ASES score	45	44

Four patients in the group B (DCP) and the six patients in the group A (IMN) both had the open fractures. Each has an early internal fixation and the first debridement. The 2-patients of the group B experienced the superficial infections that were successfully treated with medication. They all joined together smoothly and without any issues see Table 3.

DISCUSSION

According to earlier studies, the risk of non-union in DCP fixation cases is around 5%, the rate of infection is about 2% to 4%, and the rate of the radial nerve palsy are about 2% to 5%. In study, infection occurred in 5 cases (20.8 percent), non-union occurred in 2 cases out of 24 (8.3 percent), and radial nerve occurred in the 1-case. According to ASES Score, every patient had almost a full range of the shoulder and elbow motions restored.[12]

The non-union is observed in the two cases (9.5%) in our investigation of the IMN; these patients were treated with bone grafting and freshening of bone ends. [13] Between 0 and 8 percent of non-unions are recorded in the literature, and reports of shoulder and elbow function are very inconsistent. [14] Antegrade nailing may slow the healing of fractures by distracting the soft tissues and fracture, according to a study.[15] In seven (33%) patients with IMN fixation, a 1.5–4 cm shortening of the afflicted arm was found.

In four cases, the nail impinged on the shoulder and restricted shoulder abduction; these cases were later treated by having the nail removed. One case saw an implant fail because nail broke at location of distal locking screw; this is treated with bone grafting and DCP.

According to reports, antegrade nailing can harm the rotator cuff, impairing range of the motion and function of shoulder.[16] In IMN group, our investigation produced four instances of shoulder impingement. A study found that DCP fixation was associated with the 5% radial nerve damage risk. [17] Only one occurrence of iatrogenic radial nerve palsy was discovered among the twenty-four patients in our study who are treated using this technique. The IMN group's subjects were free of this problem.

Our experience is congruent with the study's findings, despite the fact that theoretically DCP might result in stress elevator towards end of plate,[18] finding that these issues might be more prevalent at location of the distal locking screws and at tip of IMN.

CONCLUSION

The absence of a sizable patient population is one of the study's limitations, but even so, it has demonstrated that, in our study, IMN is surgically superior choice to the DCP for treatment of the humeral diaphyseal fractures. It is due to the short union time and decreased likelihood of significant consequences like infection. In a way that the functional outcome and speed of the fracture's union, there doesn't seem to be difference significantly between intra-medullary nailing and DCP.

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