OUTCOME OF INTRAMEDULLARY NAILING VS DYNAMIC COMPRESSION PLATE FOR HUMERUS SHAFT FRACTURES.

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ABSTRACT

Objective: To compare the outcome of intramedullary nailing versus dynamic compression plate for humerus shaft fractures.

Methodology: This comparative cross-sectional study was done in the Department of Orthopedic Surgery, Liaquat University of Medical & Health Sciences, Jamshoro. 33 patients were enrolled. In group A, the patients underwent surgery by using IMN. In group B, the patients underwent surgery by applying DCP. Operative time was noted. After discharge from hospital the patients were followed-up there for 22 weeks. After 22 weeks, patients underwent x-ray for confirmation of union and DASH score was noted in both groups.

Results: In this study in IMN group, union within 22 weeks of the patients was noted in 16(94.1%) patients whereas in DCP group the union within 22 weeks was noted in 15(93.8%) patients (p-value>0.99). In IMN& DCP group, mean operative time was 66.12±26.21&104.50±17.512 minutes respectively, (p-value<0.001). In IMN group, mean quick DASH score was 13.2±9.6 whereas in DCP group, mean quick DASH score was 15.6±9.8 (p-value=0.48)

Conclusion: In conclusion, both groups IMN & DCP for humerus shaft fracture are equally effective, however operative time was significantly shorter in IMN group as compared to DCP for humerus shaft fracture.

Keywords: Humerus Shaft Fracture, Intramedullary Nailing, Dynamic Compression Plate.

INTRODUCTION:

Fractures of humerus are common. They may occur due to trauma, fall, road traffic accident, pathological fracture or other reasons. When treated conservatively with reduction and immobilization, uncomplicated diaphyseal fractures of the humerus heal in over 90% of instances. For open, segmental, and pathological fractures, open reduction with internal fixation is recommended.[1]Fractures of the humerus bone are normally restored by conventional methods instead of going for surgery. Open and unstable fractures, like segmental fractures, are the common causes that lead to surgery (where there are ≥2 fractures at same point on the same bone with free fragments in between these two fracture sites). [2-4]

In the last several decades, advancements in implant design and internal fixation method have resulted in widening of the indications for surgery and a fresh debate over treatment selection. The two most frequent surgical procedures are the intramedullary nail and plate. Both techniques offer benefits and disadvantages in terms of biomechanics and physiology. The IMN for humeral shaft fractures is a load-sharing implant that preserves periosteal blood flow while minimizing fracture biology disturbance. Plate fixation aids the identification, investigation, and preservation of the radial nerve by allowing direct visibility, anatomic reduction, and firm fracture stabilization of the fracture. There's no agreement on whether an intramedullary nail or a plate is the best therapeutic option. [3] IMN was related to a higher risk of shoulder impingement, more shoulder mobility limitation, higher risk of the fracture comminution during surgery, implant failure, and re-do operation. In humeral shaft fractures that need surgery, there is a dispute on which operative intervention to use.[4]

Literature showed that DCP is more effective in early union, less operative time and improved DASH score. But insignificant differences in results have been stated in literature.[5,6] So this creates an ambiguity and seems that both have equal efficacy. In order to get evidence in our populace in favor of more effective and better method of management of humerus shaft fracture, we planned to conduct this comparative study. This will help to improve our knowledge, practice and reduce number of patients with complications.

METHODOLOGY:

This cross-sectional comparative study was conducted in the Department of Orthopedic Surgery & Traumatology, Liaquat University of Medical & Health Sciences, Jamshoro from 1st September 2019 to 31st August 2021. Sample size of 33 patients was estimated by keeping 95% confidence level, 80% power of study. Patients of age 20-60years, of either gender presenting with humerus shaft fracture were included. Patients with comminuted fracture, multiple fractures of humerus, pathological fractures, bilateral fractures, immunocompromised patients, diabetic patients and infected with hepatitis B and hepatitis C patients were excluded.

After taking approval of the research project from hospital ethical board 792/19-8-2019. Written consent was taken. Demographics i.e. name, age, sex, laterality / side and fracture duration were taken. Then all the patients were randomly divided in 2 equal groups by applying the lottery method. In group A, patients underwent surgery by using IMN. In group B, patients underwent surgery by using DCP. All operations were performed under anesthesia by researcher himself. Operative time was noted. After operation, patients were moved to post-surgical wards and were then discharged from there. Then patients were followed-up there for 22 weeks. After 22 weeks, patients underwent x-ray for confirmation of union (as per operational definition). Quick DASH

score was also noted. Data was entered into SPSS Version 21. Age, duration of fracture, operative time and Quick DASH score was calculated and mean & standard deviation. Gender, laterality& bony union were presented as frequency & percentage and data compared by taking P value significant ≤ 0.05, and stratification done.

RESULTS:

The mean age of the patients was 38.67±11.321 years. In IMN group, mean age was 34.47±9.05 years while In DCP group, mean age was 43.12±12.04 years. In this study, out of 33 cases, 21(63.64%) were males whereas 12(36.36%) were females.In IMN group, mean duration of fracture was 19.59±18.95 hours whereas In DCP group, it was 15.31±14.45 hours. This difference was calculated to be insignificant i.e. p-value=0.474. In IMN group, mean hospital stay was 2.88±1.27 days whereas In DCP group, it was 4.00±1.32 days. This difference was calculated to be significant i.e. p-value=0.019.In IMN group, left laterality was noted in 6(35.3%) patients and in DCP group, left laterality was noted in 8(50%) patients. Similarly, in IMN group, right laterality was noted in 11(64.7%) patients whereas in DCP group, right laterality was noted in 8(50%) patients. This difference was calculated to be insignificant i.e., p-value=0.393.[Table: 1]

According to this study union within 22 weeks was observed in 31(93.94%) patients.In IMN group, union with 22 weeks of the patients was noted in 16(94.1%) patients whereas in DCP group, the union within 22 weeks was noted in 15(93.8%) patients. This difference was calculated to be insignificant i.e., p-value=>0.999. In IMN group, mean operative time of the patients was 66.12±26.21 minutes whereas In DCP group, mean operative time of the patients

was 100.4.50±17.512 minutes. This difference was calculated to be significant i.e. p-value=<0.001

In patients having age ≤45 years: In IMN group, mean operative time was 67.33±27.61 minutes and in DCP group, mean operative time was 103±16.26 minutes (p-value=0.003). In patients having age >45 years: In IMN group, mean operative time was 57.00±11.31 minutes and In DCP group, mean operative time was 106±19.68 minutes (p-value=0.011). Gender, duration of fracture and Laterality distribution according to group as shown in Table: 2. In IMN group, mean quick DASH score was 13.25±9.65 whereas In DCP group, mean quick DASH score was 15.64±9.89. This difference was calculated to be insignificant i.e. p-value=0.488. Age, Gender, duration of fracture and Laterality distribution according to group as shown in Table:3

Table: 1 Descriptive of Age, Gender, Duration of Fractures, Hospital Stay &Laterality according to Groups, n=33

		IMN	DCP
Age in years	**Mean& SD**	34.47+ 9.05	43.12+ 12.04
Gender	**Male**	12(70.6%)	9(56.2%)
	Female	5(29.4%)	7(43.8%)
Duration of Fractures in hours	**Mean&SD**	19.59+ 18.9	15.31+ 14.45
Hospital Stay (Days)	**Mean& SD**	2.88+ 1.27	4.00+ 1.32
Laterality	**Left**	6(35.3%)	8(50%)
	Right	11(64.7%)	8(50%)

Table: 2 Comparison of Operative Time score between study groups stratified by Age, Gender, Laterality & Duration of fracture, n=33

Operative time in minutes		Groups		P value
		IMN	DCP	
Age in years	<45	67.33+27.61	103.0+ 16.26	0.003
	>45	57.0+11.31	1.06+19.6	0.011
Gender	Male	63.25+27.34	105.3+17.48	0.001
	Female	73.0+24.66	103.4+18.8	0.035
Laterality	Left	70.50+21.29	106.7+15.8	0.003
	Right	63.73+29.23	102.2+19.85	0.005
Duration of Fracture in days	<10	68.11+34.65	104.0+17.52	0.019
	>10	63.87+13.66	105.0+18.8	0.001

Table: 3 Comparison of quick DASH score between study groups stratified by Age, Gender, Laterality & Duration of fracture, n=33

Quick Dash Score		Groups		P value
		IMN	DCP	
Age in years	**<45**	14.11+9.95	13.07.0+ 6.54	0.79
	>45	6.80+3.25	18.20+12.33	0.243
Gender	**Male**	13.64+10.88	17.69+12.23	0.434
	Female	12.30+6.74	13.00+5.54	0.35
Laterality	**Left**	15.15+14.23	16.77+11.78	0.82
	Right	12.21+5.11	14.50+8.24	0.464
Duration of Fracture in days	**<10**	9.10+6.64	18.47+12.12	0.06
	>10	17.91+10.76	12.80+6.66	0.272

DISCUSSION:

Humeral shaft fractures are frequent and impose a considerable financial burden on society. In humeral shaft fractures that need surgery, there is a dispute on which operative intervention to use. IMN and DCP are two options for surgical interventions.[7-9]In the treatment of patients with humeral shaft fractures, IMN and DCP are two options, both of which have good union rates. Several studies have shown that both IMN and DCP enhance preoperative clinical status, although it is unclear which of these two treatments is more effective.[8, 10].

In this study in IMN group, union within 22 weeks was noted in 16 (94.1%) patients whereas in DCP group the union within 22 weeks was noted in 15 (93.8%) patients. This difference was calculated to be insignificant i.e., p-value=>0.999. Average DASH score was 13.25±9.65 whereas with DCP, average DASH score was 15.64±9.89. This difference was calculated to be insignificant i.e., p-value=0.488.

One study found that mean operative time was 104±38min with DCP and 121±32minutes with IMN for humerus shaft fracture, Union was achieved in 92% patients with DCP and 91% with IMN at 22 weeks, and mean Quick DASH score was 23.9±17.7 with DCP and 21.7±19.8 with IMN. The difference was insignificant (P>0.05). [5]Another trial found that mean operating time was 100±11.24 minutes for IMN and 90.25± 15.6 minutes for DCP, union was 50% with IMN and 80% with DCP at 24 weeks. But Dash score was significantly higher with DCP at 24 weeks follow up than IMN.[6]

Although IMN has a reduced risk of infection and postoperative nerve palsy than DCP, it may induce more method-related problems including shoulder impingement. More high-quality

studies will be necessary in the future to improve these results.[6]The results of plate fixation of humeral shaft fractures are typically extremely satisfactory, according to Walker et al., with union rates ranging from 92 percent to 96 percent, duration to union average about 12 weeks, and complication rates ranging from 5 percent to 25 percent. [11]

According to Putti et al., it was reported that the average rate of non-union of bone after surgery was noted in about 8% patients with IMN while about 2-4% with DCP. They also observed iatrogenic radial nerve palsy in 2.5-14.3% patients with IMN while 2-5% patients with DCP. The authors concluded that the outcome was better and there were less complications with DCP as compared to the IMN. [12]

McCormack et al., conducted a randomized trial in four patients, who were diagnosed with fracture of humeral shaft. They treated the patients with open reduction & internal fixation by using either IMN or DCP and then followed them to attain certain findings. Patients were tracked for at least six months. According to the findings, the optimum therapy for unstable humeral shaft fractures is open reduction and internal fixation with a DCP. Fixation by IMN may be appropriate in some circumstances, but it is more technically challenging and has a larger risk of problems.[9]

The range of rate of non-union with IMN was reported from 0% to 8% while with DCP, it ranges from 2% to 4%. The researchers also observed the iatrogenic radial nerve palsy. By using IMN, the rate of iatrogenic radial nerve palsy was ranged from 2.6% - 14.3% while with DCP, the incidence of the iatrogenic radial nerve palsy was observed from 2% to 5%.[9, 13, 14]

In this study in IMN group, mean operative time was 66.12±26.21 minutes whereas in DCP group, mean operative time was 100.4.50±17.512 minutes. This difference was calculated to be significant i.e. p-value=<0.001.In one study, Wali et al., found that nailing was superior to plating in terms of the average post-operative stay of patients and operating time. The plating group's lengthier stay was mostly due to the plating patients' longer wait for surgery. [15]

Lin et al., conducted a trial on 73 patients with humeral fractures and treated them with either IMN or DCP and screws. They found a near 100 percent union rate. With locked intramedullary nails, the author noticed a considerably shorter operating time, less blood loss, and a decreased complication rate.[16]A study by Pansey et al.,[17]concluded in their study that in instances with shaft humerus fractures, nailing and plating had similar functional results. In cases where nailing was done, the average surgical time was 68 minutes, and in situations where plating was done, the average surgical time was 115 minutes (P 0.001).

In their study, Chaudhary et al. found that the operating time for nailing was 100.1±12.4 minutes, compared to 90.25 ±15.6 minutes for humerus plating. The average blood loss in the nail group was 148.75± 36.70ml, whereas the average blood loss in the plate group was 205± 45.60ml. At 6, 12, 18, and 24 weeks, both the nail and plate group's dash scores improved steadily, but the plating group's dash score was considerably higher.[5]Another study by Jeyaraman et al., resulted that the outcome of patients in IMN group was more improved and better than the outcome of DCP. They showed that in IMN group, out of 59 patients, excellent outcome was achieved in 37 (66.1%) patients, outcome was good in 15 (25.4%) patients while outcome was poor in 5 (8.5%) patients, according to the DASH score assessed for range of motion of the joint. While in DCP group, out of 48 patients, excellent outcome was achieved in 23 (47.9%) patients, outcome was

good in 16 (33.3%) patients while outcome was poor in 9 (18.8%) patients, according to the DASH score assessed for range of motion of the joint.[18]Khan et al., found that the length of stay was ranged from 1 to 20 days after surgery.It was around 10-20 days prolonged in 12 (60%) casesafter DCP while in 11 (55%) cases after IMN implantation. The average stay in hospital after DCP was 15 days while 13.5 days with IMN.[19]

CONCLUSION:

According to this study, both IMN and DCP for humerus shaft fracture are equally effective in terms of union and DASH score, however operative time was significantly shorter in IMN group as compared to DCP for humerus shaft fracture.

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