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DIAPHYSEAL FEMORAL FRACTURES IN CHILDREN – ACOMMON PEDIATRIC ORTHOPAEDIC EMERGENCY

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ABSTRACT

Background: Diaphyseal femoral fractures in children are common in orthopaedic emergencies; represent approximately 10.6% of all bony injuries.

Methodology: This prospective observational comparative study was conducted at Liaquat UniversityHospital from January 2014 to December 2014. We compared the results of casting with rigid internal fixation in a series of 40 childrenwith femoral shaft fractures. The informed consent was taken from the parents.

Forty patients of the fracture shaft of femur aged 5 to 10 years with fractures of the shaft of the femur were taken for the study. Twenty patients were randomized to group A which were managed by closed reduction and internal fixation with intramedullary nails (Rush Nail), while other twenty patients in group B were managed byconservative treatment in form of skin traction followed by hip spica.

All the data was collected through a predesigned proforma. Statistical analysis was done through SPSS 16.

Results: They were divided into two groups. Group "A" having 20patients (50%)underwent spica casting. whereas in Group "B" 20 (50%) patients underwent rigid internalfixation.The spica casting group had a mean hospital stay of 22 days. The operative group had a mean hospital stay of 9 days andhad fewer complications than the non-operative group.

In group A where the fracture was in middle third of femur, transverse and oblique. Closedreduction& internal fixation with intramedullary nail was done under general anesthesia, rush nail was inserted into the proximal fragment just on themedial aspect of the greater trochanter.

Conclusion: Femoral shaft fractures in children can be operativelytreated with excellent results and a decreased complication rate. Operation results in shorter hospitalization,which has psychological, social, educational, and economic advantages over conservative treatment.

Keywords: Femoral shaft fractures, pediatric fractures, Diaphyseal femoral fractures, pediatric orthopaedic emergencies, Spica cast, Rush nail fixation.

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INTRODUCTION

Diaphyseal femoral fractures in children are common in orthopaedic emergencies; represent approximately 10.6% of all bony injuries[1]. The male female ratio is 2.6:1[2]. Road Traffic Accidents is the main cause of femoral shaft fractures inchildren. The etiology of diaphyseal femoral fractures in children varies with the age of child. In children younger than walking age, usually femoral fractures are caused by abused[3]. Another cause of femoral shaft fracture in children is fall. Pathological fractures are relatively rare in children, but they may occur because of generalize osteopenia in infants or young children with osteogenesis imperfecta[4]. Pathological fractures may occur in children with benign lesions, such as non-ossifying fibroma, aneurysmal bone cyst and eosinophilic granuloma and rarely in patients with osteo sarcoma. The first peak occurs in early childhood, second in mid adolescent. Femoral shaft fractures are dramatic and disabling injuries both to the patient and the family. Children's bone changes from primary weak bone to stronger lamellar bone through remodling[5]. The increasing diameter and area of bone result in a markedly increased area of moment of inertia, leading to marked increased in strength. This progress increase in bone strength helps explain the bimodal distribution of femoral fracture. In early childhood, femur is relatively weak and breaks under load condition reached in normal, but in adolescence, high velocity trauma is required to reach the stress necessary for fracture[6].

In the recent past, traction and hip spica was the standard treatment for all femoral shaft fractures which involved long duration of hospitalization. More recently, a variety of therapeutic alternatives such as intramedullary nailing and dynamic compression plating have become available to decrease impairment, increase convenience & decrease cost of care. The management of femoral shaft fractures in children has evolved towards more operative approaches in the last two decades to minimize the post plaster complications. Operative management of fracture shaft femur in children is becoming a preferred option because of fact that there is decrease in incidence of malunion, short hospital stay, lesser surgical cost, better nursing care and early ambulation[7].

OBJECTIVES

1. To compare the results conservative (Spica cast) and operative (Rush nail fixation) procedures for diaphyseal femoral fracture in children.
2. To determine better method of treatment with minimal complications.

METHODOLOGY

This prospective observational comparative study was carried out at Liaquat University Hospital Hyderabad and Jamshoro in the Department of Orthopaedic Surgery and Traumatology (DOST) during January 2014 and December 2014. After obtaining the informed consent, patients were divided into two groups A and B and selected one on one basis. In our department we have provided facilities of image intensifier, therefore procedures for both groups were performed by close methods. Group A= Conservative method (spica cast) and Group B= Operative methods (rush nail). For group "A":- Cotton, Gypsona, Wooden Bar and Image Intensifier were used. For group "B":-Rush nail, Image Intensifier, Prophylactic AntibioticCotton roll, Gypsona and Crepe Bandage were used.

Patients with diaphyseal femoral fractures brought to the casualty department, after thorough clinical examination and received first aid. Patientswere sent to the radiological department for X-Ray anterioposterior & lateral views of their affected femur. Similarly up to one week old diaphyseal femoral fractures attending out patient department after the clinical and radiological assessment. According to A.O classification Type A1$_{-2,}$ A2-$_{2}$ and A3-$_{2}$were selected for this study. After counseling to parents of patient regarding the nature of injury, its importance & possible complications and about the method of treatment selected (Group A or

TABLE—I

SIDE INVOLVED	No. OF PATIENTS	PERCENTAGE
RIGHT	25	62.5%
LEFT	15	37.5%

TABLE-II

TYPE OF FRACTURE	NO. PATIENTS	PERCENTAGE
Transverse	23	57.5%
oblique	14	35%
Spiral	03	7.5%

GROUP (A)

Complications	Patients
BED SORE	1
02 CM SHORTENING	5
10^0 LATERAL ANGULATION	4
03^0 POSTERIOR ANGULATION	2

GROUP (B)

Complications	Patients
INECTION OF STAPHY AUREUS	1
03^0 LATERAL ROTATION	1

Group B) for that child.

For group "A":- Patients were admitted in the department of orthopaedic unit II, in Liaquat University Hospital Hyderabad. After informing to Operation Theater staff and image intensifier operator, patient were shifted in Operation Theater to apply spica cast under sedation. Then patient was kept under observation in the ward. After satisfactory clinical & radiological assessment, that patient were discharged and reviewed in our out patient department to the follow up regimen.

For group "B":- Patientswere admitted in the department of orthopaedic unit II, in Liaquat University Hospital Hyderabad. After all the preoperative measures, patient was kept on operation list. In operation theatre, prophylactic antibiotic was given after induction of the test dose. After aseptic measurements and getting permission from anaesthetist, fracture was reduced under image intensifier. Incision was given above the level of greater trochanter, after splitting the muscles, pyriforms fossa was found, and route of entry made, then suitable measured rush nail was introducedantegrade under image intensifier. After confirming reduction, wound was closed and back slab applied. After recovery patient was shifted and kept under observation in the ward. After satisfactory clinical & radiological assessment, patient was discharged and reviewed in our out patient department to the follow up regimen.

Patients followed according to follow up chart. Total time of follow up was six months.

Follow up regimen was initially weekly for two weeks, then for fortnightly for two and half months and then monthly for three months.Assessment of fracture union was done by clinically and radiologically. Spica cast in group A patients, were removed after the union of fracture is achieved, radiologically.Initial follow up was recorded on prescribed proforma.Fracture was declared united when there is no tenderness, no movement at fracture site; obliteration of fracture line on anteroposterior and lateral radiographs was taken as fracture union.Data was analyzed on SPSS 16.

RESULTS

After collecting and compiling the data of 40 patients who were treated by spica cast of diaphyseal femoral fractures or by internal fixation with Rush nail, final results were made after follow up for six months.In this study patients were from 5- 10 years of age selected.Their mean age was 7.08 years.The mean age of patients treated with spica cast was 7.175 years.The mean age of patients treated with rush nail was 7 years.

Total 40patients were selected in this study 20(50%) patients were treated by spica cast and 20 (50%) patients were treated by Rush nail. In this study total male patients were 27 (67.5%) and female patients were 13 (32.5%). There were 14 (70%) male patients and 6 (30%) female patients in which spica cast was done.There were 13 (65%) male patients and 7 (35%) female patients in which rush nail was done. Total diaphyseal femoral fractures of right side in this study were 25 (62.5%) and lift side were 15 (37.5%) as shown in Table – I

There were 13 patients of right diaphyseal femoral fractures treated by spica cast and 7 of left diaphyseal femoral fractures treated by same method.Total 12 patients of right diaphyseal femoral fractures were treated by rush nail 8 were left diaphyseal femoral fractures treated by same method.

Fall from height was most common mode of injury was 25 (62.5%) patients. Road traffic accidents was second most common mode of injury seen in 14 (35). Only one patient we received who has got his femoral shaft fracture due to child abused 1(2.5%).

This study was carried on closed diaphyseal femoral fractures which were selected for this study according to AO classification type 32- A1, 32- A2 and 32- A3. Out of 40 patients 23 (57.5%) were transverse fractures, 14 (35%) patients were oblique fractures and 3 (7.5%) patients were spiral fractures, as shown in Table 2.

In group A patients total hospital stay was from 2-7 days. 02 patients were admitted for 02 days, 08 patients were admitted for 03 days, 03 patients were admitted for05 days, 04 patients were admitted for 06 days and 03 patients were admitted for 07 days. The mean hospital stay in group A patients was 4.4 days.

In group B total hospital stay was 03- 05 days. 15 patients were admitted for 03 days, 03 patients were admitted for 04 days and 02 patients were admitted for 05 days. The mean hospital stay in group B patients was 3.5 days.

In group A patients spica cast was removed after 04-06 weeks. Gentle passive hip and knee movements were started and active movements were encouraged as the pain tolerated. Group B patients were allowed to sit on bed or chair after the 1st postoperative day. Gentile passive hip and knee flexion were started after the removal of back slab and active movements were encouraged as the pain subsided. Table 3 shows the complications seen in these patients.

DISCUSSION

Diaphyseal femoral fractures in children are common in orthopaedic emergencies; represent approximately 10.6% of all bony injuries. In our study total 40 patients, age range from 5-10 years were included. Most of the patients were from 6-7 years.

The femuris the longest and strongest bone in the skeleton is almost perfectly cylindrical in the greater part of its extent. In the erect posture it is not vertical, being separated above from its fellow by a considerable interval, which corresponds to the breadth of the pelvis, but inclining gradually downward and medialward, so as to approach its fellow toward its lower part, for the purpose of bringing the knee-joint near the line of gravity of the body. The degree of this inclination varies in different persons, and is greater in the female than

in the male, on account of the greater breadth of the pelvis. The femur, like other long bones, is divisible into a body and two extremities.[8]

Paediatric femoral shaft fractures have an incidence of 28 per 100,000 child years.[9] Boys are more affected more than girls with ratio of 2.8:1.[10] Children around three years of age have the highest incidence with a second peak at adolescence. The first peak presumably results from relatively larger medullary cavity as compared to cortical thickness at this age. The second peak reflects vehicular injury. Femoral shaft fractures are the result of injuries of great magnitude. Before walking age child abuse is the commonest cause, accounting for 80% of femoral shaft fractures in this age group.[10] In older children the most common aetiology is motor vehicle accidents, which accounts for over 90% of femoral fractures in this age group.[11]

"On referring to the literature on fracture of the femur in children, one is at once struck by the wide variance as to the relative importance of the way to handle these cases" (Gallant, 1897).

In the past, all isolated and uncomplicated fractures of thefemoral shaft in children were managed conservatively. .Recent advances in external and internal fixation havechanged this pattern and promoted animated debate aboutthe indications for and the methods of surgery. Any decisionto operate on this fracture in a child requires verycareful analysis in terms of convenience, cost andcomplications. First, the convenience of primary operation. Providedthat good facilities are available, surgical stabilization maybe justifiable, not only for the child and its family, but alsoto help nursing and medical staff to care for a fracturewhich may not behave satisfactorily in a Thomas splint ora plaster spica. It is suggested that fixation by flexible nails is appropriatefor patients over the age of five years, but their prospectivestudy would have been more convincing if it had includeda conservatively-managed control group.[12] Fixation by flexiblerods, plates or external fixators requires one, and oftentwo, general anaesthetics, and a total use of theatre timeapproaching or exceeding two hours. By contrast, the useof regional anaesthesia for the femoral nerve allows theapplication of skin traction in a Thomas splint without thetime and risks of general anaesthesia and an open operation.[13]

Management in a hip spica, either acutely or after aninitial period of traction, needs only a single general anaesthetic.Conservative treatment may require more time inhospital but less in the operating theatre.The convenience of only one week in hospital is attractiveto the family and to a child who can cope with swiftrehabilitation, but social circumstances may outweigh theadvantages of early discharge. The wide range of timebefore returning to school, reported to be from three to 32weeks in the study of Bar-on et al, confirms that thepersonalities of both the fracture and the child have aconsiderable influence.[12] Rapid discharge must take accountof parental competence; return to school may not be hastenedby the intramedullary rod!Secondly, cost is now an important factor. Newton andMubarak found that the early applicationof a hip spicawas the cheapest option, although effective only in youngerchildren.[14] The use of traction or intramedullary rodding wasconsiderably more expensive, but the cost of treating anadolescent patient conservatively was 50% greater than thatof early surgical fixation, largely because of a threefolddifference in mean hospital stay. Finance must not beallowed to dictate the principles of clinical care, but earlyoperative treatment does seem to benefit all concerned inthemanagement of difficult fractures in older children.[13] Forother cases, the budgetary advantages of operative interventionare less convincing, particularly when treatment bytraction at home can be competently organised.Thirdly, the potential for complicationsis important,especially any which may lead to a lasting disability. In achild, minor malunion is of little concern provided that itdoes not include a large rotational deformity. In thisrespect, internal fixation is more certain to achieve anacceptable reduction than either external fixation or splintage.

Long-term reviews of remodelling such as that Wallace and Hoffman show that an initial angular deformityof even 25° can recover to give normal function.[15]Overgrowth is more likely after an operation, although theimportance of length discrepancy may have been overratedunless it reaches 2 cm or more. Knee stiffness may complicatethe results after external fixation at least temporarily.The use of intramedullary rods introduces the unique dangersof epiphysiodesis of the greater trochanter and ofavascular necrosis of the femoral head. Raney, Ogden and Grogan report five patients with premature closure of thephysis of the greater trochanter after intramedullary nailing: they all developed increased valgus of the femoral neck andone had mild radiological subluxation of the hip.[16]Few authors also reported avascular necrosis of thefemoral head after closed intramedullary nailing with alocking nail.[15,16] This disastrous potential should make surgeonsthink very hard before using this type of fixation inskeletally immature patients.[17]These serious complications are infrequent, as is themajor one of deep infection, but they result only from theuse of implants.[18] The flexible, paired nail system describeby Bar-On et al reduces these risks, but may producesymptoms at the sites of nail insertion.[12] Refracture mayoccur after either conservative or operative treatment, and areview of the orthopaedic literature on thefeature providesno unequivocal evidence.[19],[20]The availability of flexible nails and the attractions ofearly definitive surgery must not blind surgeons to theadequacy and proven value of the skilled conservativemanagement of fractures of the femoral shaft in childrenunder ten years of age.[21]The complications cost and convenienceof any new method must be carefully evaluated.[22]

CONCLUSION

After analyzing the results of treatment of diaphyseal femoral fracture in children by spica cast versus Rush nail, it is concluded that operative method is suitable method between 5-10 years, especially in restless head injury cases and poly trauma patients in which stabilizing the diaphyseal femoral fractures greatly facilitates nursing care.

The procedure is noninvasive, the fracture heamotoma is not exposed; the hip and knee remain free. The fracture alignment achieved is well within the acceptable range and there is no significant residual limb length discrepancy. Duration of hospital stay is quite low, reducing the economic stress on the parents and hospital resources.

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