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COMPARATIVE ANALYSIS OF OUTCOME OF PLASTER CAST AND EXTERNAL FIXATOR FOR MANAGEMENT OF OPEN DIAPHYSEAL FRACTURE OF TIBIA IN CHILDREN

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ABSTRACT

BACKGROUND

Tibia is the commonest long bone fractured and when patient sustains high velocity injury soft tissue damage occurs. The incidence of open fractures, in relation to all tibial shaft fractures comes up to 6.9%.Management of open diaphyseal fractures depends upon type of fracture and soft tissue damage. Stable fractures and minimally displaced fractures are usually treated with non-operative treatment, whenever possible, but unstable fractures may require operative intervention.

OBJECTIVE

To compare outcome of plaster cast and external fixator method for treatment for open fracture of tibia in children.

METHODOLOGY

This comparative analysis was conducted upon a sample of 40 patients (in two equal groups A and B of 20 each) meeting eligibility criteria (chosen via non-probability consecutive sampling) scheduled for corrective surgery at the study setting. Group A patients were managed by manipulation under anesthesia and plaster cast and group Bpatients were managed by external fixation. The surgical outcome in terms of restored functionality and incidence of infection was recorded onto a self-structured questionnaire after taking written informed consent. The data obtained was analyzed using SPSS v. 22.0.

RESULTS

The mean age of the sample stood at 6.5 years. Group A patients encountered a lesser and milder incidence of post-operative pain and encountered no limb length discrepancies and thus attained a better surgical outcome in this regard then group B. In terms of surgical site infection and functionality; no significant difference were observed between the groups.

CONCLUSION

After careful consideration, it can be concluded that both treatments have their merits and neither can be discredited owing to the fact that either choice achieves good surgical outcome.

Keywords: Tibial Fracture, High Velocity Fracture, Lower Limb Trauma, External Fixation, and Surgical Outcome

INTRODUCTION

Tibia is the commonest long bone fractured and when patient sustains high velocity injury soft tissue damage occurs. The incidence of open fractures, in relation to all tibial shaft fractures comes up to 6.9%.Management of open diaphyseal fractures depends upon type of fracture and soft tissue damage. Stable fractures and minimally displaced fractures are usually treated with non-operative treatment, whenever possible, but unstable fractures may require operative intervention **[1, 2]**.

Methods of fixation include percutaneous pins with plaster cast, external fixator, plates, screw fixation, and intramedullary nails. However in 3rd degree fractures, stabilization with external fixator is usually required to avoid infection **[3, 4]**.

Manipulation and casting is a reliable treatment for open tibial fractures in children. For high grade open fractures (Gustillo 3) or comminuted fractures, external fixation remains the gold standard **[5]**.

Majority of isolated open tibial fracture in children can be treated by wound debridement and plaster cast immobilization. There is still a role for the use of external fixator especially where there is a grossly unstable fracture or extensive soft tissue injury requiring a flap procedure **[6, 7]**. Advantages of the External fixator are avoidance of infection, quick and better rehabilitation and excellent functional outcome. Factors such as the degree of soft tissue damage and periosteal stripping that are noticed following wound debridement and velocity of injury are far more important than the wound size **[8, 9]**.

The management of the open diaphyseal fracture of tibia in children historically is difficult to treat. It remain controversial whether to treat these fractures conservatively or surgically. External fixator is a valuable clinical treatment option, providing surgeons with the ability to affect the spatial relationship of tissues, both statically and dynamically, via minimally invasive techniques. The external fixation method provides rigid fixation of the bones in cases in which other forms of immobilization, for one reason or another, are inappropriate. This is most common in severe, open type II and III fractures in which POP Cast would not permit access for management of the soft-tissue wounds and in which exposure and dissection to implant an internal fixation appliance would devitalize and contaminate larger areas and might significantly increase the risk of infection or loss of the limb itself **[9, 10]**.

Literature is scanty about the management of tibial fractures in children, and falls short of addressing the ideal choice of surgical technique. This study will help determine the outcome following two of the most prominent surgical techniques for management of open fracture of tibia in children.

METHODOLOGY

This comparative analysis was conducted upon a sample of 40 patients (in two equal groups A and B of 20 each) meeting eligibility criteria (chosen via non-probability consecutive sampling) scheduled for corrective surgery at the study setting. Group A patients were managed by manipulation under anesthesia and plaster cast and group Bpatients were managed by external fixation. The surgical outcome in terms of restored functionality and incidence of infection was

recorded onto a self-structured questionnaire after taking written informed consent. The data obtained was analyzed using SPSS v. 22.0.

All children received tetanus prophylaxis, systemic antibiotics and thorough debridement and irrigation of wound. Wounds with minimal soft tissue injury were closed primarily and others left open to allow to heal secondarily. Larger wounds require split skin grafts or local rotational flaps. Stable and unstable both fractures were reduced and immobilized in an above knee plaster cast in Group A patients and external fixator was used for Group B patients.

Patients with minimal soft tissue injury were discharged within one week of admission after wound management and pop cast with fracture in acceptable position and no signs of compartment syndrome. Patients with open fracture of tibia with moderate to severe soft tissue injury were remain admitted in ward from two to eight weeks, immobilization of fracture done with external fixator, wound was properly managed. All patients were followed up every week one month, then every two weeks for five months and then every month for six months for total of twelve months. Patients were evaluated on the basis of compartment syndrome, superficial infection, deep infection, and delayed union, non-union, and malunion, pain at fracture site, joint stiffness, cosmetic defects and minor leg-length discrepancies.

Inclusion Criteria

1. Patients ranging upto 12 years of age.
2. Fresh open diaphyseal fractures of tibia and patients arriving within 1 week of injury.
3. Grade I, II, III A and B.

Exclusion Criteria

1. Patients more than 12 years of age.
2. Fracture of tibia more than 1 week.
3. Grade III C open fractures.
4. Pathological fractures.
5. Malunited fractures.
6. Nonunion fractures.
7. Patient with thoracic, abdominal and head injuries.

RESULTS

The mean age of the sample stood at 6.5 years **(Table 1)**.

Group A patients encountered a lesser and milder incidence of post-operative pain and encountered no limb length discrepancies and thus attained a better surgical outcome in this regard then group B. In terms of surgical site infection and functionality; no significant difference were observed between the groups **(Table 2)**.

Table 1

Basic Variables– n (%)		Group A	Group B
		POP Cast	Ext. Fixator
Mean Age (Years)		6.5	7.2
Gender	Male	18 (87.5%)	17 (85%)
	Females	02 (12.5%)	03 (15%)
Side of Fracture	Left	06 (30%)	12 (60%)
	Right	14 (70%)	08 (40%)

Table 2

Adverse Surgical Outcomes – n (%)		Group A	Group B
		POP Cast	Ext. Fixator
Post-Op Pain	Nill	18 (90%)	16 (80%)
	Mild	02 (10%)	02 (10%)
	Moderate	-	02 (10%)
	Severe	-	-
Limb Length Discrepancy	Present	20 (100%)	19 (95%)
	Absent	-	01 (05%)
Knee Range of Motion	0 - 135 ^{o}	14 (70%)	16 (80%)
	0 - 120 ^{o}	04 (20%)	02 (10%)
	0 - 105 ^{o}	01 (05%)	02 (10%)
	0 - 90 ^{o}	01 (05%)	-
	< 90 ^{o}	-	-
Surgical Site Infection	Absent	18 (90%)	18 (90%)
	Superficial	01 (05%)	-
	Deep	01 (05%)	01 (05%)
	Pin Tract	-	01 (05%)

DISCUSSION

This study was conducted on 40 children with open diaphyseal fracture of tibia. There were 35 males (87.5%) and 5 females (12.5%) children. Males are affected more; this male predominance has been shown in various studies, as is **Table 3** below **[11 – 14]**.

The average age of the patients was 6.5 years and distribution of patients in different age group is reported in literature is largely synonymous with our findings **[15]**. There were two infections out of 20 patients in each group i.e. infection rate was 10% in both cases. In group A, one case of superficial and deep infection each was reported (managed by debridement and proper antibiotics according to culture report). Evidence exists regarding the rate of infection being even lower (as low as 3%) in POP group. The infection rate was higher than world literature due to conventional operation theaters and late arrival of patients **[16, 17]**.

In group B, one case of deep and pin tract infection each was reported (and treated with proper antibiotics according to culture report and repeated wound debridement). Lower rates of infection are reported for external fixation as well (as low as 1.8%) and the

difference yet again may be attributed to aforementioned reasons **[18]**.

In group "A" limb length was maintained and equal to contra lateral normal limb in all patients, which is comparable to other studies. Buckley et al. reported no limb length discrepancy in children treated with POP Cast. Mark C. Cullen et al showed no limb length discrepancy in children treated with POP Cast. In group B the limb length was maintained and equal to contra lateral normal limb in 19 patients. There was only 1cm of shortening in 1 patient i.e. 5% shortening rate. Hope and Cole shows 9.3% rate of leg shortening **[11, 15]**.

Table 3

Gender Distribution in Evidence Based Literature	Male		Female	
	n	%	n	%
Mark C. Cullen *et al*	65	84.4	18	15.6
Memon A *et al*	38	76	12	24
PG Hope *et al*	74	78	21	22
Cramer K.E *et al*	37	92	03	08

CONCLUSION

After careful consideration, it can be concluded that both treatments have their merits (cost – effectiveness, easy application and high maneuverability) and neither can be discredited owing to the fact that either choice achieves good surgical outcome.

REFERENCES

[1] Jones BG. Open tibial fracture in children. A survey of 83 cases. Injury. 2003; 34(10): 776-80.

[2] Vinz H, Kurz W. Opendiaphyseal tibial fractures in children. A survey of 138 cases. ZentalblChir. 1980; 105(1): 32

[3] Stephen D.H. Fracture of the shaft of the Tibia and fibula. In: Rockwood CA Jr, Kewilkins. ed: Fractures in children. 4th ed: Philadelphia: Lippincott. 1996. 1331-1375.

[4] Charalambous CP, Alvi F, Siddique I, Zenios M, Hirst P, Marshall P. Survey of 39 cases. IntOrthop. 2005 Dec; 29(6): 392-5.

[5] Gicquel P, Giacomelli MC, Basic B, Karger C, Clavert JM. Injury 2005 Feb; 36 Suppl 1: A44-50

[6] Canale ST. Fracture and dislocation in children. In: Crenshaw AH. ed: Campbell's operative orthopaedics. 7th ed: Tornoto. ST. Louis 1987: 1833-2013.

[7] Faraj AA. Watters AT. The role of definitive skeletal stabilization. Zhonghua Yi Xue ZaZhi (Taipei). 2002 Oct; 65(10): 453-6.

[8] Stephen D.H. Fracture of the shaft of the Tibia and fibula. In: Rockwood CA Jr, Kewilkins. ed: Fractures in children. 4th ed: Philadelphia: Lippincott. 1996. 1331-1375.

[9] Faraj AA The reliability of the pre-operative classification. Acta Orthop Belg. 2002 Feb; 68(1): 49-55.

[10] Arsalan H, Subasy M, Kesemenli C, Ersuz H. Occurrence and treatment of nonunion in long bone fractures in children. Arch Orthop Trauma Surg. 2002 Dec; 122(9-10): 499-8.

[11] Cullen MC, Roy DR, Crawford AH, Assenmacher J, Levy MS, Wen D. Open fracture of the tibia in children. JBJS. 1996 Jul 1; 78(7): 1039-47.

[12] Memon A, Ali M, Memon F, Laghari M.A and SiddiquiK. A. Management of open fracture of tibia in children. The Journal of Pakistan Orhtopeadic Association. 2008; 20(1): 81-87, 2008.

[13] Hope PG, Cole WG. Open fractures of the tibia in children. The Journal of bone and joint surgery. British volume. 1992 Jul; 74(4): 546-53.

[14] Cramer KE, Limbird TJ, Green NE. Open fractures of the diaphysis of the lower extremity in children. Treatment, results, and complications. The Journal of bone and joint surgery. American volume. 1992 Feb; 74(2): 218-32.

[15] Buckley, SL, Smith G, Sponseller PD, Thompson JD and Griffin PP.Open fractures of the tibia in children. J Bone and Joint Surg. 1990; 7(2): 1462-1469.

[16] Charalambous CP, Alvi F, Siddique I, Zenios M, Hirst P, Marshall P. Casting versus surgical fixation for grade IIIA open tibial diaphysial fractures in children: effect on the rate of infection and the need for secondary surgical procedures to promote bone union. International orthopaedics. 2005 Dec 1; 29(6): 392-5.

[17] Shannak AO. Tibial fractures in children: follow-up study. Journal of pediatric orthopedics. 1988; 8(3): 306-10.

[18] Reynolds DA. Growth changes in fractured long-bones: a study of 126 children. The Journal of bone and joint surgery. British volume. 1981 Feb; 63(1): 83-8.