Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Orthopedic Surgery

Titanium Elastic Nail outcomes in Children with Femur Fractures

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DOI: 10.36347/sjams.2023.v11i12.008 | **Received:** 25.10.2023 | **Accepted:** 03.12.2023 | **Published:** 12.12.2023

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Abstract **Original Research Article**

***Background*:** Titanium Elastic Nails are commonly used in children to heal diaphyseal and metaphyseal fractures. The age of the patient, as well as the nature and location of the fracture, determine if the TEN is required. The management of femoral diaphyseal fractures in children aged 5 to 14 years is still disputed. It is a successful and acceptable treatment option in some cases of femoral diaphyseal fractures. The TEN allows for the utilisation of elastically stable intramedullary nailing. ***Aim of the Study*:** The purpose of this study was to assess the effectiveness of Titanium Elastic Nails (TEN) in paediatric femoral fractures. ***Methods*:** This study was conducted in 250 Bedded General Hospital, Pabna, Bangladesh, from January 2020 to December 2020. The study included 65 paediatric patients aged 5 to 14 years who had femoral shaft fractures and were admitted to the study institution. All acquired data was entered into a Microsoft Excel Work Sheet and analysed in SPSS 11.5 using descriptive statistics. ***Results*:** The majority of the participants (84.62%) were male. Most of the participants (78.46%) were aged 5-10 years. Sports-related injuries caused fractures in 44.62% of the participants. The fracture began in the middle of the femur in 47.69% of the cases, the proximal region in 43.08% of the cases, and the distal region in 9.23% of the cases. In this study, 58.46% of participants were hospitalised for 7-14 days, while 33.85% were hospitalised for 14-21 days. Only 7.69% of the individuals had to spend more than 21 days in the hospital. The majority of participants in this study had no post-operative difficulties. At the 12-month follow-up, 81% of participants reported excellent patient satisfaction, 17% reported satisfactory patient satisfaction, and 2% reported poor patient satisfaction. ***Conclusion*:** Titanium elastic nailing is a successful and practical therapeutic alternative in certain cases of femoral shaft fractures in children aged 5 to 14. TENS is a safe and efficient treatment for paediatric femoral shaft fractures since it is less intrusive, easy to administer, and offers great functional and cosmetic results.

Keywords: Titanium elastic nail (TEN), Diaphyseal, Pediatric, Femoral fractures.

INTRODUCTION

Femoral fractures are the most prevalent type of fracture in children aged 0 to 18 years. There are several approaches to treating such instances. Titanium elastic nailing is one of them, and it is a well-established and dependable treatment approach for these types of fractures. There has been no agreement on the best therapy for fractures in children aged 5 to 14, therefore the issue is still being debated. The most common but incapacitating fractures in children are femur fractures. They are responsible for about 1.6% of all bone injuries in children [1]. In fact, femoral fractures are among the most common significant paediatric orthopaedic injuries that necessitate hospitalisation. Traditionally, the treatment for this has been age-related. It is also affected by the type of fracture and any concomitant injuries [2]. Most femoral shaft fractures in children under the age of six years can be managed conservatively since they heal quickly and spontaneously [3]. The issue arises when conservative techniques fail to achieve or maintain an adequate reduction of the fracture and surgery stabilisation is required. It is debatable which treatment is better for children aged six to sixteen. Over the last 20 years, patents older than six years have opted for a more operative strategy [2]. Some of the earlier methods of operational stabilisation of paediatric femoral shaft fractures include external fixation, compression plating, and stiff intramedullary nailing [4]. Over the years, many different forms of flexible intramedullary nails have been employed. Ender's nails and titanium elastic nails are two

of the most commonly utilised [5]. Titanium Elastic Nailing, also known as Elastic Stable Intramedullary Nailing, has emerged as the preferred method of stabilising paediatric long bone fractures, particularly femoral shaft fractures. The age of the child, the location and type of fractures, the family environment, the surgeon's knowledge [6], ability, and preferences, and even financial implications are some of the factors that determine the ideal treatment method of femoral shaft fracture. However, because children under the age of five have quick healing and spontaneous angulation correction, the conservative approach is still the preferred strategy of treating individuals with fracture shaft femur [7, 8]. Because angular deformity is not correctable by growing near the end of skeletal maturity, precise reduction is required [9]. The availability of locking intramedullary nails has contributed significantly to the advancement of treatment for femoral shaft fractures in skeletally grown youngsters. However, the appropriate treatment for children aged 5 to 14 remains debatable [10]. It is widely assumed that titanium's biomechanical properties are superior to those of stainless steel for intramedullary fracture fixation, and in-vitro mechanical studies have shown that titanium elastic nails fix paediatric femoral fractures as well as stainless steel elastic nails [11]. This approach has a number of reported advantages, including early union due to repeated micro motion at the fracture site, respect for early mobilisation, scar acceptance, early weight bearing, a high patient satisfaction rate, and easy implant removal. We discovered numerous advantages to this technique. The purpose of this study was to assess the effectiveness of titanium elastic nails (TEN) in paediatric femoral fractures.

METHODOLOGY

This study was conducted in 250 Bedded General Hospital, Pabna, Bangladesh, from January 2020 to December 2020. The study included 65 paediatric patients aged 5 to 14 years who had femoral shaft fractures and were admitted to the study institution. Each participant supplied written informed consent, and the research hospital's ethical review committee approved the study. The patients' age, gender, fracture location, fracture type, cause of fracture, post-operative complications, length of hospital stay, and patient satisfaction were all collected using a pre-prepared questionnaire. The TENs therapy technique required the following preparatory preparations. Flynn's formula was used to compute the nail diameter on the fracture x-ray. Nail sizes were kept consistent to avoid varus or valgus malpositioning. Making opposing longitudinal medial and lateral incisions 2.5-3.5 cm above the physis, the shattered bone was revealed, and the soft tissues were distributed in the same direction with blunt tip scissors. All patients were required to be immobilised for two weeks to avoid entrance site discomfort. The knee immobilisation was removed on the 14th postoperative day. Each participant was followed up on after a year. All acquired data was entered into a Microsoft Excel Work Sheet and analysed using descriptive statistics in SPSS 11.5.

RESULT

The majority of the participants (84.62%) were male, with 15.38% being female (Table-1). Most of the participants (78.46%) were aged 5-10 years, while the remaining 21.54% were aged 11-14 years. The average age of the participants was 7.45 years (Table-2). Sports-related injuries caused fractures in 44.62% of the participants, while road traffic accidents caused fractures in 27.69%. Falling from various heights fractured 18.46% of the participants, while minor trauma fractured 9.23% of the cases (Table-3). The fracture began in the middle of the femur in 47.69% of the cases, the proximal region in 43.08% of the cases, and the distal region in 9.23% of the cases (Table-4). In (Table-5) 58.46% of participants were hospitalised for 7-14 days, while 33.85% were hospitalised for 14-21 days. Only 7.69% of the individuals had to spend more than 21 days in the hospital. The average length of stay in the hospital was 13.2 ± 2.1 days. The majority of participants in this study had no issues, although 15.38% had <1.0 cm of leg length inequality, 1.54% had 1-2 cm leg length inequality, 1.54% had infection, 3.08% had entry site irritation, and 1 patient had soft tissue irritation caused by a prominent nail (Table-6). At the 12-month follow-up, 81% of participants reported excellent patient satisfaction, 17% reported satisfactory patient satisfaction, and 2% reported poor patient satisfaction (Figure-1).

Table-1: Sex of the participants (N=65)

Sex	Frequency	Percent
Male	55	84.62
Female	10	15.38
Total	**65**	**100**

Table -2: Age of the participants (N=65)

Age in years	Frequency	Percent
5-10	51	78.46
11-14	14	21.54
Total	**65**	**100**
Mean ± SD	7.45 ± 1.2	

Table-3: Cause of injury of the participants (N=65)

Cause of Injury	Frequency	Percent
Sports	29	44.62
RTA	18	27.69
Fall	12	18.46
Minor Trauma	6	9.23
Total	**65**	**100**

Table-4: Participant distribution by fracture location (N=65)

Location of fracture	Frequency	Percent
Proximal	28	43.08
Middle	31	47.69
Distal	6	9.23
Total	**65**	**100**

Table-5: Participant distribution by hospital stay duration (N=65)

Hospital Stay	Frequency	Percent
7-14 days	38	58.46
15-21 days	22	33.85
>21 days	5	7.69
Total	65	100
Mean ± SD	13.2 ± 2.1	

Table-6: Post-operative difficulties among participants (N=65)

Post-operative difficulties	Frequency	Percent
Infection	1	1.54
<1.0 cm leg length inequality	10	15.38
1.0-2.0 cm leg length inequality	1	1.54
Soft tissue irritation by prominent nail	1	1.54
Entry Site irritatio	2	3.08
No Complications	50	76.92
Total	**65**	**100**

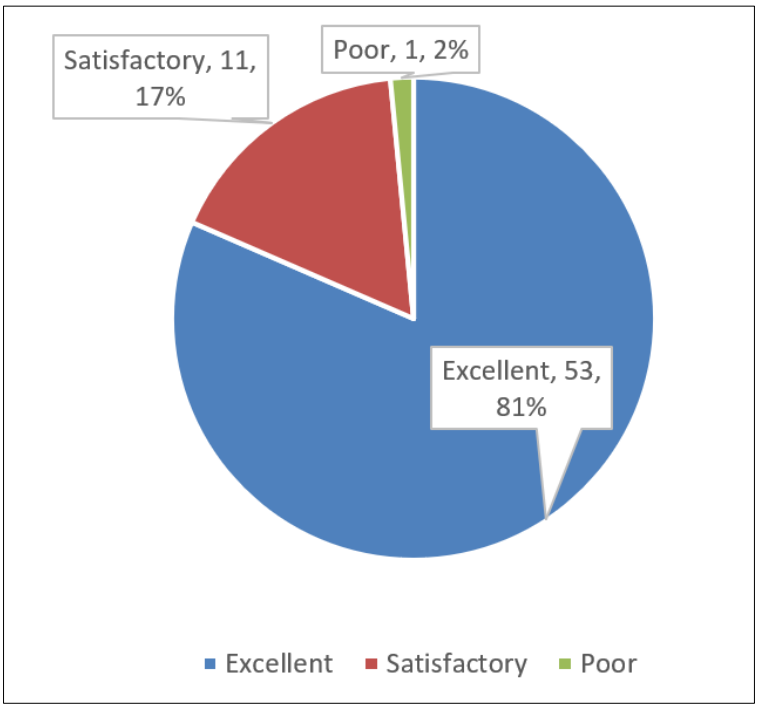

Figure-1: Outcomes after a 12-month follow-up among participants (N=65)

DISCUSSION

Femoral shaft fracture is a common type of fracture in youngsters. Many steps can be taken to treat a fractured femoral shaft, and depending on the severity of the fracture, the required surgery may be conservative or surgical in nature. The current study comprised 65 paediatric femoral fracture patients who were treated with the Titanium Elastic Nailing TEN procedure. The bulk of participants (84.62%) were male, with 15.38% female. Because boys engage in more outdoor activities than females, paediatric femoral fractures are more common in boys. Several other studies have validated the high proportion of male participants in our study [12, 13]. The bulk of participants (78.46%) were aged 5-10 years, with the remaining 21.54% aged 11-14 years. The average age of the participants was 7.45 years. The increasing incidence of fractures at this age group may be due to youngsters getting more interested in various outdoor sports and activities around this age. This was corroborated by an examination of the causes of the incidents, which revealed that 44.62% were wounded in sports-related incidents, 27.69% in road traffic accidents, 18.46% in falls, and the remaining 9.23% suffered fractures from minor injuries. These explanations were similarly consistent with earlier studies on paediatric fracture, however the incidence distribution varied in several circumstances [14, 15, 16]. The fracture began in the middle of the femur in 47.69% of the cases, the proximal region in 43.08% of the cases, and the distal region in 9.23% of the cases. 58.46% of participants were hospitalised for 7-14 days, while 33.85% were hospitalised for 14-21 days. Only 7.69% of persons had to spend more than 21 days in the hospital. The average length of stay in the hospital was 13.2 2.1 days. When patients stayed in the hospital for shorter lengths of time, this was higher than in previous studies of TENS fixation of femoral shaft fractures [17]. Although 15.38% of participants in this study had 1.0 cm of leg length inequality, 1.54% had 1-2 cm leg length inequality, 1.54% had infection, 3.08% had entry site irritation, and 1 patient had soft tissue irritation caused by a prominent nail, the majority of participants had no difficulties. At the 12-month follow-up, 81% of participants stated they had great patient satisfaction, 17% said they had good patient satisfaction, and one indicated they had poor patient satisfaction. These findings were evaluated using the TEN grading standards proposed by Flynn *et al*., [17].

Limitation of the Study:

The study featured a single point of focus and minimal sample sizes. As a result, the study's conclusions may not completely reflect the entire situation.

CONCLUSION & RECOMMENDATION

According to the study, titanium elastic nailing is an efficient and realistic therapeutic alternative in selected cases of femoral shaft fractures in children aged 5 to 14. TENS is a safe and efficient treatment for paediatric femoral shaft fractures since it is less intrusive, easy to administer, and offers great functional and cosmetic results.

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