Original Article

A COMPARATIVE STUDY OF INCIDENCE OF IATROGENIC ULNAR NERVE INJURIES IN TWO DIFFERENT TECHNIQUES OF CROSS KIRSCHNER WIRE CONFIGURATION FOR FIXATION OF PAEDIATIC SUPRACONDYLAR FRACTURES OF HUMERUS

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Abstract

Objective: The objective of this study was to compare the incidence of iatrogenic ulnar nerve injuries in two different techniques of cross Kirschner wire configuration for the fixation of paediatric supracondylar fractures of humerus.

Methodology: Forty patients attending Accident and Emergency Department of The Children's Hospital and Institute of Child Health, Lahore, with supracondylar fracture of humerus were studied from September 2014 to March 2015 to compare the incidence of iatrogenic ulnar nerve injuries in two techniques of cross Kirschner wire configuration for the fixation of supracondylar fractures of humerus. These patients were divided in group A and group B. Each group consisted of 20 patients. The fracture of patients in group A was fixed with two lateral cross Kirschner wires configuration and fracture of patients in group B was fixed with mediolateral cross Kirschner wires configuration. All the operations were performed by same team of Paediatric orthopaedic surgeons. Technique of Kirschner wire fixation of the fracture was allocated to the patients randomly. Informed consent was taken from parents of the patient. Detailed history of the patient was taken and thorough clinical examination including evaluation of neuromuscular status of the injured limb was done and recorded. Complete blood counts and urine analysis were done. Preoperative antibiotics were administered intravenously. In general anaesthesia, closed reduction of the fracture was done under C arm x-ray image intensifier control, fracture was held reduced manually and fixed with percutaneous Kirschner wires according to the fixation technique allocated to the patient. The Kirschner wires were bent, cut, buried under the skin, aseptic dressing and plaster back slab was applied. After recovery from general anaesthesia neurovascular status of the limb

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was re-evaluated and check x-rays of the elbow were done. Next day, the patient was discharged from the hospital and examined clinically and radiologically at 3 weeks, 6 weeks and 12 weeks.

Results: In this comparative study of incidence of iatrogenic ulnar nerve injuries in two different techniques of cross Kirschner wire configuration for fixation of paediatric supracondylar fractures of humerus, the peak incidence of the fractures was between the age of 5 – 7 years. There were 28 (70%) males and 12 (30%) were females with male to female ratio of 2.3:1. Nine (23%) patients sustained injury at home, 7 (17%) patients during cycling, 22 (55%) patients during playing and 2 (5%) fell from height. Right side was fractured in 14 (35%) patients and left side was fractured in 26 (65%) patients. One patient (5%) had flexion type of fracture and 39 patients (95%) had extension type of fracture. According to Gartland classification 5 (13%) had type II and 34 (87%) had type III fractures. In group A, in which the fracture was fixed with two lateral cross Kirschner wire configuration none of the patients had iatrogenic ulnar nerve injury. In group B, 1 (5%) patient in which fracture was fixed with mediolateral cross Kirschner wire configuration, an iatrogenic ulnar nerve injury was observed which completely recovered in 6 weeks with physiotherapy.

Conclusion: Techniques of two lateral cross Kirschner wire configuration and mediolateral cross Kirschner wire configuration are equally effective for fixation of paediatric supracondylar fracture of humerus. But mediolateral cross configuration technique can cause iatrogenic ulnar nerve injury. Therefore, it is concluded that two lateral cross Kirschner wire technique is a safe method for fixation of paediatric supracondylar fractures of humerus in terms of iatrogenic ulnar nerve injury.

Keywords: Supracondylar fracture, closed percutaneous K wires, lateral cross and mediolateral cross.

Introduction

Paediatic supracondylar fracture of humerus is the most common fracture.[1] It represents 50 – 70% of all elbow fractures in the first decade of life[2] with a peak incidence between the ages of 5 – 7 years,[3] because this is the period of maximum ligamentous laxity. This fracture usually occurs by a fall on outsretched hand from beds, couches, monkey bars, slides or swings which are 3 – 6 feet high.[4] During fall, traumatic force from the outstretched hand is transmitted to the distal humerus through the olecranon process to radial head, the elbow joint hyperextends and immature metaphyseal bone of distal humerus fractures in its supracondylar area. As brachial artery, median, radial and ulnar nerves are in the vicinity of the elbow joint therefore, they are always at risk during trauma and in the treatment of these fractures. In the literature, reported incidence of neurovascular injuries in paediatric supracondylar fracture ranges from 8% to 21%[5] which may result in serious complications. Therefore, treatment of paediatric supracondylar fractures is a matter of great importance. Initially these fractures were treated by closed manipulation and immobilization with plaster casts. This technique had a high rate of displacement of the fracture. To overcome this problem the technique of percutaneous fixation of paediatric surpracondylar fractures of humerus with one Kirschner wire was described. This technique provides anterioposterior stability but the fracture remains rotationally unstable. To provide anterioposterior and rotational stability at the fracture site, different technique of insertion of two Kirschner wires were introduced. The current method of treatment of paediatric supracondylar fractures of humerus is closed reduction and percutaneous Kirschner wire fixation.[6-11] The common configurations of Kirchner wires used for fixation of paediatric supracondylar fracture of humerus are two lateral parallel wires, two lateral cross wires and two mediolateral cross wires. Among these three configurations cross pin configuration is biomechanically more stable but iatrogenic ulnar nerve injury may result from placement of the medial wire.[12-18] Therefore, controversy still persists regarding selection of technique of cross Kirschner wire configuration for percutaneous fixation of paediatric supracondylar fracture of humerus.[19-23]

In this study, we have compared the incidence of iatrogenic ulnar nerve injuries in two different techniques of cross Kirschner wire configurations for the fixation of paediatric supracondylar fractures of humerus.

Inclusion Criteria

Children with closed, displaced supracondylar fracture of humerus attending Accident and Emergency department of The Children's Hospital and Institute of Child Health, Lahore.

Exclusion Criteria

Patients with more than two days of history of trauma, open fractures, fractures associated with neurovascular

injuries, fractures already treated by manipulation, and patients with history of trauma to the same elbow joint in past were excluded from the study.

Material and Methods

Methodology:

Forty patients attending Accident and Emergency Department of The Children's Hospital and Institute of Child Health, Lahore, with supracondylar fracture of humerus were studied from September 2014 to March 2015 to compare the incidence of iatrogenic ulnar nerve injuries in two techniques of cross Kirschner wire configuration for the fixation of supracondylar fractures of humerus. These patients were divided in group A and group B. Each group consisted of 20 patients. The fracture of patients in group A was fixed with two lateral cross Kirschner wires configuration and fracture of patients in group B was fixed with mediolateral cross Kirschner wires configuration. All the operations were performed by same team of Paediatric orthopaedic surgeons. Technique of Kirschner wire fixation of the fracture was allocated to the patients randomly. Informed consent was taken from parents of the patient. Detailed history of the patient was taken and thorough clinical examination including evaluation of neuromuscular status of the injured limb was done and recorded. Complete blood counts and urine analysis were done. Preoperative antibiotics were administered intravenously. In general anaesthesia, closed reduction of the fracture was done under C arm x – ray image intensifier control, fracture was held reduced manually and fixed with per cutaneous Kirschner wires according to the fixation technique allocated to the patient. The Kirschner wires were bent, cut, buried under the skin, aseptic dressing and plaster back slab was applied. After recovery from general anaesthesia neurovascular status of the limb was re-evaluated and check x-rays of the elbow were done. Next day, the patient was discharged from the hospital and examined clinically and radiologically at 3 weeks, 6 weeks and 12 weeks.

Results

In this comparative study of incidence of iatrogenic ulnar nerve injuries in two different techniques of cross Kirschner wire configuration for fixation of paediatric supracondylar fractures of humerus, the peak incidence of the fractures was between the age of 5 – 7 years. There were 28 (70%) males and 12 (30%) were females with male to female ratio of 2.3:1. Nine (23%) patients sustained injury at home, 7 (17%) patients during cycling, 22 (55%) patients during playing and 2 (5%) fell from height. Right side was fractured in 14 (35%) patients and left side was fractured in 26 (65%) patients. One patient (5%) had flexion type of fracture and 39 patients (95%) had extension type of fracture. According to Gartland classification 5 (13%) had type II and 34 (87%) had type III fractures. In group A, in which the fracture was fixed with two lateral cross Kirschner wire configuration none of the patients had iatrogenic ulnar nerve injury. In group B, 1 (5%) patient in which fracture was fixed with mediolateral cross Kirschner wire configuration an iatrogenic ulnar nerve injury was observed which completely recovered in 6 weeks with physiotherapy.

Discussion

Paediatic supracondylar fracture of humerus is the most common fractures.[1] These represent 50 – 70% of all elbow fractures in the first decade of life[2] with a peak incidence between the ages of 5 – 7 years.[3] During this period the children are more active and prone to trauma which may be a reason for supracondylar fracture of humerus. In our study of 40 patients the incidence of supracondylar fractures of humerus was between the age of 5 -7 years. Parsad M Gowda et al, 2014[24] reported a study of 30 paediatric supracondylar fractures of humerus with peak incidence between the age of 4 – 6 years and Mallikarjuna et al, 2015[25] reported peak incidence between 5 – 6 years. Peak incidence of the fracture in our study is comparable with the above mentioned studies.

In the study of paediatric supracondylar fractures of humerus, male to female ratio is an important parameter as it is an indicator of ratio of exposure of male and female paediatric population to the trauma. In our study of 40 patients, 28 (70%) were males and 12 (30%) were females with the male and female ratio of 2.3:1. Ramji Lal Sahu 1997,[26] reported a study of 170 paediatric supracondylar fractures of humerus. In this study 97 (57%) were males and 73 (43%) were females with the male female ratio of 2.6:1. Iqtadar Ullah Baber et al 2009,[27] reported a study of 70 paediatric supracondylar fractures of humerus, in this study 58 (83%) were males and 12 (17%) were females with male to female ratio of 5:1. Mallikarjuna et al, 2015[25]

reported a study of 122 paediatric supracondylar fractures of humerus in this study 88 (72%) were males and 34 (28%) were females with the male to female ratio of 2.6:1. Male female ratio of our study is 2.3:1 which is comparable with other studies with minor difference except the study reported by Iqtadarullah Babar et al 2009,[27] in which it is 5:1. It is a significant difference which is due to less exposure of the female paediatric population to outdoor activities which may result in supracondylar fracture of the humerus.

Cause of injury in paediatric supracondylar fractures of humerus on one hand indicates about activities of the children in a given population and on the other hand dictates type of fracture. In our study of 40 paediatric supracondylar fractures of humerus 7 (17%) fell during cycling, 9 (23%) fell at home, 2 (5%) fell from height and 22 (55%) sustained the injury during playing. J Mangwani et al 2006[28] reported a study of 341 paediatric supracondylar fractures of humerus with 291 patients with full documentation. In this study 180 (62%) fractures occurred at home, 67 (23%) occurred at school, 41 (14%) occurred during playing and 3 (1%) occurred during road traffic accidents. Kaya Memisoglu et al 2010,[29] reported a study of 189 patients with paediatric supracondylar fractures of humerus in which 87 (62%) fell from height, 31 (22%) sustained the fracture during road traffic accidents, 21 (16%) due to accidents while cycling and playing. In our study 22 (55%) sustained the injury while playing, in the series of J Mangwani et al 2006,[28] 180 (62%) patients sustained the injury at home and in the series of Kaya Memisoglu et al 2010,[29] 87 (62%) patients sustained the injury due to fall from height. In all the above mentioned studies mechanism of injury is quite different. In our study, maximum number of injuries occurred while playing. This can be attributed to a greater involvement and activity of our paediatric population in physical activity and games.

Importance of side of fracture cannot be denied as it is related to the handedness of the patient and functional outcome of the treatment. In our study of 40 supracondylar fractures of humerus, right side was fractured in 14 (35%) patients and left side was fractured in 26 (65%) patients. In all the patients of our study with supracondylar fracture of humerus, right side was dominant. AP Thomas et al 1987[30] reported a study of 70 paediatric supracondylar fractures of humerus, in this study, right side was fractured in 30 (42%) patients and left side was fractured in 40 (57%) patients. Kaya Memisoglu et al 2010,[29] reported a study of 189 patients with paediatric supracondylar fractures of humerus among them 139 patients attended that final examination. Forty three (31%) patients had fracture of right side and 96 (69%) had fracture of left side. It is comparable with our study as non dominant side was more fractured in previous reported studies. It is due to the motor skills which are more developed on the dominant side. Therefore, the dominant side efficiently protects itself from injury.

Type of fracture is the end result of application of direction of force which determines the method of treatment of the fracture. In our study flexion type of fracture was 1 (5%) and extension type fractures were 39 (95%). Among them 5 (13%) were type II and 34 (87%) were type III fractures. J. V. Fowles et al 1974[31] reported a study of 175 paediatric supracondylar fractures of humerus and recorded 158 (90%) children had extension and 17 (10%) had flexion type of fractures. Ramji Lal Sahu 1997,[26] reported a study of 170 paediatric closed supracondylar fractures of humerus in this study 158 (93%) were extension type and 12 (7%) were flexion type. Mallikarjuna et al, 2015[25] reported a study of 122 paediatric supracondylar fractures of humerus in this study all the 122 (100%) fractures were extension type. Our study confirms the fact that flexion type of paediatric supracondylar fractures of humerus are very small in number and extension type of the fractures are major burden on paediatric orthopaedic surgeons.

Iatrogenic nerve injuries are a part of the treatment of paediatric supracondylar fractures of humerus. Mangwani J et al 2006,[28] reported a study of 341 paediatric supracondylar fractures of humerus among them 158 were treated with cross configuration of Kirschner. In this study 9 (6%) iatrogenic ulnar nerve injuries were reported out of them 3 (2%) required exploration. In these patients various degrees of ulnar nerve bruising was observed.

In our study, group A, patients in which fractures were fixed with two lateral cross Kirschner wire configuration none of the patients had iatrogenic ulnar nerve injury. Kaya Memisoglu et al 2010,[29] reported a study of 189 patients with paediatric supracondylar fractures of humerus among them 75 fractures were fixed with two lateral cross configuration Kirchner wire technique. None of these patients had iatrogenic ulnar nerve injury observed. In group B patients in which fractures were fixed with mediolateral cross Kirschner wire configuration technique 1 (5%) patient had iatrogenic ulnar nerve injury which completely recovered within 6 weeks with physiotherapy. Kaya Memisoglu et al 2010,[29] reported a study of 189 patients with

paediatric supracondylar fractures of humerus among them 64 (34%) were fixed with mediolateral cross Kirshcner wire configuration among them 6 (9%) patients had iatrogenic ulnar nerve injury. Our study confirms that technique of two mediolateral cross Kirchner wire configuration for the fixation of paediatric supracondylar fractures of humerus has a risk of iatrogenic ulnar nerve injury.

Conclusion

Techniques of two lateral cross Kirschner wire configuration and mediolateral cross Kirschner wire configuration are equally effective for fixation of paediatric supracondylar fracture of humerus. But mediolateral cross configuration technique can cause iatrogenic ulnar nerve injury. Therefore, it is concluded that two lateral cross Kirschner wire technique is a safe method for fixation of paediatric supracondylar fractures of humerus in terms of iatrogenic ulnar nerve injury.

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