



Orthopaedics

PROSPECTIVE STUDY TO EVALUATE FUNCTIONAL OUTCOME OF PAEDIATRIC RADIAL NECK FRACTURES TREATED BY METAIZEAU TECHNIQUE

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ABSTRACT

Background: Radial neck fractures in children are a rare injury, and the timing of surgery as well as the surgical technique will determine how well they respond to treatment. When the tilt surpasses 60 degrees, radial neck fractures in children are significant injuries with frequent after effects. In these situations, conservative treatment is frequently insufficient, and open reduction may result in iatrogenic consequences. Retrograde intramedullary nailing of the radius is one method of treating dislocated radial neck fractures in children (the Metaizeau technique). **Aim:** The purpose of this study was to evaluate the functional outcome of Metaizeau technique. **Methodology:** After taking proper consent and ethical clearance a prospective study was conducted in 16 cases of closed radial neck fractures in children aged 6-12 years without any neurovascular deficit. Patients were treated by Metaizeau technique at Jorhat medical college and Hospital from 2021-2022 and were followed up at 2 weeks, 4 weeks, 6 weeks, 10 weeks and 12 weeks. **Result:** In this study, it is found that this technique is safe and effective in treating radial neck fracture in children. The fracture should be reduced within 7 days of injury. Later on, fracture reduction will be difficult because of fibrosis and fracture healing. In our study, average age was 9 years. Males were affected more than females and the common mode of injury was fall on outstretched hand. All cases achieved radiological and clinical union by 6 weeks. All cases achieved comparable flexion-extension of elbow, supination-pronation of the forearm (as compared to healthy side). Average MEPS was 82.19 which was quite remarkable. Only one patient developed entry site pressure necrosis by cut end of TENS nail. The other disadvantage of this technique was need of second surgery for tens removal. **Conclusion:** Metaizeau technique is a minimally invasive technique with easy learning curve, minimal tissue damage, and reduced chance of elbow stiffness and osteonecrosis of radial head. Our results are within the acceptable range of satisfactory outcomes, if not more towards the better end of the outcomes quoted in literature.

KEYWORDS : Metaizeau technique, Radial neck fractures, intramedullary pinning**INTRODUCTION**

Radial neck fractures in children are a rare injury, and the timing of surgery as well as the surgical technique will determine how well they respond to treatment. The literature refers to a number of closed reduction techniques, including the push and lever techniques using either Kirschner wires (K-wire), Steinmann pins, or intramedullary nails. The Metaizeau procedure, commonly known as Métaizeau's retrograde intramedullary pinning, is frequently employed because of its outstanding results and minimal complications.¹ Since Feray's initial description of percutaneous leverage reduction in 1969, the Métaizeau approach is increasingly being used in conjunction with it.² The immature radial head is primarily cartilaginous and intra-articular radial head fractures in children and adolescents are rare. The radial head is entirely articular cartilage and the primary blood supply comes from the metaphysis. This may predispose the radial head to avascular necrosis and non-union with significant displacement. The cartilaginous head absorbs the force and transmits it to the weaker physis or metaphysis of the neck.³

When the tilt surpasses 60 degrees, radial neck fractures in children are significant injuries with frequent after effects. In these situations, conservative treatment is frequently insufficient, and open reduction may result in iatrogenic consequences. Retrograde intramedullary nailing of the radius is one method of treating dislocated radial neck fractures in children (the Metaizeau technique). Whether the forearm is supinated, neutral, or pronated at the time of the fall determines which way the elbow will angle. Vostal demonstrated that in neutral, the pressure is primarily applied to the side of the head and neck. The pressure is concentrated anteriorly in supination and posteriorly in pronation.^{4,5}

The prognosis is based on the level of displacement, the patient's age, any accompanying elbow injuries, and the type of therapy used. Increased angulations and displacement are typically linked to worse outcomes. For the elbow's stability and biomechanics to return to normal, the radial neck's angulation and displacement must be

corrected. The majority of mildly displaced radial neck fractures are managed conservatively by starting physical therapy as soon as possible. Conservative treatment may result in secondary displacement, malunion, and cubitus valgus. Conversely, open reduction and internal fixation (ORIF) is linked to non-union, implant-related complications, reduced range of motion (ROM), posterior interosseous nerve palsy, heterotopic bone formation, and avascular necrosis of the radial head.

The purpose of this study was to evaluate the functional outcome of Metaizeau technique.

METHODOLOGY

After taking proper consent and ethical clearance a prospective study was conducted in 16 cases of closed radial neck fractures in children aged 6-12 years without any neurovascular deficit. Patients were treated by Metaizeau technique at Jorhat medical college and Hospital from 2021-2022 and were followed up at 2 weeks, 4 weeks, 6 weeks, 10 weeks and 12 weeks.

Surgical Technique: The patient was positioned supine, with arm 90 degrees abducted, and forearm resting on a radiolucent side table. Under general anaesthesia, closed reduction was initially attempted by applying traction to the extended elbow with the forearm supinated, then Varus stress to the elbow while applying direct pressure over the radial head (Patterson manoeuvre). The Israeli technique, which involves pronating and flexing the supinated and extended elbow while the thumb directly stabilises the proximal radial fragment, was used for difficult reductions. If manual reduction was successful, that is if $\square < \square 30^\circ$ of angulation and $< 30\%$ of displacement was achieved, (or even if the radial neck-shaft angle was reduced to $\square < \square 45^\circ$) then an elastic intramedullary nail was used for fixation, especially in unstable fractures based on pre-op displacement and intra op stability on continuous screening of elbow, taking through the full range of movement under image intensifier. The nail was inserted 1cm proximal to the distal physis of radius and advanced through the

fracture site into the radial head. The nail tip was positioned to the radial head, and the fracture ends were distracted before the nail was rotated up to 180° in combination with manual reduction, and following which, the elbow range of motion was assessed. In unsuccessful reduction, a 2-mm K-wire was percutaneously inserted from the side of displacement of radial neck into the proximal fragment, and the k wire was used as a joystick to reduce by leveraging. Radial neck fractures were reduced to <30° with a displacement of <30%.

Above elbow slab was applied after operation for 1 week. Patients were advised to do light activities like eating, grooming etc. Heavy work and playful activities were forbidden. Clinical assessment was done by degree of active range of motion and MEPS at 6 weeks. Radiological assessment for union was also done at 6 weeks.

preop xray



postop xray



RESULT

A total of 16 cases were included. Average age was 9 years (range = 6 yrs - 12 yrs.). Functional outcome data was compiled at 6 weeks.

DEMOGRAPHY	N (%)
Male	10 (62.5%)
female	6 (37.5%)
right	8 (50%)
left	8 (50%)

FUNCTIONAL OUTCOME

SL NO	PRONATION-SUPINATION	FLEXION-EXTENSION	MEPS
1	70/90	0-130	85
2	80/90	0-120	85
3	70/90	0-130	85
4	90/80	10-120	80
5	90/70	10-130	80
6	80/80	0-130	85
7	90/80	0-120	85
8	70/90	10-120	80
9	80/80	0-130	85
10	90/70	0-120	85
11	70/80	0-120	80
12	80/80	10-120	75
13	90/90	0-120	85
14	80/90	0-120	85
15	70/80	10-120	75
16	80/70	0-130	80

DISCUSSION

In general, the non-surgical option is suggested for children younger than five years of age, who present with full pronation and supination and a radial neck-shaft angle of less than 50°-60° together with

minimal displacement or translation (<2-3 mm). Satisfactory outcomes have been reported with conservative management in most series. The non-surgical option can also be considered in children up to 10 years of age with an angle of <30°. Fractures with angulation more than 30° and displacement of more than 50% (or >4 mm) should undergo an attempt of closed reduction. Authors differ widely about the acceptable angulation for good results, which ranges from 15 to 60° based on the age of the patients.^{6,7}

Our results are encouraging in obtaining stable fixation to avoid additional surgery due to loss of reduction, compared to the failure rates stated in the literature with this technique, which were almost more than 10%. In our study, we didn't find any subpar outcomes caused by loss of reduction. It is possible for epiphyseal plate injury to occur during reduction, particularly in affected fractures. The distraction of the fragments and reduction of the proximal fragment with the rotation of the nail was managed without irritating the growth plate due to its ability to achieve stable attachment to the proximal fragment. Due to assurance in fixation, it was more comfortable to initiate an early range of movement, which avoid any formation of tissue adhesions and consequent stiffness of the joint in these patients.

In this study, it is found that this technique is safe and effective in treating radial neck fracture in children. The fracture should be reduced within 7 days of injury. Later on, fracture reduction will be difficult because of fibrosis and fracture healing. In our study, average age was 9 years. Males were affected more than females and the common mode of injury was fall on outstretched hand. All cases achieved radiological and clinical union by 6 weeks. All cases achieved comparable flexion-extension of elbow, supination-pronation of the forearm (as compared to healthy side). Average MEPS was 82.19 which was quite remarkable. Only one patient developed entry site pressure necrosis by cut end of TENS nail. The other disadvantage of this technique was need of second surgery for tens removal.

Our retrospective study is not free of any flaws, especially considering the small number of patients. Further prospective randomised studies with a large number of patients and robust statistical analysis with extended periods of follow-up may help in establishing the significance of this method.

CONCLUSION

Results of Metaizeau technique in children was promising. Proper selection of patient and timing of surgery is important for success. Metaizeau technique is a minimally invasive technique with easy learning curve, minimal tissue damage, and reduced chance of elbow stiffness and osteonecrosis of radial head. In our series, though, not big enough to substantially conclude and extrapolate the effectiveness of this technique, we have not noticed any poor outcomes due to loss of reduction. Our results are within the acceptable range of satisfactory outcomes, if not more towards the better end of the outcomes quoted in literature.

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