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MANAGEMENT OF MULTIPLE FRACTURES IN OSTEOGENESIS IMPERFECTA PATIENTS IN REGIONAL HOSPITAL OF RURAL AREAS: WHAT AN ORTHOPEDIC SURGEON CAN DO?

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Abstract

Background: Osteogenesis Imperfecta (OI) is a connective tissue disorder characterized by bone fragility and recurrent fractures. Man aging fractures in OI patients in rural regions poses challenges due to limited resources and high treatment costs. Objective: To describe the management of pathologic fractures in a pediatric patient with OI who resides in a remote area. Case Summary: An 8-year-old girl with known OI presented with pain and deformity of the right lower leg after falling from a stroller. Radiographs confirmed closed fractures of the tibia and fibula. The ideal management is Fassier-Duval intramedullary rodding; however, due to socioeconomic limitations and lack of facility availability, closed reduction and immobilization were performed. Conclusion: Management of fractures in OI should be individualized. In resource-limited settings, closed reduction and immobilization may be an acceptable alternative.

Keywords: *Osteogenesis imperfecta, pediatric fracture, rural hospital, closed reduction, pathologic fracture.*

INTRODUCTION

Background

Osteogenesis Imperfecta (OI) is a congenital connective tissue disorder characterized by bone fragility, osteopenia, blue sclera, dentinogenesis imperfecta, and hearing loss. Most cases are caused by mutations in the COL1A1 and COL1A2 genes. The prevalence ranges from 4–6.7 per 100,000 live births. OI patients experience recurrent fractures, often from minor trauma.

Fractures account for nearly one-fourth of childhood injuries, with a peak incidence during early adolescence. Causes include accidental trauma, non-accidental trauma, and pathologic conditions such as OI. Managing fractures in OI requires careful consideration of bone fragility, growth potential, and available medical resources.

Problem Formulation. How should closed fractures in pediatric OI patients be managed in remote areas with limited facilities and economic constraints?

Research Purpose. To describe appropriate management of closed fractures in OI patients living in resource-limited regions.

Benefits of Research

Theoretical Benefits. To expand knowledge regarding fracture management in OI patients in rural healthcare settings.

LITERATURE REVIEW

2.1 Theoretical Basis

2.1.1 Osteogenesis Imperfecta (OI)

Bisphosphonates are commonly used to reduce fracture frequency, increase bone density, and relieve bone pain. Early diagnosis is based on clinical findings, radiographic features, bone density assessment, and genetic testing.[1,2]

2.1.2 Basic Principles of Fracture Treatment in Children

Goals of pediatric fracture treatment include:

1. Achieving and maintaining reduction
2. Protecting the growth plate
3. Preserving soft tissue integrity
4. Facilitating fracture healing
5. Allowing early mobilization
6. Promoting joint motion
7. Preventing complications such as malunion, non-union, infection, stiffness, and neurovascular injury.[3]

2.1.3 Incomplete Fractures in Children

Basic treatment principles were applied according to the type of the fracture. The classification of fractures has been used in almost all bone injuries both in adults and children for many years. A classification is needed for better understanding the injury mechanism, planning a proper treatment strategy, and estimating the prognosis (Torus, traumatic bowing, greenstick fractures).[4,5,6]

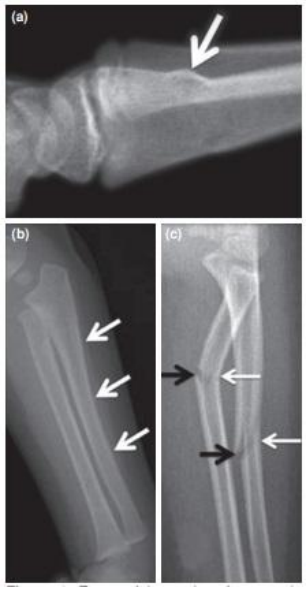


Figure 1. Types of incomplete fractures in children. (a) Torus fracture of distal radius (arrow). (b) Traumatic bowing of ulna. Note that posterior convex bowing of ulna in lateral radiograph is lost

and becomes concave (arrows). (c) Greenstick fracture of forearm (black arrows indicate failure sides and white arrows indicate plastic deformation sides).

2.1.4 Complete Fractures

Complete fractures can involve diaphysis, metaphysis and are similar to adult fractures. Besides, such fractures can involve the epiphysis and growth plate. The fracture pattern is directly related with the direction of the applied force to the long bone. The fracture pattern may be helpful for determining the most effective reduction maneuver and the way of cast molding.[4,6]

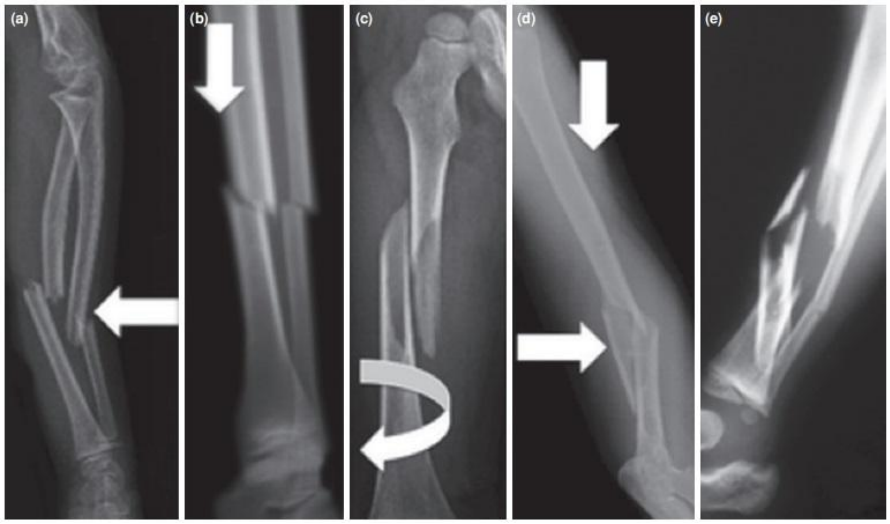


Figure 2. Classification of complete fractures according to fracture pattern. Arrows show direction of applied forces to produce fractures. (a) Transverse fractures of radius and ulna shafts. (b) Oblique fracture of tibia shaft. (c) Spiral fracture of femur shaft. (d) Butterfly fracture of distal third of humerus shaft. (e) Comminuted fracture of tibia shaft.

2.1.5 Open Fractures. The rate of open fractures in children is about 3% and the most affected site is tibia like in adults. Open fractures require debridement, stabilization, antibiotics, and early soft tissue management.[4,7,8]

2.1.6 Multiple Fractures. The rate of multiple fractures in children is approximately 4%. Early stabilization is recommended once life-threatening conditions are managed.[7]

2.1.7 Pathologic Fractures. Pathologic fractures may occur due to local or systemic bone abnormalities such as OI. Management varies according to underlying etiology.[4,6,9]

2.1.8 Diaphyseal Fracture Management by TENS

Diaphyseal fractures in children are among the most common major paediatric injuries treated by orthopaedic surgeons and account for approximately 1.6% of all fractures seen in this population. Peak incidences occur at 2 & 17 years of age in bimodal distribution and boys have 2.6 times greater incidence than girls. Titanium elastic nailing is widely used due to faster healing, minimal invasiveness, and early mobilization.[10]

2.1.9 Fracture Management in Osteogenesis Imperfecta. Treatment involves minimal immobilization, careful handling, and intramedullary rodding when indicated. Flexible casts are preferred to avoid stress risers. Pre-existing deformities should be corrected to prevent refractures.[11]

CASE REPORT

3.1 Patient Identity

Name: MA
Age: 8 years
Gender: Female
Address: Tanjung Payang Village
Date of Visit: February 10, 2025

3.2 Anamnesis

Chief Complaint. Pain in the right lower leg following a fall from a stroller.

History of Present Illness. The patient fell from a stroller after being pushed by a classmate. The right leg hit the floor while the child held onto the stroller. Immediate pain and difficulty moving the leg occurred.

History of Previous Illness. At age 1 year, patient was diagnosed with OI. History of previous fractures and bisphosphonate therapy noted.

Family History. No family members with similar conditions.

Social Background. Patient attends school but has functional limitations requiring assistance for prolonged sitting or standing.

3.3 Physical Examination

General Condition. Mildly ill, conscious, HR 110 bpm, RR 24/min, Temp 37°C.

Local Examination. Right lower leg deformity, crepitation, pain (VAS 3), limited ROM, no swelling or skin injury.

3.4 Supporting Examination

Radiology



Figure 3. Closed fractures of midshaft tibia and fibula.

3.5 Resume. An 8-year-old female with OI presented with pathologic fracture of the right tibia and fibula following low-energy trauma.

3.6 Clinical Photo Pre-Operation



Figure 4. Clinical photo pre-operation

3.7 Working Diagnosis

Pathologic closed fracture of the right tibia and fibula + Osteogenesis Imperfecta.

3.8 Management

Closed reduction under general anesthesia followed by backslab immobilization. The patient was
monitored and discharged on postoperative day 2.

3.9 Clinical Photo Post-Operation



Figure 5. Day 0 post operation



Figure 6. Day 1 post operation

DISCUSSION

This case illustrates the complexities of managing pathologic fractures in OI patients in rural hospitals. Limited access to specialized implants such as Fassier-Duval rods requires adopting practical approaches such as closed reduction and immobilization.

Key fracture management principles were upheld, including maintaining reduction, protecting soft
tissues, allowing early mobilization, and minimizing complications.

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

OI is caused by type I collagen mutations leading to bone fragility. Ideal management of fractures in OI involves multidisciplinary care and appropriate surgical stabilization. In rural settings, conservative management may be necessary when resources are limited.

5.2 Recommendations

Further research is needed on management strategies for OI in resource-limited environments.

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