

Management of Combined Fracture Neck of Femur and Femoral Deformity in Osteogenesis Imperfecta Patient: A Case Report

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Received on: 11 October 2023; Accepted on: 30 March 2024; Published on: 06 May 2024

ABSTRACT

Osteogenesis imperfecta (OI) patients usually sustain repeated fractures from trivial trauma and also have skeletal deformities that affect walking. The bone fragility and repeated fractures produce deformities of the long bones especially in femur and tibia. However, neck of femur (NOF) fractures in OI are rarely described.

A 11-year-old male patient known to have OI (Sillence type IV) sustained a NOF fracture after a fall. He also had proximal femoral anterolateral bowing proximally and over an intramedullary (IM) rod inserted 4 years back. He was treated by corrective osteotomy and stabilisation with an IM telescoping nail for the deformed femur and the Wagner technique for the NOF fracture. One year after operation, the patient had recovered satisfactory functional outcome with union of the NOF fracture and correction of the femoral deformity.

Conclusion: The method of the Wagner technique can achieve stable fixation for femoral neck fractures and introduces the least interference with concurrent telescoping nail insertion.

Keywords: Fracture neck of femur, Osteogenesis imperfecta, Proximal femoral deformity, Telescoping nail, Wagner technique.

Strategies in Trauma and Limb Reconstruction (2024): 10.5005/jp-journals-10080-1611

INTRODUCTION

Osteogenesis imperfecta (OI) patients sustain repeated fractures due to trivial trauma and have skeletal deformities that affect walking.¹ According to the inheritance pattern and clinical characteristics, the Sillence classification divides OI patients into four types: type I (mild, non-deforming), type II (perinatal lethal), type III (severely deforming), and type IV (moderately deforming).²

Bowing of long bones, especially in lower limbs, can result in repeated fractures. Malunion of these fractures increases bowing and produces a vicious cycle.³ There are few reports in the literature of NOF fractures in OI.⁴ The methods of fixation for these fractures are difficult as described in the few case reports.⁵⁻⁷ These difficulties are highlighted by the very poor bone quality, a narrow neck diameter, and often, the presence of an intramedullary (IM) rod or telescoping nail in the femoral shaft.

Case Description

A 11-year-old male with OI (Sillence type IV) and on regular bisphosphonate therapy presented with right hip pain and inability to walk after a fall on ground. On clinical examination, external rotation of the right lower limb, local hip tenderness and painful limitation of range of motion were noted. The limb was 3.5 cm shorter than the other side due to severe femoral bowing. Anteroposterior and lateral views X-rays were done. These revealed a displaced transcervical right NOF fracture and also showed IM rods in both femurs from previous operations 4 years ago with one rod (right side) displaced and lying intracortical. There was a flexion deformity in the proximal femur (Fig. 1). The subsequent CT scan showed no comminution in the NOF (Fig. 2).

Under general anaesthesia and in the floppy lateral position, an open reduction of the NOF fracture was performed and fixation

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How to cite this article: Elbaseet HM, Ibrahim AH, Abol Oyoum N, *et al.* Management of Combined Fracture Neck of Femur and Femoral Deformity in Osteogenesis Imperfecta Patient: A Case Report. *Strategies Trauma Limb Reconstr* 2024;19(1):56-59.

Source of support: Nil

Conflict of interest: None

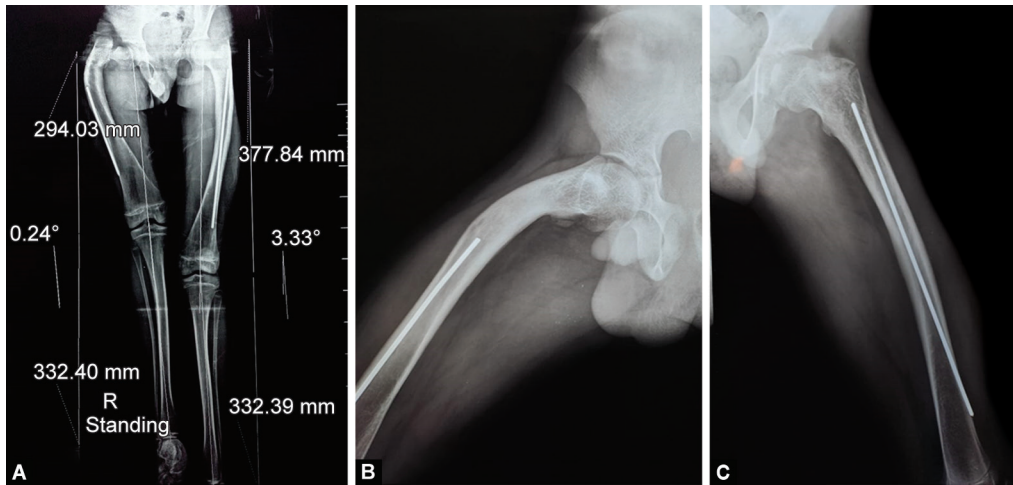
Patient consent statement: The author(s) have obtained written informed consent from the patient's parents/legal guardians for publication of the case report details and related images.

accomplished with two threaded Kirschner wires crossing the head physis. The intracortical rod was removed and an anterolateral wedge excised at the centre of rotation and angulation (CORA) of proximal femur to correct both varus and flexion deformity was done. A telescoping nail was then inserted in the newly straightened femur and two cerclages were used to hold the two k wires to the femoral shaft (Wagner technique) (Figs 3 to 5).

After 1 year follow-up, X-rays showed the union of NOF fracture and correction of femoral deformity that was maintained (Fig. 4).

DISCUSSION

Patients with OI often sustain repeated fractures, mainly of the long bones, which can leave them with angulation and disability.⁸



Figs 1A to C: (A) Anteroposterior long X-ray film showing mid-cervical NOF fracture and intracortical rod migration in both femurs. Note varus malalignment at proximal third of right femur; (B and C) Lateral views showing flexion deformity on the right side

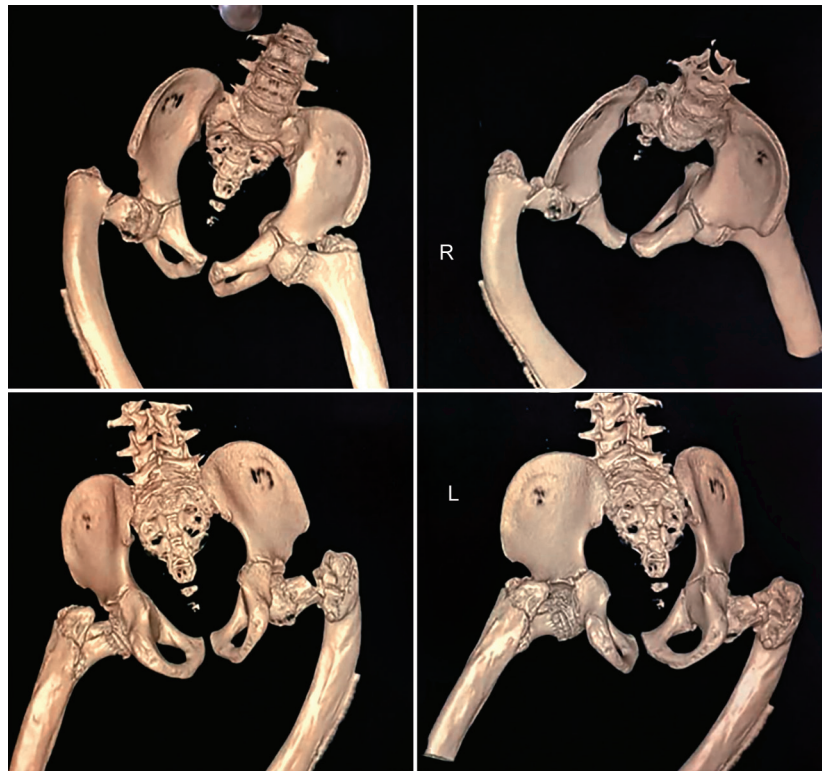


Fig. 2: Three-dimensional CT scan showing no comminution at NOF fracture

The telescoping IM nail has been found to be an effective implant to fix fractures as well as for stabilisation after deformity correction. The telescoping function of the device helps to decrease the reoperation rate for the growing child.⁹

Associated NOF fractures in OI with a concurrent femoral deformity are uncommon. It usually occurs proximal to an implant and may be attributed to the relative stiffness of shaft of the femur (with inserted implant) concentrating high stresses upon

NOF.⁶ Difficulties are encountered during surgical fixation of such a fracture and deformity combination and the literature lacks detail in how the intraoperative obstacles can be overcome and the subsequent clinical outcomes.^{4,5,7} In a review of the literature, Chung et al. reported a NOF in an adult female with an IM nail. They used cannulated cancellous screws for fixation assisted by a navigation system to guide the entry point.¹⁰ Tsang et al. published on two O.I. patients with NOF on top of pre-existing IM rods.

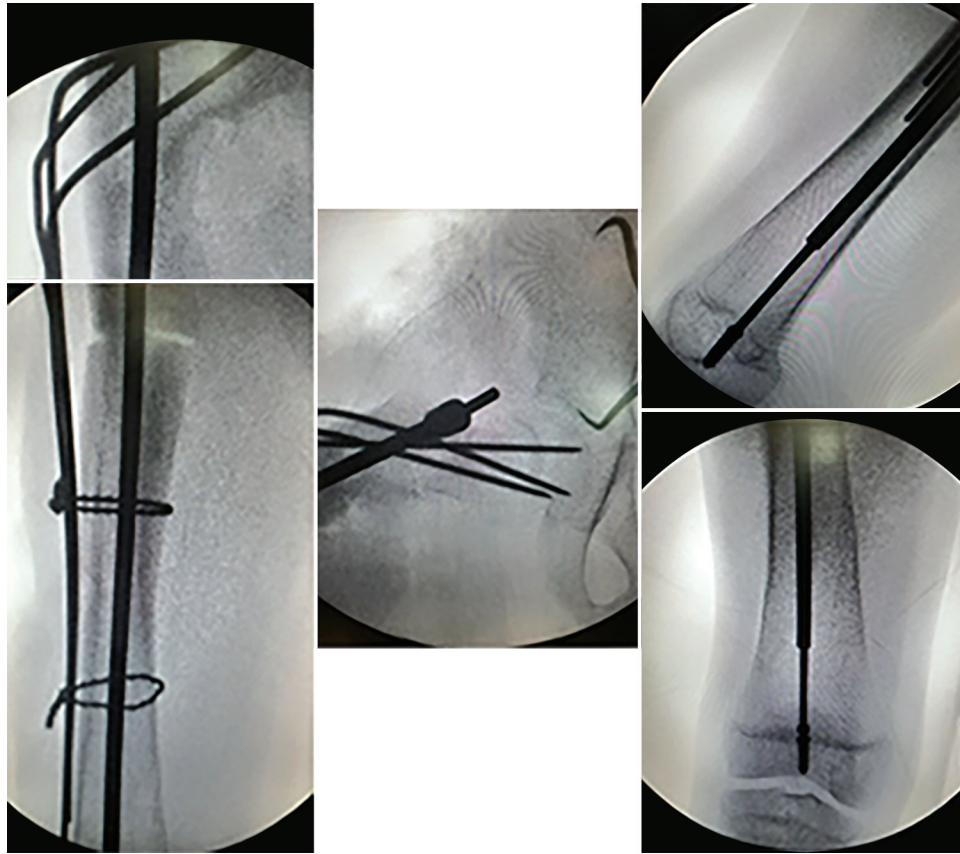


Fig. 3: Intraoperative C arm images after telescopic nail insertion

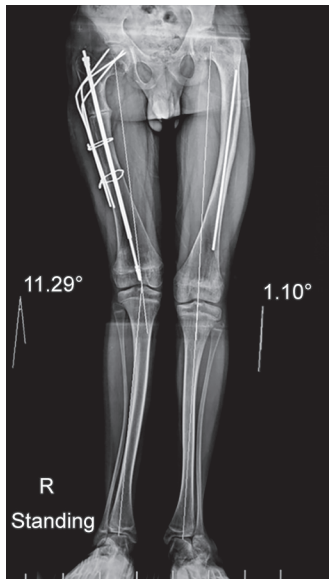


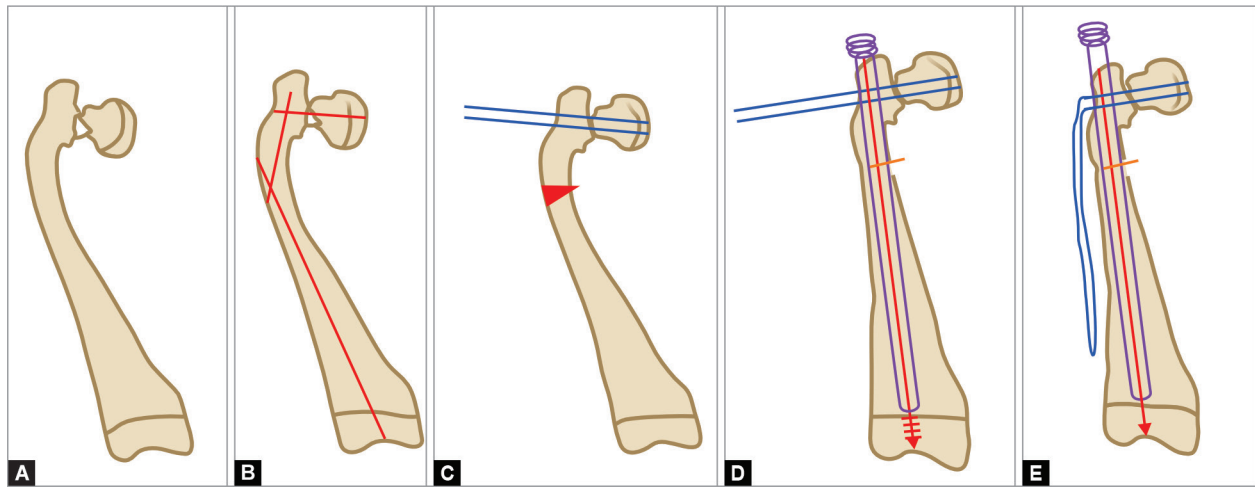
Fig. 4: Anteroposterior long X-ray at 1-year follow-up showing union of NOF fracture

Difficulty was experienced during the fixation by cannulated screws in both cases.¹¹ Morcos et al. added augmentation to the use of 4.5 mm cannulated screw fixation by bending the guide wires of the screws parallel to femoral shaft and wrapping them around the shaft with two cerclages.⁶ In our case, the addition of two 4.5 mm screws on top of a rod in situ may be quite difficult especially if neck diameter is small.

The review suggests that combination techniques are necessary when stabilisation is used for children who sustain femoral neck fractures and may also have concurrent deformities that require addressing. There are no implants that are designed to deal with both problems in these children, particularly those with OI who have narrow diameter IM canals and narrow femoral necks.

CONCLUSION

The combined Wagner technique for fixation of a fracture of the neck of femur (NOF) combined to a femoral deformity correction, stabilised with an IM telescopic nail, has demonstrated satisfactory results in this case report. It is a technique that may prove useful to surgeons faced with a similar problem and is one of the choices of treatment that should be considered.



Figs 5A to E: (A and B) Schematic diagram of preoperative planning. Detection of CORA at proximal femur; (C) Fixation of NOF fracture by two threaded guide wires and anterolateral based wedge excision; (D) Insertion of male and female components of telescoping nail; (E) Bending of guide wires parallel to the shaft and wrapping two cerclages around them

Ethical Approval

Assiut Faculty of Medicine Ethical committee.
IRB local approval number: 04-2023-300179 Date:3.6.2023.
Clinical trial registration number: NCT05878548.

AUTHOR CONTRIBUTIONS

Hesham Mohamed Elbaseet: Conception and design of the technique, final approval of the version to be submitted. Abdel Khalek Hafez Ibrahim: Final approval of the version to be submitted. Nariman Abol Oyouun: Drafting article. Mohamed Abdelhady Abdelzاهر: Surgery performance, drafting article. Mohamed Khaled: Drafting article.

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