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Functional Outcome in a Case of Atrophic Non-union of the Distal Radius Following Osteomyelitis: A Case Report

Dr. Chakherang Debbarma

Department of Orthopaedics, Agartala Government Medical College & GBP Hospital, Tripura, India

Abstract

Background: Distal radius fractures represent one of the most common fractures of the upper limb. However, non-union of the distal radius remains an uncommon complication because of its rich vascular supply and favourable biological environment. When complicated by osteomyelitis and bone loss, reconstruction becomes technically demanding and may lead to significant functional disability.

Case Presentation: We present a case of a 12-year-old male with a history of open forearm injury who presented with pain, deformity, and restricted wrist movement for one year. Radiographic evaluation demonstrated atrophic non-union of the distal radius with malunion of the distal ulna following previous management with debridement and JESS fixation for infection. Surgical management involved radial non-union debridement, ulnar osteotomy, reconstruction using autologous non-vascularized fibular graft, and internal fixation with a reconstruction plate and Kirschner wires.

Results: Radiological union was achieved at 16 weeks postoperatively. Functional outcome assessment using the DASH score improved from 72 preoperatively to 48 at one year follow-up. The patient demonstrated significant improvement in wrist range of motion, grip strength, and pain reduction.

Conclusion: Structural reconstruction with autologous fibular graft combined with stable internal fixation can provide reliable union and satisfactory functional outcomes in cases of distal radius atrophic non-union following osteomyelitis.

Introduction

Fractures of the distal radius account for nearly one-sixth of all fractures treated in emergency departments and represent one of the most frequent injuries managed by orthopaedic surgeons. Due to the cancellous nature of the metaphysis and the extensive vascular network surrounding the distal radius, the majority of fractures heal uneventfully with conservative or operative treatment.

Non-union of the distal radius is therefore considered an uncommon complication, with an incidence reported to be less than 1%. When non-union occurs, it is usually associated with high-energy trauma, severe open injuries, infection, poor fixation stability, or compromised vascular supply.

Osteomyelitis following open fractures remains an important cause of impaired bone healing. Infection may lead to destruction of bone tissue, sequestrum formation, and disruption of local blood supply. These pathological processes interfere with the biological mechanisms required for fracture union and may result in atrophic non-union.

Management of infected non-union presents significant challenges. The primary objectives include eradication of infection, restoration of skeletal stability, reconstruction of bone defects, and preservation

of limb function. Various reconstructive strategies have been described including vascularized bone grafts, non-vascularized autologous grafts, bone transport techniques, and internal fixation methods.

Autologous fibular grafts remain a widely accepted option for reconstruction of segmental bone defects because they provide adequate cortical strength, osteoconductive properties, and minimal donor site morbidity. In paediatric patients, non-vascularized fibular grafting combined with stable fixation can effectively restore bone continuity and promote healing.

This case report highlights the successful surgical management and functional recovery of a rare case of atrophic distal radius non-union following osteomyelitis using autologous fibular graft reconstruction and internal fixation.

Case Presentation

A 12-year-old male presented to the orthopaedic outpatient department of Agartala Government Medical College with complaints of persistent pain, deformity, and limited function of the right forearm for approximately one year.

The patient had sustained an open injury to the forearm 18 months earlier following trauma. Initial management at another healthcare centre included surgical debridement and stabilization using Joshi's External Stabilization System (JESS) due to associated infection.

Although the infection was treated, the patient subsequently developed progressive deformity of the wrist and persistent functional limitation.

Clinical Examination

On examination the following findings were noted:

- Visible deformity of the distal forearm
- Tenderness at distal radius
- Restricted wrist movements
- Decreased grip strength
- No active sinus or signs of infection

Radiological Findings

Plain radiographs of the forearm demonstrated:

- Atrophic non-union of the distal radius
- Bone loss at the distal radial metaphysis
- Malunion of the distal ulna
- Disturbance of wrist alignment

These findings were consistent with post-infective atrophic non-union of the distal radius.

Surgical Management

The patient underwent reconstructive surgery under general anaesthesia.

Operative Steps

1. Exposure of distal radius non-union site
2. Excision of fibrous tissue and necrotic bone
3. Freshening of the bone ends

4. Corrective ulnar osteotomy
5. Harvesting of autologous fibular graft from the ipsilateral lower limb
6. Placement of fibular graft between prepared radial ends
7. Stabilization with reconstruction plate and Kirschner wires
   Adequate mechanical stability was achieved intraoperatively.

Postoperative Protocol

Postoperative management included:

- Intravenous antibiotics
- Limb immobilization
- Regular wound inspection
- Gradual physiotherapy

Follow-up was performed at 6 weeks, 12 weeks, 6 months, and 12 months.

Functional evaluation included:

- Wrist range of motion
- Grip strength
- DASH functional score

Results

Radiological union was achieved at **16 weeks**.

Radiographs demonstrated:

- Incorporation of fibular graft
- Restoration of radial length
- Satisfactory alignment of wrist joint

Functional Outcome

Parameter	Preoperative	1 Year Follow-up
DASH Score	72	48
Pain	Severe	Mild
Wrist ROM	Restricted	Improved
Grip Strength	Weak	Improved

The patient regained satisfactory wrist function and returned to routine activities.

Interpretation:

At the 1-year follow-up, the patient demonstrated significant functional improvement compared to the preoperative status. The DASH score improved from 72 to 48, indicating a reduction in disability of the upper limb. Clinically, the patient reported a marked reduction in pain from severe to mild. Examination revealed improved wrist range of motion compared to the previously restricted movements. Additionally, grip strength improved**,** suggesting recovery of functional hand power.

These findings indicate progressive functional recovery and satisfactory clinical outcome following the intervention.

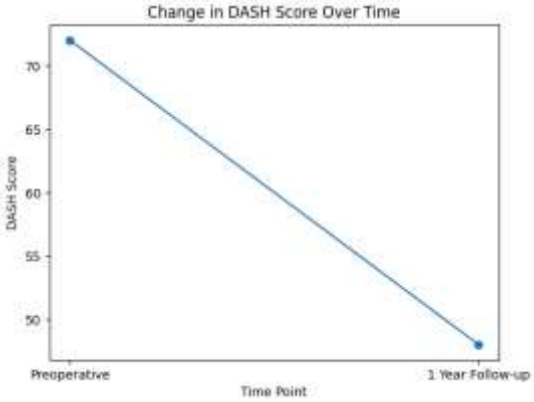

Fig 1: Change in DASH Score

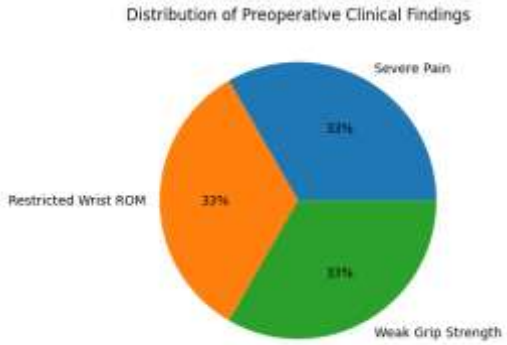

Fig 2: Preoperative Clinical findings

Discussion

Distal radius non-union is rare compared to non-union of other long bones due to favourable biological conditions and robust vascularity of the distal radius. However, infection remains one of the most important factors that can disrupt bone healing.

Osteomyelitis following open fractures may lead to chronic inflammatory changes, destruction of bone tissue, and impaired vascularity, resulting in atrophic non-union. These cases require both biological stimulation and mechanical stability to achieve union.

The principles of treatment for infected non-union include:

1. Radical debridement
2. Infection control
3. Restoration of bone continuity
4. Stable fixation
5. Functional rehabilitation

Autologous fibular grafts have been widely used for reconstruction of segmental bone defects in upper limb surgery. The fibula provides strong cortical bone capable of supporting mechanical loads while also serving as a scaffold for osteogenesis.

Tarng et al. demonstrated successful reconstruction of infected bone defects using non-vascularized fibular grafts with satisfactory union rates. Similarly, Guidi et al. reported favourable outcomes in distal radius reconstruction using vascularized fibular grafts. In the present case, a non-vascularized fibular graft combined with plate fixation provided sufficient structural stability and biological support for healing. Radiological union occurred within 16 weeks and functional outcomes improved significantly.

The improvement in DASH score and wrist mobility observed in this case highlights the effectiveness of this surgical approach.

Conclusion

Atrophic non-union of the distal radius following osteomyelitis represents a rare but clinically significant complication that can lead to persistent pain, deformity, and functional impairment of the wrist. Because the distal radius normally demonstrates strong healing potential, the occurrence of non-union in this region usually reflects the presence of additional complicating factors such as infection, bone loss, or compromised vascularity.

Management of such complex cases requires a systematic surgical approach aimed at restoring both the biological environment and the mechanical stability necessary for fracture healing. Thorough debridement of necrotic and infected tissue is essential to eliminate the source of infection and to establish a viable bed for reconstruction. Once infection has been adequately controlled, restoration of bone continuity becomes the primary objective.

Autologous fibular grafting provides an effective method for bridging segmental bone defects while simultaneously offering structural support and biological stimulation for new bone formation. When combined with stable internal fixation, fibular grafts can promote reliable union and facilitate restoration of limb alignment.

The present case demonstrates that reconstruction using a non-vascularized fibular graft and internal fixation can successfully achieve radiological union and meaningful functional recovery even in the setting of post-infective distal radius non-union. The improvement in pain, grip strength, and wrist mobility observed in this patient highlights the potential benefits of this reconstructive strategy.

Early postoperative rehabilitation and regular clinical follow-up are also important components of treatment, as they help maximize functional recovery and detect potential complications at an early stage.

In conclusion, although distal radius non-union following osteomyelitis is uncommon, it can be effectively managed with meticulous surgical technique, appropriate bone graft reconstruction, and stable fixation. Autologous fibular grafting remains a reliable option for addressing bone defects and restoring wrist function in these challenging cases.

Summary

This case report describes the management and functional outcome of a rare case of atrophic non-union of the distal radius following osteomyelitis in a paediatric patient. Distal radius fractures are among the most common fractures of the upper limb and typically heal well due to their rich vascular supply. However, complications such as infection, bone loss, and impaired vascularity can lead to non-union, which is an uncommon but challenging condition to treat.

The report presents a 12-year-old male who sustained an open forearm injury and was initially treated with debridement and Joshi's External Stabilization System (JESS) due to infection. Despite treatment of the infection, the patient later developed persistent wrist deformity, pain, restricted wrist movement, and reduced grip strength. Radiographs revealed atrophic non-union of the distal radius with bone loss and malunion of the distal ulna, resulting in disturbed wrist alignment.

To address the problem, the patient underwent reconstructive surgery consisting of debridement of the non-union site, removal of fibrous and necrotic tissue, corrective ulnar osteotomy, and reconstruction of the bone defect using an autologous non-vascularized fibular graft. The graft was stabilized using a

reconstruction plate and Kirschner wires, providing mechanical stability and biological support for healing.

Postoperatively, the patient received antibiotics, immobilization, and physiotherapy, with follow-up evaluations at regular intervals. Radiological union was achieved at 16 weeks, demonstrating successful incorporation of the fibular graft and restoration of radial length and wrist alignment. Functional assessment showed significant improvement: the DASH score improved from 72 preoperatively to 48 at one year, with decreased pain, improved wrist range of motion, and better grip strength.

The case highlights the importance of combining biological reconstruction with stable fixation in managing infected non-unions. Autologous fibular grafting provides structural support, osteoconductive properties, and minimal donor site morbidity, making it an effective option for reconstructing segmental bone defects. The authors conclude that fibular graft reconstruction with internal fixation can achieve reliable bone union and satisfactory functional recovery in distal radius non-union following osteomyelitis, particularly when accompanied by appropriate surgical debridement and rehabilitation.

Clinical Pictures

Fig 3: Patient initially treated with external fixation and K-wire for Infected open fracture

Fig 4: Preoperative radiograph demonstrating atrophic nonunion of distal radius with malunion of distal ulna.

Fig 5-7: Intraoperative reconstructions using autologous fibular graft.

Fig 8-9: Immediate postoperative radiograph showing fixation with reconstruction plate and Kirschner wires.

Fig 10: Follow-up radiograph at 16 weeks demonstrating graft incorporation and union.

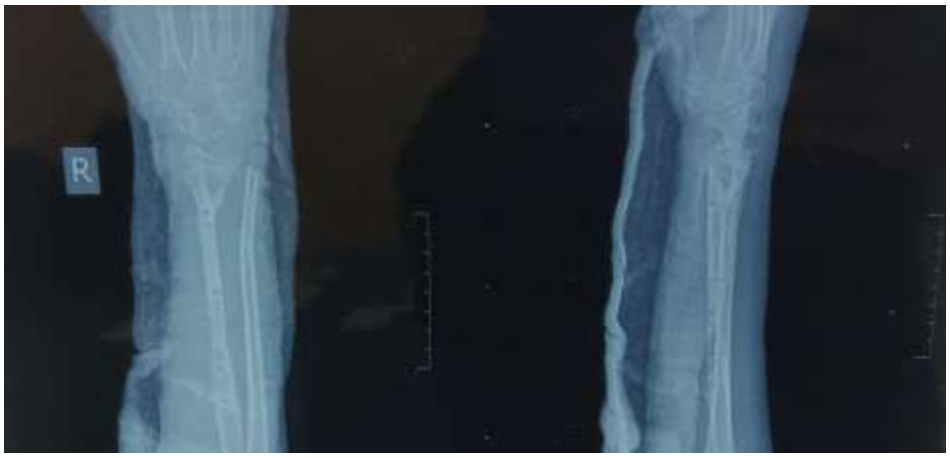

Fig 11: Follow up radiograph at 18 weeks following removal of plate and screw and Darrach Osteotomy

Fig 12-13: Range of movement in follow up

References

1. Tarng YW, Lin KC. Management of bone defects due to infected nonunion using fibular grafts. Injury. 2020.
2. Guidi M, Frueh FS. Bone reconstruction with vascularized fibula in distal radius osteomyelitis. European Journal of Plastic Surgery. 2023.
3. Jupiter JB. Complex fractures of the distal radius. Journal of Bone and Joint Surgery Am.
4. Fernandez DL. Fractures of distal radius. In: Fernandez DL, Jupiter JB, editors. Fractures of the Distal Radius: A Practical Approach to Management. New York: Springer.
5. Court-Brown CM, Heckman JD, McQueen MM, Ricci WM, Tornetta P, McKee MD, editors. Rockwood and Green's Fractures in Adults. 8th ed. Philadelphia: Wolters Kluwer Health.
6. Canale ST, Beaty JH, editors. Campbell's Operative Orthopaedics. 13th ed. Philadelphia: Elsevier.
7. Paley D. Principles of Deformity Correction. Berlin: Springer-Verlag.
8. Wolfe SW, Hotchkiss RN, Pederson WC, Kozin SH, Cohen MS, editors. Green's Operative Hand Surgery. 7th ed. Philadelphia: Elsevier.
9. Ring D. Nonunion of distal radius fractures. Hand Clinics.
10. Jupiter JB, Fernandez DL. Complications following distal radius fractures. Journal of Bone and Joint Surgery Am.