Challenges Faced in the Management of Radial Shaft Nonunion and Implant Failure on a Background of Distal Radius Malunion

Vidhya Kasilingam¹ Ronak Patel¹ Kerementi Othieno-P'otonya¹ Karthik Karuppaiah¹

¹Department of Orthopaedics, King's College Hospital, Denmark Hill, London, United Kingdom

Address for correspondence Karthik Karuppaiah, MRCSEd, MS, MSc, MCh, FRCS, Department of Orthopaedics, King's College Hospital, Denmark Hill, London, SE5 9RS, United Kingdom (e-mail: karthi97@gmail.com).

J Hand Microsurg 2018;10:180–181

A 70-year-old, right-hand dominant woman with an active lifestyle was referred to our upper limb clinic with a distal radial shaft nonunion and implant failure, on a background of distal radius malunion of the left forearm. She had a fall one year ago where she fractured the distal third of her left radial shaft and was treated with a narrow limited contact dynamic compression plate (LCDCP) in her local hospital. Postoperatively, she continued with painful and restricted range of movements in her forearm and wrist. One year after surgery, while removing her jumper, she felt a sharp pain, snap, and deformity in her forearm due to implant failure and nonunion (►Fig. 1). Few centimeters distal to the nonunion segment, she also has a decade-old distal radius malunion, following conservatively managed extra-articular distal radial fracture.

On assessment, she had a tender radially shortened forearm. On radiographic evaluation, she had an atrophic

nonunion, fracture gap, and a couple of centimeters of bicortical bone between the nonunion and malunion site (►Fig. 1). To have a stable fixation distally and achieve satisfactory healing, a decision was made to do an implant exit and corrective osteotomy, freshen the nonunion site, use a long distal radius plate, and fill the gaps with iliac crest bone graft (ICBG).

Through the volar approach using old scar, the implant exit and nonunion site were freshened. A precontoured distal radius plate (AcuLoc distal radius plate system, Acumed) was fixed to the radius distal to malunion, and an osteotomy parallel to the joint surface was performed at the malunion site. The deformity of 40-degree dorsal angulation and 0-degree radial inclination was corrected, and distal radio ulnar joint (DRUJ) was restored and fixed to the intermediate fragment with distal radius plate (►Fig. 2A).

Fig. 1 Patient's radiograph showing atrophic nonunion with malunited distal radial fracture and broken plate.

Fig. 2 (A) Intraoperative pictures and radiograph following implant removal showing dorsal angulation along with osteotomy site and distal radius plate. (B, C) Wrist and forearm radiographs at final follow-up showing union at both osteotomy and nonunion sites.

received
February 2, 2018
accepted after revision
May 28, 2018
published online
September 27, 2018

©2018 Society of Indian Hand & Microsurgeons

DOI <https://doi.org/10.1055/s-0038-1669366>.
ISSN 0974-3227.

Fig. 3 Patient at 12-month follow-up showing 80-degree dorsiflexion, 70-degree palmar flexion, full supination, and 80-degree pronation.

In the nonunion site, the dead sclerotic bone was removed, medullary canal was opened, and the ends were prepared with burr to receive the ICBG. Shortening of around 3 cm was corrected at the nonunion site with laminar spreader, and DRUJ was restored. An extension plate was applied to the distal radius plate and fixed with screws to the proximal fragment. The nonunion gap was packed with tricortical ICBG (30 mm) and corticocancellous chips in osteotomy site. Eccentric screws were placed proximal to the graft site, and graft was compressed at the nonunion site. To add stability and allow early mobilization, a locking screw was used to fix the graft to the plate.

Postoperatively, the wrist was protected using a thermoplastic splint for 6 weeks and mobilized as tolerated by the hand therapists. After 6 weeks, the patient was allowed to use the hand and wrist without restrictions. Both osteotomy and nonunion site healed by 3 months, and at the final follow-up of 12 months, the patient had around 80-degree dorsiflexion, 70-degree palmar flexion, full supination, and 80-degree pronation (►Fig. 3). At the final follow-up, her DASH (disabilities of the arm, shoulder, and hand)¹ and PRWE (patient-rated wrist evaluation)² scores were 0.8 and 0, respectively. Radiographs at the final follow-up revealed a volar angulation of 5 degrees, radial inclination of 20 degrees, restored DRUJ, and radial length (►Fig. 2B, C).

Distal radius malunion and atrophic nonunion of distal radial shaft are challenging and complex problems to treat on their own. However, management of combination of them is even more challenging and, to our knowledge, not reported in the English literature. The risk of distal radius malunion is around 35% following conservative management³ and the risk of diaphyseal nonunion is less than 5% following surgical management.^{4,5} Although some malunion may be asymptomatic, patients with severe malunion, as in our case, could present with weakness, carpal instability, posttraumatic arthritis, ulnar carpal abutment, pain, and restricted range of movements.⁶ Diaphyseal nonunion, though rare, could be severely disabling as dysfunction extends from the elbow to the hand and wrist, which limits the ability to place the hand in space.^{4,5} Despite the complexity of the conditions,

restoring distal radius anatomy and appropriate management of nonunion have consistently showed good functional and radiologic outcomes.^{4–8} In our patient, we corrected the radiocarpal anatomy and stabilized the distal radius with precontoured plate. Then the length including DRUJ was restored with ICBG and fixed with extension plate added to the distal radius plate. The principle of restoration of radiocarpal and DRUJ joint alignment, stable fixation, autogenous bone grafting, and early mobilization leads to good functional outcome and is supported by literature.^{3,4,8,9}

Conflict of Interest

None.

References

- 1 Hudak PL, Amadio PC, Bombardier C; The Upper Extremity Collaborative Group (UECG). Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected] *Am J Ind Med* 1996;29(6):602–608
- 2 MacDermid JC, Turgeon T, Richards RS, Beadle M, Roth JH. Patient rating of wrist pain and disability: a reliable and valid measurement tool. *J Orthop Trauma* 1998;12(8):577–586
- 3 Sharma H, Khare GN, Singh S, Ramaswamy AG, Kumaraswamy V, Singh AK. Outcomes and complications of fractures of distal radius (AO type B and C): volar plating versus nonoperative treatment. *J Orthop Sci* 2014;19(4):537–544
- 4 Kloen P, Wiggers JK, Buijze GA. Treatment of diaphyseal non-unions of the ulna and radius. *Arch Orthop Trauma Surg* 2010;130(12):1439–1445
- 5 Kloen P, Buijze GA, Ring D. Management of forearm nonunions: current concepts. *Strateg Trauma Limb Reconstr* 2012;7(1):1–11
- 6 Patton MW. Distal radius malunion. *J Hand Surg Am* 2004;4(4):266–274
- 7 Opel S, Konan S, Sorene E. Corrective distal radius osteotomy following fracture malunion using a fixed-angle volar locking plate. *J Hand Surg Eur Vol* 2014;39(4):431–435
- 8 Prommersberger KJ, Fernandez DL. Nonunion of distal radius fractures. *Clin Orthop Relat Res* 2004;419(419):51–56
- 9 Fernandez DL, Ring D, Jupiter JB. Surgical management of delayed union and nonunion of distal radius fractures. *J Hand Surg Am* 2001;26(2):201–209