Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 19s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Complications And Revision Surgeries Associated With Single Bone Forearm Reconstruction

Dr. Ashok[*1], Dr. Vikrant Narayan[2], Dr. Crazy Choudhary[3], Dr. D S Meena[4]

[*1]Consultant And Orthopedics Surgeon, Department Of Orthopedics, Sub District Hospital Nawa City, Kuchaman Didwana, Rajasthan

[2]Consultant Orthopaedics, Department Of Orthopaedics, S M S Medical College Jaipur

[3]Assistant Professor, Department Of Orthopaedics, Govt Medical College Barmer

[4]Senior Professor, Department Of Orthopaedics, S M S Medical College Jaipur

*** Corresponding Author**

Dr. Ashok

Email ID: ashokdugastava@gmail.com

Cite this paper as: Dr. Ashok, Dr. Vikrant Narayan, Dr. Crazy Choudhary, Dr. D S Meena, (2025) Complications And Revision Surgeries Associated With Single Bone Forearm Reconstruction. *Journal of Neonatal Surgery*, 14 (19s), 222-227.

ABSTRACT

Background: Single bone forearm reconstruction is a surgical technique used to manage severe forearm bone defects. Despite its efficacy in restoring limb stability and function, the procedure is associated with notable complications and the potential need for revision surgeries.

Methods: This retrospective study analyzed 30 patients who underwent single bone forearm reconstruction, focusing on complications, revision surgeries, and long-term outcomes. Data were collected on union rates, complication types, and patient satisfaction levels post-surgery.

Results: The study found that 80% of patients achieved bone union without grafts, while 20% required additional interventions. Complications were reported in 6.67% of the cases, including volar subluxation of the wrist and skin flap necrosis. Overall, 93.33% of patients were satisfied with their surgical outcomes.

Conclusion: Single bone forearm reconstruction provides effective management for severe forearm defects but carries a significant risk of complications and the need for potential revision surgeries. Ongoing monitoring and comprehensive postoperative care are essential to maximize patient outcomes and satisfaction.

Keywords: *Single bone forearm reconstruction, complications, revision surgeries, orthopedic surgery, forearm defects, patient outcomes.*

1. INTRODUCTION

The reconstruction of the forearm following severe bone loss poses a significant challenge in orthopedic surgery, primarily due to the forearm's critical role in functional activities involving rotation and grip. Single bone forearm reconstruction is a surgical technique developed as a salvage procedure for severe forearm defects where traditional reconstructive options are either not viable or have failed. While this procedure can restore stability and function, it is not without its complications and the potential need for revision surgeries.

Forearm reconstruction surgery, such as the conversion to a single bone forearm, has been increasingly recognized as an effective solution in cases of extensive trauma, infection, and congenital defects [4]. The procedure involves the removal of one of the forearm bones—typically the radius or ulna—and the reconfiguration of the remaining bone to serve the role of both. This technique has been particularly noted for its utility in managing complex cases where other treatments have not yielded successful outcomes [2]..

Complications following one-bone forearm surgery, as documented by Jacoby et al., include issues such as joint instability, non-union, and the potential for revision surgeries, which are significant considerations that must be carefully weighed when planning this type of surgical intervention [1]. Similarly, Kim et al. discuss the outcomes and complications associated with this procedure, highlighting that while many patients achieve satisfactory functional outcomes, a subset experiences complications that may require additional surgical intervention [2].

The management of segmental bone defects, especially in the upper limb, requires meticulous planning and consideration of various treatment modalities. Ferreira et al. provide a comprehensive review of the different management strategies and emphasize the complexity of decision-making in such cases, particularly when considering the patient's functional demands and the resources available [5].

Clinical outcomes of the one-bone forearm procedure have shown that while the technique can significantly improve patient outcomes, it is not devoid of challenges. Peterson et al.'s longitudinal study illustrates the long-term results and clinical viability of the procedure, affirming its role as a valuable option in the orthopedic surgeon's arsenal, particularly for patients with massive bone loss or where other reconstructive efforts have failed [6].

Despite the advantages, the exactitude of pain assessment and monitoring remains critical in the postoperative period. Delgado et al. validate the use of digital visual analog scales for pain assessment, underscoring the importance of accurate and reliable pain evaluation methods in the management and recovery of patients undergoing such significant reconstructive surgery [7]. This is crucial for improving patient outcomes and enhancing the understanding of post-operative recovery dynamics.

Given the potential for significant complications and the need for possible revision surgeries, the decision to proceed with a single bone forearm reconstruction must be approached with a comprehensive understanding of the patient's individual needs, potential risks, and the expected functional outcomes. This introduction sets the stage for a detailed exploration of the complications associated with single bone forearm reconstruction, aiming to delineate strategies to minimize these risks and manage complications effectively when they occur.

2. MATERIALS AND METHODS

Study Design and Setting

This hospital-based prospective interventional study was conducted at the Department of Orthopaedics, SMS Medical College and Attached Hospitals in Jaipur, Rajasthan—a tertiary care center. The study included patients who underwent surgery for large forearm bone loss and were treated with single bone forearm reconstruction. All patients were followed for a minimum of 12 months to assess functional outcomes and limb stability.

Study Population

Patients presenting with large forearm bone defects to the Orthopaedics Department from May 2020 onwards were considered for inclusion in the study. Eligibility was determined based on specific inclusion and exclusion criteria. A total of 30 patients meeting these criteria were enrolled, as calculated by the sample size estimation.

Sample Size Calculation

Based on a reference study anticipating that 81% of patients with forearm segmental bone loss would exhibit excellent or good functional outcomes according to Peterson's ten-point scoring system, and considering a 14% absolute error at a 95% confidence level, the required sample size was calculated to be 30 patients.

Inclusion Criteria

Patients aged between 2 and 70 years with large bone defects in the forearm were included. Causes of bone loss encompassed post-traumatic bone loss, chronic infections such as osteomyelitis (after sequestrectomy), post-tumor resection, and congenital forearm bone deformities or deficiencies. Patients who had failed all other surgical procedures, met all surgical prerequisites, and provided informed written consent were eligible for the study.

Exclusion Criteria

Exclusion criteria comprised patients with distal sensory loss not expected to recover after nerve repair, poor distal vascularity, inadequate forearm skin coverage, advanced metastatic bone tumors, mental instability or psychiatric conditions, those not meeting surgical prerequisites, and patients refusing to participate in the study.

Ethical Considerations

Approval was obtained from the Institutional Research Review Board and Ethical Committee prior to the commencement of the study. Informed written consent was secured from all participants or their guardians, adhering to ethical standards.

Preoperative Assessment

Upon presentation, all patients underwent a comprehensive history-taking and physical examination. Routine investigations included complete blood count (CBC), prothrombin time-international normalized ratio (PT-INR), hepatitis B surface antigen (HBsAg), hepatitis C virus (HCV), human immunodeficiency virus (HIV) tests, liver function tests (LFT), renal function tests (RFT), random blood sugar (RBS), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP). Radiographs of the involved forearm, wrist, elbow (anteroposterior and lateral views), and chest (posteroanterior view) were obtained.

Surgical options were thoroughly discussed with each patient, and individualized surgical plans were formulated based on preoperative bone stock and soft tissue evaluation. Advantages and disadvantages of each surgical option were explained, and informed consent was obtained.

Anesthesia and Surgical Preparation

Patients under 12 years of age received general anesthesia, while those over 12 years were administered a supraclavicular block. The affected extremity was prepared with antiseptic solutions and isolated with sterile drapes. A pneumatic tourniquet was applied to the upper arm to provide a bloodless surgical field.

Surgical Techniques

The surgical approach was tailored to each patient, considering existing scars, skeletal and muscular defects, and anatomical principles. Two primary surgical techniques were employed:

1. **Proximal Ulna to Distal Radius Fusion**

In cases where feasible, the ulna or radial periosteal sleeve was preserved. The distal ulna was inserted into the remaining radius, following the method recommended by Hey Groves. Fixation was achieved using various implants, including cortical screws, neutralization plates, multiple Kirschner wires, encirclage wires, or external fixators. The rotational position of the forearm was set in mid-prone, and the wrist was fused in 15 degrees of dorsiflexion with neutral deviation.

2. **Distal Ulnar Translocation and Ulno-Carpal Fusion**

A dorsal straight or 'lazy S' incision was made from the diaphysis of the third metacarpal to the middle third of the forearm. After careful dissection and protection of the extensor tendons and radial sensory nerves, the radius was osteotomized approximately 2 cm proximal to the tumor site. En-bloc resection of the distal radius with surrounding soft tissue was performed, and the tumor bed was treated with 3% hydrogen peroxide. The ulna was then osteotomized and translocated radially to bridge the defect. Fixation was accomplished using a dorsal 3.5 mm dynamic compression plate or long Kirschner wires extending from the third metacarpal to the radial diaphysis. The wrist was positioned in slight dorsiflexion before wound closure and application of a cock-up slab.

Postoperative Management

Postoperative care included administration of analgesics, antibiotics, and fluids. Radiographs were taken on the day of surgery to confirm proper alignment and fixation. Mobilization exercises for the shoulder, elbow, and fingers were initiated on the same day. Wound inspections and aseptic dressing changes were performed starting on the third postoperative day, with a below-elbow cock-up slab applied for immobilization.

Sutures were removed on the 14th postoperative day, unless delayed due to wound complications. The below-elbow slab was maintained for six weeks. Patients were instructed to perform gentle mobilization exercises as tolerated.

Follow-Up and Rehabilitation

Patients were scheduled for follow-up visits at two weeks, four weeks, two months, four months, six months, nine months, and twelve months postoperatively. During each visit, clinical assessments were conducted to evaluate functional status, grip strength, and range of motion of the forearm, wrist, elbow, and shoulder. Radiological evaluations were performed to assess bone union, stability at the ulno-carpal junction, and any deformities.

Grip strength was measured using a dynamometer and expressed in kilograms and as a percentage compared to the contralateral side. The Peterson scoring system and Visual Analog Scale (VAS) were utilized to assess functional outcomes and pain levels, respectively. Any complications were documented and managed accordingly.

Bone Grafting

In cases where union was not achieved with the initial procedure, bone grafting was performed using free fibular grafts or iliac crest grafts to facilitate bone healing.

Outcome Measures

The primary outcomes assessed included functional capability using the Peterson scoring system, pain levels using the VAS score, grip strength, incidence of postoperative complications, bony union between the radius and ulna, and the range of motion of the forearm, wrist, elbow, and shoulder.

Data Collection and Measurement

Data were collected systematically during follow-up visits. The Peterson scoring system evaluated functional capability, pain level, and union, with scores categorized as excellent, good, fair, or poor based on a ten-point scale. The VAS score measured pain on a scale from 0 (no pain) to 10 (worst pain imaginable). Range of motion was measured using a goniometer and expressed in degrees. Grip strength was assessed with a dynamometer. The incidence of complications was calculated as a

percentage of the total number of operated cases.

Radiological assessments focused on the status of radio-ulnar union, stability at the ulno-carpal junction, and any deformities.

Statistical Analysis

Data were summarized as counts and percentages for categorical variables. Continuous variables were presented as mean and standard deviation for normally distributed data or median and range for non-normally distributed data. The Chi-square test and Fisher's exact test were used to compare categorical variables. A p-value of less than 0.05 was considered statistically significant. Statistical analysis was performed using SPSS software (Version XX), and data entry was managed using EpiData software. Graphs and charts were created using Microsoft Excel and Word.

Bias and Limitations

No identifiable sources of bias were detected in the study design. However, limitations include the single-center setting and the relatively small sample size, which may affect the generalizability of the findings.

Ethical Approval and Consent

The study was conducted in accordance with the ethical standards of the institutional research committee and the Declaration of Helsinki. Written informed consent was obtained from all participants or their legal guardians before inclusion in the study.

3. RESULTS

The outcomes of single bone forearm reconstruction were evaluated in 30 patients across various parameters including radioulnar union status, patient satisfaction, complications, and range of motion in pronation, supination, and wrist deviation.

Radioulnar Union Status The results in **Table 1** indicate a high rate of successful bone union post-reconstruction. Out of the total patients, 80% (24 patients) achieved union without the need for bone grafts, while 20% (6 patients) required bone grafting to achieve union. This highlights the efficacy of the single bone reconstruction technique in achieving structural integrity.

Patient Satisfaction As detailed in **Table 2**, the majority of patients expressed a high level of satisfaction following the surgery. Approximately 93.33% (28 patients) reported being satisfied with the outcome of their surgery, whereas only 6.67% (2 patients) were partially satisfied. This reflects positively on the procedure's ability to meet patient expectations and improve their quality of life.

Complications The complication rate, shown in **Table 3**, was notably low, which is significant considering the complexity of the surgeries involved. 93.33% of the patients (28 patients) experienced no complications. However, there were isolated cases of volar subluxation of the wrist and skin flap necrosis, each affecting 3.33% of the cohort (1 patient each). These instances underline the importance of careful surgical technique and diligent postoperative care.

Pronation and Supination The functional outcomes regarding pronation and supination are summarized in **Table 4**. Sixty percent (18 patients) were fixed in a mid-prone position, while 40% (12 patients) retained 0-90 degrees of motion. This distribution indicates that while a significant number of patients lose some range of motion, the remaining patients retain a functional range, which is critical for performing daily activities.

Wrist Deviation In **Table 5**, the results regarding wrist deviation indicate that 60% of the patients (18 patients) maintained 0-20 degrees of radial and ulnar deviation, suggesting preserved wrist movement within a functional range. The other 40% (12 patients) were fixed in a neutral position, indicating a limitation in wrist mobility that could affect finer motor functions.

TABLE 1: DISTRIBUTION OF CASES ACCORDING TO RADIO-ULNAR UNION STATUS

Union Status	Number of Patients	Percentage (%)
Union Achieved	24	80.00
Union Achieved with Bone Graft	6	20.00
Total	**30**	**100.00**

TABLE 2: DISTRIBUTION OF CASES ACCORDING TO PATIENT SATISFACTION

Patient Satisfaction Level	Number of Patients	Percentage (%)
Satisfied	28	93.33

Partially Satisfied	2	6.67
Total	**30**	**100.00**

TABLE 3: DISTRIBUTION OF CASES ACCORDING TO COMPLICATIONS

Complication	**Number of Patients**	**Percentage (%)**
None	28	93.33
Volar Subluxation of Wrist	1	3.33
Skin Flap Necrosis	1	3.33
Total	**30**	**100.00**

TABLE 4: DISTRIBUTION OF CASES ACCORDING TO PRONATION AND SUPINATION

Movement	**Range**	**Number of Patients**	**Percentage (%)**
Pronation	0–90 Degrees	12	40.00
	Fixed in Mid-Prone	18	60.00
Supination	0–90 Degrees	12	40.00
	Fixed in Mid-Prone	18	60.00
Total Patients		**30**	**100.00**

TABLE 5: DISTRIBUTION OF CASES ACCORDING TO WRIST DEVIATION

Movement	**Range**	**Number of Patients**	**Percentage (%)**
Radial Deviation	0–20 Degrees	18	60.00
	Fixed in Neutral Position	12	40.00
Ulnar Deviation	0–20 Degrees	18	60.00
	Fixed in Neutral Position	12	40.00
Total Patients		**30**	**100.00**

4. DISCUSSION

Single bone forearm reconstruction, while a valuable surgical approach for severe forearm defects, comes with a set of challenges, notably complications and the potential need for revision surgeries. This surgical technique aims to restore function by creating a single osseous structure from the remnants of the radius and ulna, which simplifies the limb's anatomy but may alter its biomechanics.

Complications associated with this procedure are multifaceted. As highlighted by Jacoby et al., postoperative complications such as joint instability and non-union are significant concerns that can drastically impact patient outcomes and may necessitate subsequent surgical interventions [1]. Kim et al. also acknowledge a spectrum of complications, stressing that while the procedure generally results in satisfactory functional recovery, the incidence of adverse outcomes cannot be ignored [2]. These findings underscore the necessity for meticulous surgical planning and postoperative management to mitigate risks and enhance recovery.

The case reported by Sahdi et al. illustrates a unique scenario where single bone forearm surgery was employed as a salvage procedure in a resource-limited setting, further demonstrating the procedure's versatility and adaptability [3]. However, this adaptability must be carefully balanced with an understanding of potential complications and the physical demands expected of the limb post-recovery.

Long-term outcomes and the necessity for revisions are critical considerations. Devendra et al. and Ferreira et al. discuss the

management strategies for massive bone loss, where single bone forearm construction is deemed a last-resort but often necessary intervention [4][5]. These studies suggest that while the immediate postoperative outcomes can be favorable, the long-term sustainability of such reconstructions requires ongoing evaluation.

Revision surgeries, often necessitated by complications such as those detailed by Peterson et al., highlight the importance of patient selection and surgical precision [6]. The need for such interventions can significantly affect a patient's quality of life and overall satisfaction with the surgical outcome.

In light of these challenges, Delgado et al.'s work on validating digital pain assessment tools is particularly relevant [7]. Accurate assessment of pain using validated scales is crucial for evaluating postoperative outcomes and can guide adjustments in pain management strategies, potentially reducing the need for revisions.

5. CONCLUSION

While single bone forearm reconstruction offers a viable option for managing severe forearm defects, the procedure is associated with a noteworthy risk of complications and revisions. Careful patient selection, meticulous surgical technique, and thorough postoperative management are imperative to minimize these risks and optimize functional outcomes.

REFERENCES

[1] Jacoby S M ,Bachoura A , Diprinzio E V , et al. Complications Following OneBone Forearm Surgery for Posttraumatic Forearm and Distal Radioulnar Joint Instability. J Hand Surg Am. 2013 May;38(5):976-82.

[2] Kim SY, Chim H, Bishop AT, Shin AY. Complications and outcomes of one-bone forearm reconstruction. Hand (N Y) 2017;12:140-4.

[3] Sahdi H, Chan WH, Dollah NB. EntriA,Single-Bone Forearm Salvage Procedure for a Child with Acquired Radial Clubhand in a Resource Limited Centre: A Case Report Malaysian Orthopaedic Journal 2018 Vol 12 No 3

[4] Devendra A, Velmurugesan PS, Dheenadhayalan J, Venkatramani H, Sabapathy SR, Rajasekaran S. One-Bone Forearm Reconstruction: A Salvage Solution for the Forearm with Massive Bone Loss. J Bone Joint Surg Am. 2019 Aug 7;101(15)

[5] Ferreira, Nando & Saini, Aaron & Birkholtz, Franz & Laubscher, Maritz. (2021). Management of segmental bone defects of the upper limb: a scoping review with data synthesis to inform decision making. European Journal of Orthopaedic Surgery & Traumatology. 31. 1-12. 10.1007/s00590-021-02887-4.

[6] Peterson CA 2nd, Maki S, Wood MB. Clinical results of the onebone forearm. J Hand Surg Am. 1995 Jul;20(4):609-1

[7] Delgado DA, Lambert BS, Boutris N, et al. Validation of Digital Visual Analog Scale Pain Scoring With a Traditional Paper-based Visual Analog Scale in Adults. J Am AcadOrthopSurg Glob Res Rev. 2018;2(3):e088. Published 2018 Mar 23. doi:10.5435/JAAOSGlobal-D-17-00088

[8] Boonstra AM, Schiphorst Preuper HR, Reneman M, Posthumus JB, Stewart RE: Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. Int J Rehabil Res 2008;31:165-169.

[9] Couper M, Tourangeau R, Conrad F, et al.: Evaluating the effectiveness of visual analog scales: A web experiment. SocSciComput Rev 2006;24:227-245.

[10] Jamison R, Gracely R, Raymond S, et al. : Comparative study of electronic vs. paper VAS ratings: A randomized, crossover trial using healthy volunteers. Pain 2002;99:341-347

[11] Jensen MP, Chen C, Brugger AM. Interpretation of visual analog scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. J Pain. 2003 Sep;4(7):407-14.

[12] Allende and Allende DattaTanmay , Arnab Karmakar2 , Abhishek Chakraborty3 , Sunil Kumar Das4 , AnandaKisor Pal5Evaluation of Performance of Single Bone Forearm as A Salvage Procedure in Different Clinical Scenarios – A Short Case Serie.sInternational Journal of Scientific Study | May 2014 ;2(2) Datta Tanmay et al (2014)

[13] Abid H, et al., Single Bone Forearm for Post Traumatic Bone Defect: A Case Report. Int J Bone Rheumatol Res,(2015) 2(4), 21-24.

[14] Sabapathy SR, Venkatramani H, Bharathi RR, Dheenadhayalan J, Bhat VR, Rajasekaran S. Technical considerations and functional outcome of 22 major replantations J Hand Surg Eur Vol. 2007 Oct;32(5):488-501.