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Allograft Replacement For A Massive Distal Radio Ulnar Bone Loss : A Case Report

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Abstract: Allograft bone replacement has risen up as a popular method in recent years after a limb salvage surgery to save a forearm function but there are still lack of proper study in long-term outcome. In this case we evaluate a patient outcome after 8 years undergone an allograft replacement procedures with multiple surgeries 8 years ago

Keywords: — Allograft bone replacement, Bone loss, Limb Salvage, Crush injury, Long term outcome

I. INTRODUCTION

Bone loss in the forearm may occur as a result of high energy blunt trauma, gunshot injury or following non-union with infection. A resulting defect in either the radius or ulna is difficult to treat because of the close proximity of vital neurovascular structures and the need to maintain supination, pronation and range of motion of the wrist and elbow[1]. We have advocated the use of a bone allograft because it allows a restoration of an immediate true anatomy without harvesting or weakening another bone. The decision to do limb salvage and do a allograft bone replacement procedure to save the forearm function can give a good functional outcome due to our consideration for a large defect at the forearm is a real challenge for the restoration of the biomechanics of the elbow and hand[2].

2. CASE REPORT

The patient complained difficulties to perform daily activities due to the existing bone loss of his right forearm, 3 months prior admission (January 2013), he experienced a road traffic accident involving a car versus a car, which caused a crush injury in his distal forearm. The Mechanism of injury of the incident being; patient's distal forearm was crushed by the body of the motorcycle when he fell off the vehicle. Excessive force and pressure were applied to the distal forearm, causing a major crush injury. Post-incident, the patient experienced massive pain and discomfort, particularly in the site of incident. The patient claimed that he was unable to move his hand at the slightest, he asked to be brought immediately to the hospital for initial treatments. Physical examination and radiological examination were done promptly after patient's arrival in the ER. Signs of fracture were clearly discovered from physical examinations, thus confirmed by AP/LAT X-ray. The patient lost approximately 8 cm of his distal radius bone, and 10 cm of his distal ulnar bone. Not only losing the bones, the patient also bereaved his flexor muscle, both radial and ulnar arteries, lastly the nerve. Concerning this matter, the decision to perform limb salvage in the ER was taken to prevent further complications. Disabilities of Arm Hand and Shoulder Score in the initial assessment was 75 and the Michigan Hand Outcomes Questionnarie was 54.

Emergency procedures were performed in sequences; massive debridement followed by vascular repairment, external fixation and K-wire were installed to temporarily stabilize the patient's bones. Existing wound after the emergency procedures in the forearm was already healed with no signs of infection. The patient was then scheduled for allograft bone replacement 6 months after limb-salvage. The process was relatively long and complex, due to the availability of the material from tissue bank. In most

cases, screening for pathology and risk-factors for communicable diseases such as HIV, Hepatitis B and C were conducted before the material is chosen to be implanted.

Allograft replacement procedures with surgery sequences were done with multiple surgery sequences. Firstly by removing all the external fixator and wires from the previous operations. An 8 cm radial head allograft was prepared from the tissue bank. Afterwards, fixating the allograph to the radial bone using locking plate and screw. Fortunately, surgery was performed smoothly without impediments durante-op.

Figure 1 Development of Radiographic Examination from after trauma until Allograft Bone Replacement

Figure 2 The Distal Radius Allograft specimen

After 8 weeks after the surgery, the wound healed without any signs of infection. 6 months after the surgery, the patient was able to hold a glass. 1 year after the surgery, the patient could drive his car without external assistance. In 2019 patient showed improvement in his grasping ability. In 2021, 8-year post operative follow-up showed a major improvement of the initial DASH score, from 75 to 45 and Michigan Hand Outcomes Questionnarie, from 54 to 74

Figure 3 Clinical Post-Operative Evaluation

3. DISCUSSION

The metatarsal allograft has proved useful as a bone graft to replace or lengthen the metacarpals. Complications associated with the use of allograft for metacarpalreconstruction are no more frequent than those associated with the use of autogenous bone. Banked allograft bone offers two advantages over autogenous bone for reconstructive hand surgery: (l) There is no donor site morbidity, and (2) large defects can be filled with tubular cortical bone of appropriate size and shape, which offers excellent stability as an intercalary graft[3,4] Based on our study, a satisfactory functional outcome can be obtained with allograft elbow reconstruction, particularly with hemiarticular allografts. This trend was reported previously in a series with 100% (six of six) good and excellent results in hemiarticular versus one failure and one fair result in total elbow allografts Our overall complication rate in approximately one third of our patients was less than that in similar reported series[5]

One of the advantages of using a bone allograft is that it offers a true anatomical replica if the allograft has been procured from the same location as the excised bone and if it has been matched for size. Any significant size mismatch at the forearm bones will trouble the prosupination movement. The use of a bone allograft in this location appears to be satisfactory at long-term. Its use as an osteoarticular allograft at the upper limb is less restricted than at the lower limb where mechanical constraints appeared too high for a frozen-preserved cartilage. Its use as an intercalary bone might be considered at both upper and lower limbs. Using an allograft exposes the patient to a very low risk of a transmitted disease. However, with the cumulative safety levels from the donor selection to biological investigation, such risks related to the use of an allograft remain remote[2]

The more recent technique using impaction of morsellised allograft has provided encouraging early results with few complications and this is now widely used to restore bone stock during revision of hip replacements. Its application is restricted to situations in which it can be contained and impacted although, even then, the stability of the impacted bone has been questioned. Significant early migration has been reported, and it is likely that surgical technique, graft composition and choice of prosthesis are important. A number of animal and clinical biopsy specimens have suggested that incorporation is quite consistent.Live donors are requested to attend for second HIV and HCV antibody tests at 180 days after donation. Cadaver donors cannot do this, and screening therefore relies on a single test and an interview with the relatives, often under difficult circumstances[3]. At the time of admission, we recommend the use of the Katz ADL and the Pfeiffer SPMSQ forms in addition to recording the routine medical history and physical exam ination. These provide simple and robust information which can be used to optimise the use of available resources for rehabilitation, and may also be valuable when comparing the effect of different treatments[6] We identified an independent significant association between a sub-optimal clinical outcome after fracture of the acetabulum and four prognostic factors (local complications, imperfect fracture reduction, associated fracture type and heterotopic ossification). In our study group a prolonged interval from injury to surgery (within 18 days) did not adversely affect outcome and the effect of increasing agewas only significantly associated with sub-optimal outcome through an inter-relationship with imperfect fracture reduction[7]. Comparison of the SMFA scores with normative data showed our population to be a healthy one. At six months, the cohort was functionally impaired, with higher values for all subscores. From this time-point, men seemed to recover faster than women. By one year, the mean SMFA scores approached baseline levels, indicating further recovery. However, age was no longer significantly associated with this improvement[8].

Patient satisfaction is not necessarily related to functional outcome, reflected by the DASH score. The mean DASH score was 45, yet the patient satisfied with the result. This could be explained by the fact that the patients were aware of the severity of their pre-surgical states where he were well aware that the surgery would be a salvage procedure[9].

In a previous study, fracture was the most prevalent complication of bone allografts implanted at the forearm where concerned four of their 10 patients. Fracture occurred more often in the osteoarticular group and was an early event in the two cases that required implantation of a new allograft. But it is stated fracture remains to be an unpredictable occurance. Nonunion was the second highest complication[2]

4. CONCLUSION

The metatarsal allograft has proved useful as a bone graft to replace or lengthen the metacarpals after a limb salvage surgery to save a forearm function in terms of patient's satisfaction with a limited results of scoring parameters

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