Retrospective Study of Implant Failure in Orthopaedic Surgery

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Introduction

The goal of modern orthopedics is to obtain anatomical union of fracture compatible with maximal functional return of the patient, for which rigid internal fixation by using appropriate implants is required. The success of an implant depends on a multiple factors and is necessary to determine whether failure was inherent to the device or was caused by external factors such as installation, patient co-operation or rate of fracture healing [1].

Material and Methods

41 patients who reported to OPD of a service hospital from October 2001 to October 2003 were subjects of this study. There were 30 failed dynamic compression plates of which 19 were broken (Fig 1,2) (6 femoral, 3 tibial, 8 humeral and 2 radial), 6 had bent dynamic compression plate of femur, (Fig 3) 4 had bent dynamic compression plate of humerus and 1 had infection with loosening of dynamic compression plate of tibia. Among 11 failed nails, 5 were broken K-Nails of femur, 2 broken Interlocking nails of femur and 4 bent K-Nails of femur (Fig 4). All the patients were evaluated clinically and radiographically for evidence of infection. One case of infection with failed dynamic compression plate was managed by Ilizarov ring fixator after removal of the failed implant. In 15 cases, nailing was done after removal of plate (Fig 5) and in 2, replating was done with special attention to the site and pattern of the fracture. In 2 cases of failed interlocking femoral nail, re-nailing with larger size interlocking nail was done along with bone grafting, and in remaining 9 cases of failed K-nail, re-nailing by modified K-nailing of one size larger was done along with bone grafting. In 2 cases with bent K-nail and 2 cases with broken K-nail, closed re-nailing using one size large K-nail was done and interlocking nailing was done in 5 cases (Fig 6). Adequate post-operative immobilization was ensured in all cases.

Results

41 patients with implant failure were taken for this study

Fig. 1 : Broken DCP femur

Fig. 2 : Broken DCP of humerus removed

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Fig. 3 : Bent DCP femur

retrospectively. 39 were male and 2 female with male female ratio of 19.5:1. Age ranged from 17 to 65 years. 23 had failure of femoral, 4 tibial, 12 humeral and 2 of radial implant. Implant failure in fractures of lower limb constituted 80% of cases. 1 had infection (2.4%) and 36 had re-trauma (87.8%). 16 gave history of inadequate immobilization in the post-operative period along with re-trauma and 16 had inadequate fixation followed by excessive abnormal loading at the fracture site. In 26 patients nailing was done and in 14 plating was done after removal of the failed implant. In 1 case of infection, Ilizarov's external ring fixator was applied after implant removal. 4 patients (9.7%) had post-operative infection following re-surgery, which subsided with local dressings and oral antibiotics. In all cases, union was achieved in less than 6 months and they were able to perform activities of daily living. Maximum follow-up period was 24 months.

Discussion

Mechanical failure of implants fall into 3 categories, plastic, brittle and fatigue failure. Plastic failure is one in which the device failed to maintain its original shape resulting in a clinical failure. Brittle failure, an unusual type of implant failure, is caused by defect in design or metallurgy. Fatigue failure occurs as a result of repetitive loading on a device. Therefore, when a surgeon inserts an implant, he must realize that he is entering a race between fatigue of the implant and healing of the fracture [2].

In our series, we had 30 plate and 11 Nail failures. Caution must be exercised in the use of plates, since they exhibit both good and bad features of implant [3]. The advantage is that they allow anatomical reconstruction of the bone, giving a perfect reduction and early mobilization [4]. Plate failure occurs because of interference with periosteal blood supply. Brittle and

Fig. 4 : Bent K nail femur

plastic failure occur due to minor loads in small plates and secondary major trauma in large plates [5]. The most common failure of plate is fatigue failure. The ends of the plate act as stress riser leading to a fresh fracture proximal or distal to the original one. Improper application of plates and poor technique are other causes of plate failure. Fatigue failure of plate is inevitable if healing fails to occur [6].

An intramedullary nail provides excellent stability for a fractured long bone as well as good biomechanical environment for healing. It allows early rehabilitation of the limb and functional recovery. However, intramedullary nail fails due to fatigue of the implant due to cyclical loading [7]. Early fatigue failure of the nail can be due to unstable fracture configuration [8], the distal location of the fracture and small diameter of the nail. Other causes of failure are delayed union or non-union of the fracture and in unlocked nail due to rotation of fracture fragments since nail may not provide rotational stability at the fracture site [9].

Summary

Our study shows that plate failure is more common than nail failure for long bones of lower limb. In most cases of implant failure, there was significant re-trauma during the consolidation phase of healing. In good number of cases, there was inadequate post-operative immobilization, inadequate fixation and in few cases, poor surgical techniques. In all cases, adequate union was achieved with proper selection of implant and proper choice of procedure considering pattern of the fracture, bone involved and the evidence of infection.

Fig. 5 : Broken DCP optd with interlocking nailing

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Fig. 6 : Bent K nail removed and interlocking nailing done