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IMPLANTS FAILURE IN ORTHOPAEDIC SURGERY IN KUT

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Abstract

Out of 558 cases of internal fixation of long bones done within five years, 22 cases of implant failure were recorded at Al-Karama Teaching Hospital at Al-Kut city, IRAQ. This is a prospective and retrospective study to review the possible causes of implant failure and their management. This study included sex, age and the coincident diseases of the affected patients. The failure rate in this study was 3.9%. There were 4 females (18.27%) and 18 males (81.54%). Age range of the affected patients was ranged from 19-76 years with average of 34 years. Implants failure in the lower limbs form 77.27%. This study also pointed to the possible error in metallurgy of the fixation implants because we noticed that most of the failed plates are manufactured by one company!

Introduction

The goal of fractures treatment 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 depend 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]. Implant failures arise mainly from loosening or breakage of the internal fixation device. Because bones are more flexible than metal plates, screwing a metallic plate to bone stiffens it and produces "stress riser" at each end of the plate[2]. In the absence of union, even the strongest metal plates and screws will eventually break or pull out of bone[2].

Materials and Methods

From April 2006 to April 2011, among 558 cases of internal fixation of long bones done for 548 patients, (table I), this study recorded 22 cases of implant failure in work at Al-Karama Teaching Hospital in AL- Kut city IRAQ.

Table I: Fracture sites and methods of fixation in 558 fractures.

Bone	plate	nail	other methods	total
Femur	140	117	19	276(49.46)
Tibia	75	1	33	109(19.53%)
Humerus	18	0	9	27 (4.83%)
Ulna	50	0	10	60 (10.75%)
Radius	68	0	18	86 (15.41%)
Total	3 51(62.90%)	118(21.14%)	89(15.94&)	558

It is found that most of the broken implants are related to one manufacturing company!. Of those failed implants, there were 19 plates, one k nail and 2 screws internal fixations (table II).

Table II: Type of fixation and implant failure rate in 558 fractures.

Type of fixation	total number	cases of implant failure
Plate	351	19(5.41%)
K nail	118	1(0.84%)
Others	89	2(2.24%)
Total	558	22(3.94%)

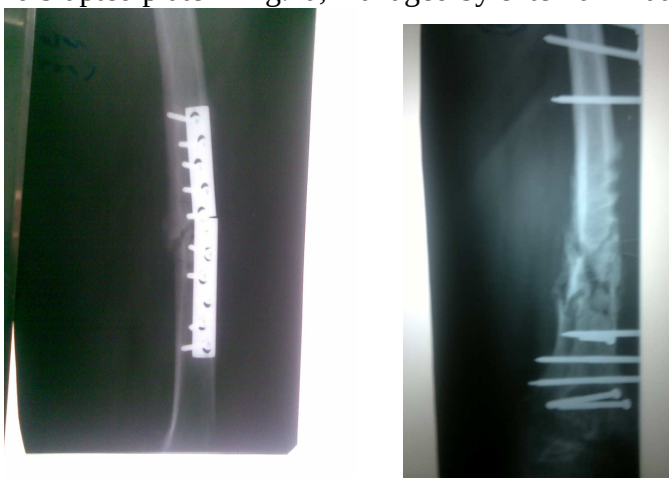
The failed plates were distributed as follow: femoral: 6 Brocken DCP plates; all are males, 4 disrupted DCP plates; 3 are females, one is male. Tibial: 2 broken DCP plates (all were males). One disrupted DCP plate (Female). Humeral: 2 broken semi tubular plates(one male and other was female). One disrupted plate. Radial:2 broken semi tubular plates (males), There was one disrupted radial and ulnar semi tubular plates in a male. There was one broken femoral k nail in a male. There were 2 cases of screws failure as follow: one was male tibial medial malleolar, the other was femoral multi screws fixation in a female. All the broken plates were removed and re plating was done utilizing longer DCP plates with supplementation with autogenous iliac and upper tibial cancellous bone graft after refreshening of the bone ends and removal of the small separated segments at the site of the fracture. We had put the screws more than one centimeter away from the fracture line on each side (fig.1 a, b, c).

Fig 1: A:28 years male with plating femur seven months post operatively. B: Broken DCP the same patient in fig 1a after 9 months post operatively. C: Replating with upper tibia cancelous bone.

A B C

One disrupted femoral L shaped DCP was removed and the fracture was fixed by external fixation with supplementation with autogenous tibia cancellous bone graft (Fig.2 a, b). The other disrupted plate was removed and AO one bar external fixator was utilized for fixation.

Fig 2: Patient with disrupted plate in fig.2a, managed by external fixation and bone graft



A B

Those tibial broken plates was removed and the bones were refixed by another DC plates after re freshening of the bone ends and supplemented with autogenous bone graft taken from the same upper tibia or the iliac crest. In all replatting we decide to put the screws at least two cm or more away from the fracture site and opening the medullary canal from both ends. In the humeral broken semi tubular plates (two), the plates were removed and put a more rigid and longer DCP plates with supplementing autogenous bone graft ;(fig.3 a,b).

Fig.3: A:19 years female with broken semitubular plate. B: broken semitubular plate (humerus).

A B

For that humeral disrupted plate, we remove the plate and re platting the fracture with longer plate and supplement it with autogenous upper tibia cancellous bone graft. For lady who had disrupted femoral screws, we removed the screws and fix her femur with L shape plate and we had utilized the huge callous at the

fracture site as a bone graft. (Fig.4 a,b,c,d).

Fig 4: A: 55 years severely osteoporotic, diabetic female with fracture. B: Femoral multiple screws. C: After fall down. D: fixed by L shape plate with utilizing callous bone.

A B C D

For that patient with broken intramedullary K nail, the nail was taken out and substituted with a wider one and supplemented with an autogenous cancellous bone graft, (fig.5 a,b).

Fig 5: A:24 years aged male with broken K nail. B: The same patient after nail exchange with wider one.

A B

The disrupted tibial medial maleollar screw was removed and the small maleolus was re freshened and fixed by tension band wiring. Those two cases with broken radial semi tubular plates were managed by re platting with autogenous cancellous bone graft augmentation. There were four cases got infection and then plate disruption. One with humeral plating, the second with radial and ulnar plating, the third was with tibia plating and the fourth was femoral platting. All were managed by removal of the implants, excision of all the devitalized and fibrous tissues and were supported by pop casts with covering antibiotics except that one with femoral fracture for which external fixation was used.

Results

This report is a prospective and retrospective study of phenomena of implant failure which we were faced with from time to time. From 558 cases of

internal fixation I have done within five years, I have 22 cases of implant failure: 3.94%. The age rang of the patients was 19-76 years with average of 34 years. There were 4 females: 18.27%, and 18 males: 81.54%. The implants failure in the lower limbs forms 77.27% of the total number of failed implants. Implant failure which associate infection compose 8,18%. There was 10 cases of implant disruption 45.45%, (femur, tibia, humerus, radius, radius and ulna) and 12 cases of implant breakage 45.55%(femur, tibia, humerus, radius, ulna). There was only one case of broken intramedullary Kuntscher nail, (4.54%, 19 cases,(86.36) of plate failure (disruption, broken), 3 cases of screw failure(13.63%). The implants failure which associate early weight bearing constitute 8 cases, (36.36). Those which were associated retrauma (fall down) are 10 cases, (45.45). Those associated infection were 4cases, (18.18). Those patients who get Implant failure were managed and followed up for 1-4 years. Those four cases that had got infection and then plate disruption were managed by removal of the plates and excision of all the devitalized and fibrous tissue. External fixation was used for that with fracture femur, with antibiotic s covering but he had got chronic osteomyelitis and then we lost the patient. The other three cases (tibia, humerus and fore arm were managed by removal of the implants and POP support with antibiotic coverage. They got good union except that with fracture tibia who got non union and chronic osteomyelitis.

Discussion

Mechanical failure of implants fall in three 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[3].

The causative factors of implant failure are one of the followings: The surgeon, the patient, and the implant.

When the surgeon inserts an implant, he must realize that he is entering a race between fatigue of the implant and healing of the fracture[4].

The surgeon should deal with the fracture in strict and proper way without over confidence. He should select the proper implant, and use the proper procedure to reach the proper fixation without leaving a chance for the possibility of nonunion. Fatigue failure of implant is inevitable if healing fails to occur[5]. Implants failure from fatigue fracture is common with plates than intramedullary nails (IMNs) because the location of an intramedullary nail in the centre of the shaft tends to spare the IMN some of the bending forces responsible for fatigue failure[6]. Vallier et al[7], reported medial comminution as a major cause of implants failure with use of locking compression plate (LCP) condyler plate fixation of distal femoral fractures. We noticed that failure in the medial comminuting of shafts of all long bones in our series.

In our series we have noticed that using a weak plate, small diameter k nail, short plates, are the causes of implant failure in certain cases. Other factors are wide stripping of the periostium, doing fixation for comminuted medial side without augmentation with bone graft. Other, using screws nearby the fracture site which we think that it interferes with endostial bone formation. Missed selection of a proper implant suitable to provide rigid and strong fixation.

Brittle and plastic failure occurs due to minor loads in small plates; (Fig3b) and secondary major trauma in large plates[5].

early weight bearing, new trauma, overweight, and coincident diseases like diabetes mellitus and osteoporosis fall in patient factors which may lead to non union, then for implant failure.

Implant metallurgy may be a factor of implant failure. We noticed that a high percent of broken implants are related to a named factory. In those implants we noticed that the broken sides are brittle and sandy! Although we haven't the technical facilities to evaluate its consistency!!

Conclusion: This study shows that the most important factor which leads to implants failure was the fatigue factor due to re trauma during the consolidation phase of union. This is facilitated by other factors including the, already, weak bones like osteoporotic bone and the pattern of the fracture. The surgical procedure and the selection of the proper implant and the proper dealing with the comminuted bone are of great importance to achieve good results.

Although we found that most of the failed plates are related to one manufacturing company, and the consistency of those broken plate ends raise a question, we cannot decide to blame that unless we analyze its chemical composition.

It is noticed also that the plate failure is more common than intra medullary nails used in femoral fixation.

With severe osteoporosis, we found that use of external fixation after removal of the failed plate is a good way to get rid of more damage to the blood supply of the bone and had got good result.

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