

# Salvage Total Hip Arthroplasty after Two Gamma 3 Nail Failures: A Case Report

**Záchranná totální náhrada kyčle po dvou selháních Gamma 3 hřebu: kazuistika**

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## SUMMARY

We report a case of 68-year-old female patient who suffered two Gamma 3 nail breakages following trochanteric fixation failure revision surgery. A patient was primarily treated with sliding hip screw. Revision surgeries of reverse trochanteric non-union were performed with short Gamma 3 nails and bone grafting. The nail failures occurred 11 and 7 months after implantation. This undesired series of events were caused by inappropriate implant selection, thus replacing the nail to a modular total hip arthroplasty was more effective as salvage surgery.

**Key words:** salvage total hip arthroplasty, gamma nail, sliding hip screw, fixation failure, reverse trochanteric fracture, non-union.

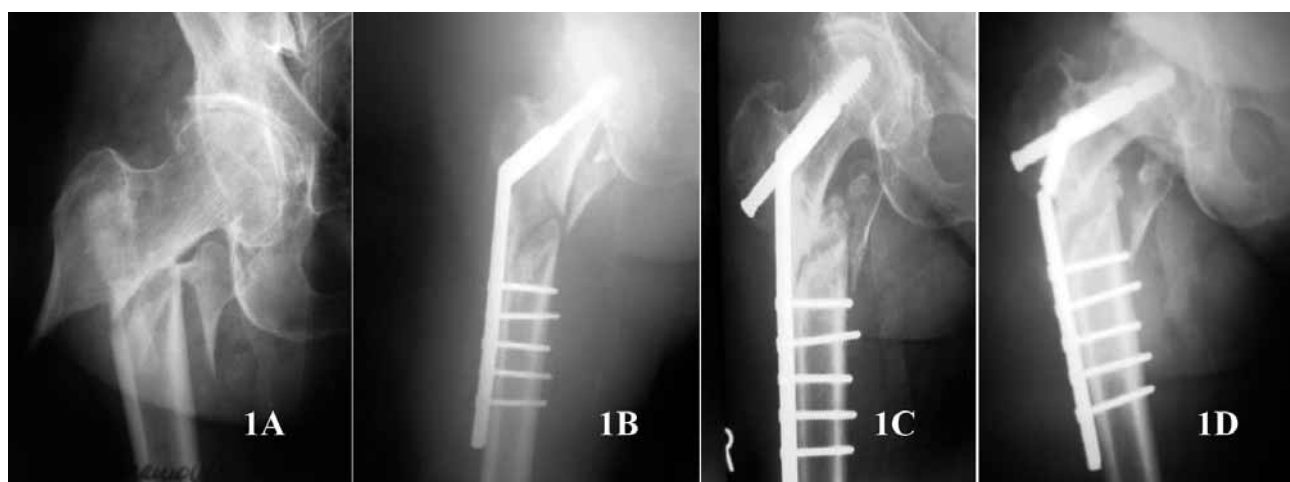


Fig. 1. A – radiograph showing an unstable trochanteric fracture AO-OTA 31 A 3.3. B – apparently satisfactory reduction of the fracture with the unsolved posteromedial cortical deficiency treated with SHS. C – signs of uncontrolled impaction and shaft medialization. D – signs of non-union and fatigue failure of the implant.

## INTRODUCTION

Management of failed trochanteric fracture fixation is a challenging task. An implant selection used in index surgery is of the utmost importance in unstable trochanteric fracture patterns, particularly when problems with healing imply planning of a salvage hip arthroplasty (4). Breakage of the Gamma 3 nail represents a rare complication due to fatigue failure of the material. Non-union of the fracture due to malreduction and fracture distraction is mostly accused for its failure (2, 4–7). This case of a 68-year-old patient shows that even a highly durable, well-designed implant such as Gamma 3 nail, when installed incorrectly, has the limited capacity to provide trochanteric non-union to heal, which may result in fatigue failure of the implant.

## CASE REPORT

A 68-year-old female patient, sustained an unstable, AO 31-A3.3, trochanteric fracture of the right femur, after falling from a standing height in July 2011 (Fig. 1A). She was overweight, with history of hypertension, treated hyperthyroidism, diabetes and non-smoking. The fracture was primarily treated with sliding hip screw (SHS) in local community hospital. Medialization of the distal fragment and implant breakage occurred 5 months after surgery (Fig. 1B, C, D).

After hardware removal in January 2012, reverse trochanteric non-union was treated with stainless steel Gamma 3™ Trochanteric nail of 180 mm (Stryker-Howmedica-Osteonics) with a cervico-diaphyseal angle of 125°, a distal diameter of 11 mm, a lag screw of 95 mm and a distal static locking. Fresh frozen femoral head allograft was combined with autologous bone to promote bone healing (Fig. 2A). Swab cultures from the surgical site were found negative. Toe-touch weight-bearing was allowed immediately after surgery, and she

regained full mobility with a walker and crutches. Clinical follow up at 6 and 12 weeks after surgery revealed slight pain in the right hip region during partial weight bearing. Radiographs revealed signs of delayed union. She postponed regular follow-up and started to fully bear weight with crutches on her own responsibility. Eleven months after surgery, she was referred to our institution after feeling sudden pain in her thigh, and being unable to walk. Radiograph revealed signs of a non-union and breakage of the nail (Fig. 2B).

The broken nail was replaced with a new Gamma 3 nail and 105 mm lag screw in December 2012 (Fig. 3A). The same surgical and rehabilitation protocol were implemented. Clinical follow up at 6 and 12 weeks after surgery revealed no callus formation at radiography. The patient was advised to consider nail dynamization,

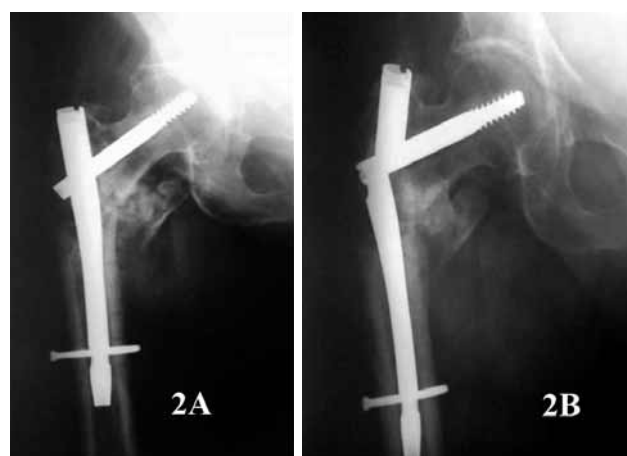


Fig. 2. A – AP radiograph showing insufficient reduction with lateral cortical wall deficiency and the unsolved posteromedial cortical buttress. The main fragments are distracted. B – signs of non-union and nail breakage at the aperture for the lag screw, 11 months after surgery.

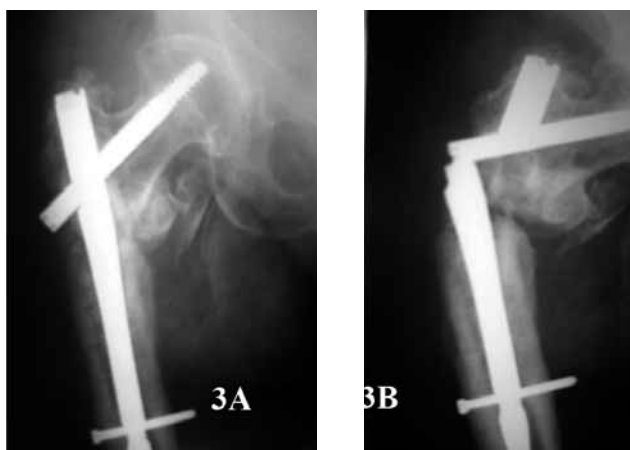


Fig. 3. A – postoperative radiograph of second Gamma 3 nail locked in static mode distally. Main fragments still distracted. Posteromedial wall deficiency filled with bone allograft. B – signs of bone non-union and renewed failure of the nail at the aperture of the lag screw, 7 months after surgery.



Fig. 4. A – AP radiograph of the right hip, 4 months after salvage total hip arthroplasty, using modular, cementless, distally fixing stem. Signs of delayed bone union. B – signs of an incomplete bone consolidation and scant bridging callus on the medial femoral cortex, 12 months after salvage total hip arthroplasty.

which she declined. At 6 months, signs of non-union and graft resorption were noticed. She was advised to consider nail removal and salvage total hip arthroplasty, which she refused. Month later, she was referred to our institution with signs of femoral non-union and mechanical failure of the nail at the aperture for the lag screw (Fig. 3B). The nail extraction was performed in June 2013 and proximal femoral non-union was treated by use of modular total hip prosthesis type ZMR (Zimmer, Warsaw, Indiana, USA) and allogenic bone graft (Fig. 4A). Surgical site cultures were found negative. Partial weight bearing with walker and crutches was started immediately. During clinical follow up at 6 and 12 weeks after surgery, she was ambulatory with crutches and asymptomatic. Postoperatively, 12 months after surgery, she was mobile with a cane, and asymptomatic (Fig. 4B).

## DISCUSSION

We report an uncommon event such is two failures of the Gamma 3 nail due to erroneous surgical treatment of unstable trochanteric fracture, particularly in primary fracture surgery.

Over the years the Gamma nail became superior tool over SHS for the management of unstable trochanteric and subtrochanteric fractures in the elderly population (2, 11).

A recent study compared perioperative differences between a failed SHS construct and a cephalomedullary nail for conversion to total hip arthroplasty. The authors concluded that conversion after a failed intramedullary device is a more complex procedure (4, 6, 12). Previous reports in the literature have confirmed the limited capacity of intramedullary devices to promote healing of subtrochanteric non-unions, which are advantages that a condylar blade plate can offer (13). Salvage hip arthroplasty has been shown to be a viable treatment

option for managing fixation failures of unstable trochanteric fractures in elderly population. These procedures are challenging and require overcoming numerous difficulties including femoral and acetabular bone defects, removal of broken hardware and bone loss from previous surgeries (4, 6).

This is the first report of Gamma 3 nail breakage following trochanteric fracture revision surgery. Beside the two failures presented in this report, we have found a total of seven 3<sup>rd</sup> generation Gamma nail breakages in English language literature (7–10, 14, 15). The most common cause of a nail breakage was metal fatigue secondary to delayed union or non-union of the fracture. In all Gamma 3 nail failures, the weakest part of the nail was located on the aperture of the lag screw. This is the critical zone where the cross-sectional diameter of the nail is reduced by 73% and forces from the femoral neck are transmitted to the nail in the diaphysis (1, 15). All reported breakages of the Gamma 3 nail occurred at average 12.5 months after surgery (5–24 months) compared to average of 9 months in case reported. The inappropriate drilling of the nail at the aperture for the lag screw, or its off-center introduction, may damage the nail and contribute to nail breakage (8). We have found neither an obvious damage due to drilling or screw insertion, nor certain signs of manufacturing errors, but typical fatigue fractures of the implants.

The breakage of the Gamma 3 nail in both events was a result of a non-union due to fragment distraction and incorrect surgery. Regaining a firm contact between main fragments and restoration of the medial hinge with stable bone-implant construction are indispensable both in primary and revision surgeries of unstable trochanteric fractures. The main fragment diastasis would have been prevented by traction release after lag screw placement, as previously reported (2). Distal static interlocking of both nails, with main fragments distracted, prevented its axial compression and impaction, leading to

bone non-unions. Another solution for this case was initial nail dynamization by distal dynamic interlocking or complete omission of distal interlocking during the first exchange to enhance compression between main fragments (2, 3). In this race between union and non-union, low cycle fatigue under partial weight bearing induced high stresses on the nail and its yielding. Many elderly patients have poor bone quality and damaged cartilage of the hip joint due to penetrating and scratching cartilage by the previous implant. It seems reasonable for the patient and for the health care system as well, to perform salvage partial or total hip arthroplasty immediately after the first fixation failure. This could diminish numerous surgeries and risks to the patients, reducing the overall treatment costs.

## CONCLUSION

In conclusion, an implant selection used in the index surgery is of the utmost importance in unstable trochanteric fracture patterns, particularly when expecting a salvage hip arthroplasty. Gamma 3 nail breakage represents a rare, although possible, complication when prolonged healing is expected. When used for revision of failed fracture fixation, it should be used with caution, implementing bone auto grafting and restricted weight bearing. It is of principal importance to prevent distraction of main fragments during surgery that would lead to non-union and consequential implant failure. Modular total hip arthroplasty is proved as an effective salvage procedure after the failed trochanteric fracture fixation in an older patient.

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