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Destabilization of intramedullary fixation with Gamma nail for intertrochanteric fractures with sliding screw cut out

Destabilizacja śródszpikowego zespolenia gwoździem Gamma złamań przekrętarszowych z migracją śruby doszyjkowej do stawu biodrowego

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Summary

Introduction. Intertrochanteric fractures are located in the proximal upper part of the femur, extracapsularly and extend up to 5 cm under the minor trochanter (3). Intramedullary fixation is used almost exclusively for this kind of fractures in our department for many years. The most common mechanical complication of intramedullary fixation is the cut out of the sliding screw through the femoral head. The most common reasons for fixation instability are unstable type of fracture, not anatomic fracture reduction and abnormal position of the sliding screw (4, 6). Patients with intertrochanteric fractures are usually operated in the early days of the hospital admission and diagnosis. Cut out of the screw is defined as the displacement of more than 1 mm beyond the contour of the femoral head.

Aim. In our analysis we prove that destabilisation of gamma nail with cut out of sliding screw is caused by technical mistakes made during the surgical procedure.

Material and methods. The analysis includes 763 patients who were operated with intramedullary fixation among 842 patients with a diagnosis of intertrochanteric fracture between 2008-2012.

Results. Complication involving migration of the sliding screw was observed among the 12 patients.

Conclusions. Complication according to literature was associated with: difficult, unstable type of the fracture, non-anatomical reduction of the fracture and non-optimal position of the sliding screw.

Key words: intertrochanteric fractures, intramedullary gamma nail, mechanical complications, cut out effect

Streszczenie

Wstęp. Złamania przekrętarszowe są złamaniami bliższego końca kości udowej, lokalizują się pozatrebkowo, sięgając do 5 centymetrów poniżej krętarza mniejszego (3). W naszej Klinice od wielu lat stosujemy niemalże wyłącznie technikę osteosyntezy śródszpikowej przy zaopatrywaniu tego typu złamań. Najczęstsze mechaniczne powikłanie dla zespolenia śródszpikowego metodą gwoźdźca Gamma to destabilizacja zespolenia z migracją śruby doszyjkowej poza głowę kości udowej z towarzyszącym przemieszczeniem odłamów i szpotawą deformacją (4). Najczęstsze powody destabilizacji zespolenia to: niestabilny typ złamania, nieanatomiczne nastawienie złamania, nieprawidłowa pozycja śruby doszyjkowej (4, 6).

Cel pracy. Celem pracy jest udowodnienie związku pomiędzy destabilizacją gwoźdźca gamma z migracją śruby doszyjkowej a błędami w technice operacyjnej.

Materiał i metody. Praca obejmuje 842 chorych, którzy zostali przyjęci z rozpoznaniem złamania przekrętarszowego w latach 2008-2012 oraz zaopatrzeni metodą osteosyntezy śródszpikowej. Chorzy ze złamaniem przekrętarszowym operowani są najczęściej we wczesnych dobach po przyjęciu do szpitala i postawieniu rozpoznania. Ocena zespolenia prowadzona jest pod kątem: prawidłowego nastawienia złamania, lokalizacji i położenia śruby doszyjkowej w płaszczyźnie AP i osiowej z podziałem głowy kości udowej na 4 części w projekcji AP i 3 części w pozycji osiowej. Migracja śruby definiowana jest jako przemieszczenie jej o więcej niż 1 mm poza obrys głowy kości udowej. W materiale przeanalizowano 842 chorych przyjętych do Kliniki z rozpoznaniem złamania przekrętarszowego, spośród których 763 poddano zabiegowi operacyjnemu.

Wyniki. Powikłanie polegające na destabilizacji zespolenia z migracją śruby doszyjkowej do stawu biodrowego zaobserwowaliśmy wśród 12 chorych.

Wnioski. Powikłanie zgodnie z doniesieniami spotykanymi w literaturze związane było z: trudnym, wielofragmentowym, niestabilnym charakterem złamania, nieanatomicznym nastawieniem złamania lub nieprawidłowym umieszczeniem śruby doszyjkowej.

Słowa kluczowe: złamanie przekrętarszowe, gwoździec śródszpikowy, gwoździec GAMMA, destabilizacja zespolenia, migracja śruby doszyjkowej

INTRODUCTION

Intertrochanteric fractures are located in the proximal upper part of the femur, extracapsular and extend up to 5 cm below the minor trochanter (1). Most often they are caused by low energy trauma or tumor metastases in elderly patients. Among young people they are caused by high energy trauma (3). Intramedullary fixation is used almost exclusively for this kind of fractures in our department for many years. The most common mechanical complication of intramedullary fixation is the cut out of the sliding screw through the femoral head with destabilization of fixation and fracture displacement (4). The most common reasons for fixation instability are unstable type of fracture, not anatomic fracture reduction and abnormal position of the sliding screw with incorrect TAD index (Tip Apex Distance specifying the sum of distances between the apex of the sliding screw and femoral head in AP and axial projection) less than 25 mm (fig. 1) (4, 6).

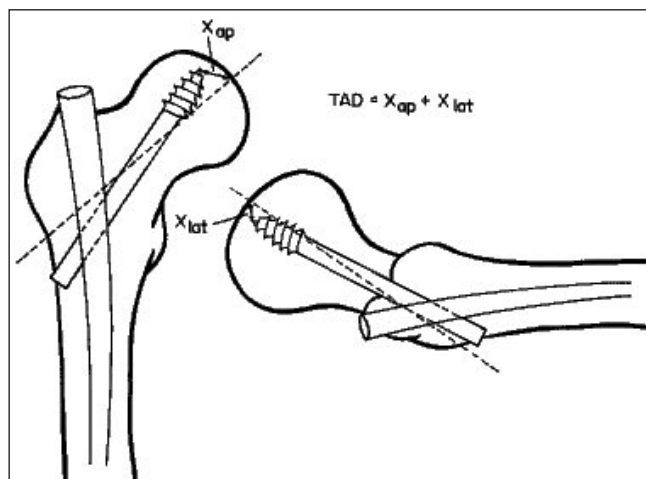


Fig. 1. TAD determination method.

AIM

In our analysis we prove that destabilisation of gamma nail with cut out of sliding screw is caused by technical mistakes made during the surgical procedure.

MATERIAL AND METHODS

The analysis includes 763 patients who were operated with intramedullary fixation among 842 patients with a diagnosis of intertrochanteric fracture between 2008-2012, analysis is based on all available x-ray scans before surgery, after fixation and late control studies which, were taken between 2008-2012.

All fractures are classified with AO classification (fig. 2).

Patients with diagnosed intertrochanteric fracture are operated in first days after diagnosis. Operations are performed by specialists or residents during specialization, both trained in operation technique. The operation is performed on traction table with fluoroscopic view in spinal or general anesthesia. In most cases procedures are performed after closed reduction, in

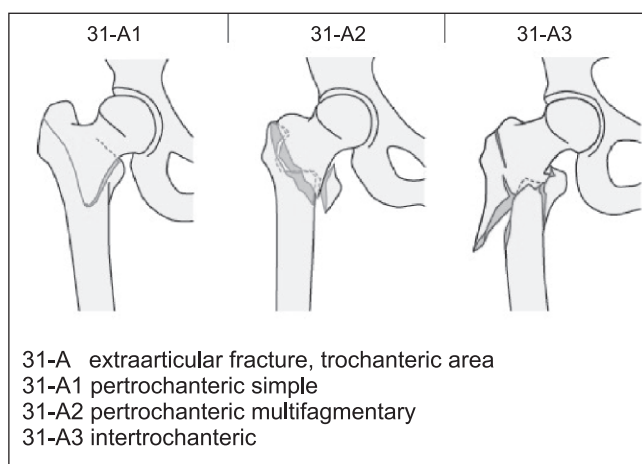


Fig. 2. AO classification (9).

special situations when closed reduction fails patients undergo open reduction and intramedullary fixation.

Operative treatment allows full weight bearing on operated limb if the reduction is anatomical and technically correct. In cases of incorrect reduction only partial weight bearing is allowed until first postoperative visit after 6-8 weeks.

Fixation is assessed in terms of: appropriate and anatomical reduction, sliding screw position in AP and axial x-ray view with division of femoral head into 3 parts in axial view and 4 parts in AP view.

The best positions for sliding screw are central-central or central-inferior positioning of the screw in axial and AP view.

The cut-out effect is defined as migration of screw more than 1 millimeter outside the femoral head.

RESULTS

We analyzed 763 among 842 patients who were operated with diagnosis of intertrochanteric fracture and identified 12 patients with in sliding screw cut out outside the femoral head. This complication was observed in 1.57% of operated patients.

According to AO classification cut out effect of sliding screw most often concerned 31-A2 type of fracture in our material.

In two cases complication was related to non anatomical fracture reduction. In post operative x-ray scans we observed incorrect reposition of fracture fragments resulting in non stable fracture fixation (fig. 4).

In five cases complication was related with invalid sliding screw position (fig. 3). According to literature the best positions for sliding screw are central-central or central-inferior screw placement in femoral head and neck in both axial and AP view. This position of sliding screw leads to stable fixation of fracture and reduces the risk of complication.

In three cases complication was related with both invalid sliding screw position and non anatomical reduction of fracture.

In two cases we observed sliding screw cut out complication through appropriate reposition and fixation.

Among patients with sliding screw cut out related to incorrect screw position we observed: in 3 cases location of the screw in upper portion of femoral head in AP view and in front portion of femoral head in axial view and in 5 cases the location of screw in upper portion of femoral head in AP view and in central portion in axial view.

According to AO classification sliding screw cut out effect concerned 31-A2 type of fracture in 10 of 12 cases (91.66%).

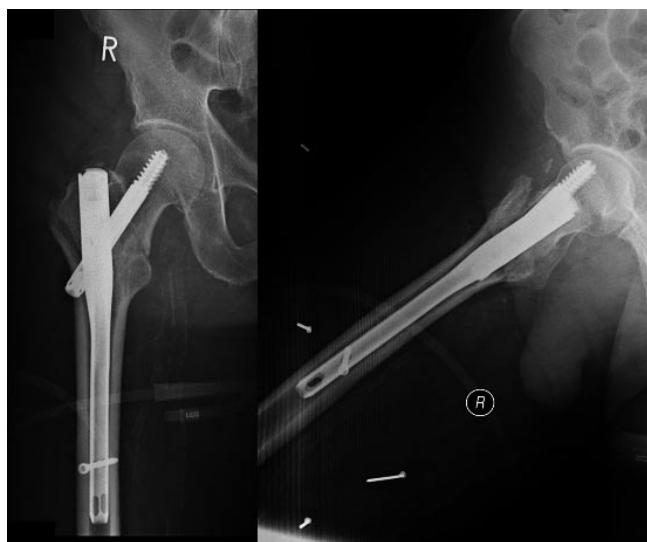


Fig. 3. Postoperative x-ray scan showing suboptimal screw placement.



Fig. 4. X-ray showing cut out effect with Massie destruction of hip joint.

DISCUSSION

The most common mechanical complication of intramedullary fixation of intertrochanteric fractures is

the cut out of the sliding screw through the femoral head with destabilization of fixation and fracture displacement (4-6). According to literature and our analysis the most common reason for fixation instability are unstable type of fracture, not anatomic fracture reduction and abnormal position of the sliding screw with incorrect TAD index (Tip Apex Distance specifying the sum of distances between the apex of the sliding screw and femoral head in AP and axial projection) less than 25 mm (4, 6).

According to literature the most common fracture type with this type of complication is 31-A3, in our analysis it was 31-A2 fracture type (4).

According to literature the most important factor having an impact on the probability of cut out effect is sliding screw placement (4, 7). The TAD index should be lower than 25 mm (4, 7).

The best placement for sliding screw are either central-central or central-inferior position of the screw in axial and AP view, it provides the best stabilization of fracture reducing to minimum the risk of destabilization. It is very important to pay attention to this aspect of surgery procedure and check every step during procedure with fluoroscopic view.

In our material suboptimal sliding screw position was the reason for 8 among 12 cases with cut out effect complication.

Multifragmentary, unstable fracture type increases the risk of complication. In those fracture types anatomical reduction and appropriate placement of Gamma nail are particularly important.

Non anatomical reduction of fracture increases probability of complications. Every time when closed reduction fails open reduction should be applied to reduce the risk of complications.

It is worth noting that in many cases non anatomical reduction forces further mistakes in following stages of surgery procedure.

In article by Bojan et al. (4) migration of sliding screw with cut out effect was observed in 1.86% of patients operated on intertrochanteric fracture among 3066 patients. In our analysis this kind of fixation failure concerned 1.57% of patients operated on intertrochanteric fracture among 763 patients.

Sliding hip screw migration with screw cut out in most cases is a complication depended on a surgical mistakes which is why we should carefully follow all rules of surgery technique.

CONCLUSIONS

In our analysis we confirm previous reports about destabilization of intramedullary fixation with Gamma nail for intertrochanteric fractures. Factors such as: unstable fracture type, non anatomical fracture reduction and abnormal position of the sliding screw with incorrect TAD index, less than 25 mm significantly increase the risk of complication. Intramedullary fixation with Gamma nail requires appropriate surgery technique with special emphasis on biomechanical aspects of this method.

BIBLIOGRAPHY

1. Tylman D, Dziak A: *Traumatologia narządu ruchu*. Wyd. 2, PZWL, Warszawa 1996; t. 1-2.
2. Canale TS, Beaty JH: *Campbell's Operative Orthopaedics*. 11th ed., Philadelphia: Mosby Elsevier 2008; 4311-4344.
3. Bucholz RW, Heckman JD, Court-Brown CM: *Rockwood and Green's Fractures in Adults*. 6th ed., Philadelphia: Lippincott Williams & Wilkins 2006; 2147-2247.
4. Bojan AJ, Beimel C, Taglang G et al.: Critical factors in cut-out complication after gamma nail treatment of proximal femoral fractures. *BMC Musculoskelet Disord* 2013 Jan 2; 14(1): 1.
5. Pascarella R, Cucca G, Maresca A et al.: Methods to avoid gamma nail complications. *Chir Organi Mov* 2008 Apr; 91(3): 133-139.
6. De Bruijn K, den Hartog D, Tuinebreijer W, Roukema G: Reliability of predictors for screw cutout in intertrochanteric hip fractures. *J Bone Joint Surg Am* 2012 Jul 18; 94(14): 1266-1272.
7. Andruszkow H, Frink M, Frömke C et al.: Tip apex distance, hip screw placement, and neck shaft angle as potential risk factors for cut-out failure of hip screws after surgical treatment of intertrochanteric fractures. *Int Orthop* 2012 Nov; 36(11): 2347-2354.
8. Lobo-Escolar A, Joven E, Iglesias D, Herrera A: Predictive factors for cutting-out in femoral intramedullary nailing. *Injury* 2010 Dec; 41(12): 1312-1326.
9. The Müller AO Classification of Fractures – Long Bones.

received/otrzymano: 25.03.2013

accepted/zaakceptowano: 08.05.2013

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