

## Case Report

## Femoral neck pseudoarthrosis in a polio patient treated with closed reduction and cell therapy

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## ABSTRACT

Poliomyelitis disease affects the anterior horns cells of the spinal cord and certain motor nuclei of the brain stem. Paralysis type is flaccid and asymmetrical and result in muscular imbalance. Due to this, in case of having a hip muscles involvement, degenerative or posttraumatic, total hip arthroplasty is normally contraindicated because of the excessive risk of hip dislocation. In cases of subcapital femoral neck fractures the femoral head vascularization is a main concern, and in cases of neglected fracture with pseudoarthrosis the vascular status to the head must be investigated prior to further decisions.

We report the case of a femoral neck fracture non-union after a missed femoral neck fracture in a polio affected leg treated with cannulated screws and percutaneous autologous injection of processed total nuclear cells (TNC) mixed with putty demineralized bone matrix.

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## Case report

We present a fifty-three-year-old woman with a history of diabetes, rheumatoid arthritis and poliomyelitis in her childhood. Her left lower limb was affected and had muscle weakness; she was an ambulatory patient and walked without aids and maintained a normal lifestyle.

Four months prior her first presentation she suffered from a fall from her own height. She attended a local emergency department because of left hip pain and inability to bear weight on her left leg. She described a sharp pain in the left hip while standing, which caused her to shift her weight to the right leg. She was examined and discharged from the emergency department. The patient was diagnosed as having a sprain; she was treated with non-steroidal anti-inflammatory drugs (NSAIDs) and was prescribed crutches for ambulating.

Two months later, the patient returned to the emergency department because of ongoing inability to walk due to pain in her hip and contra lateral knee. Physical examination revealed contra lateral knee effusion. Radiographs were not repeated, and the patient was discharged again with the diagnosis of rheumatoid arthralgia.

Four months after the initial injury, the patients presented to our clinic due to ongoing pain and inability to weight bare on the left leg. Examination showed left groin pain, tenderness, and diminution of active hip flexion. On radiographs, a displaced femoral neck fracture was obvious (Fig. 1). Computed tomography showed a nonunion of an intracapsular fracture of her neck of femur (Fig. 2).

On MRI the femoral head seemed to be vascularized (Fig. 3), thus, the operative plan was to reduce the fracture in a close or open fashion as needed, with a bone stimulative agent of a mixture between autologous processed total nucleated cell (TNC) from iliac crest and demineralized bone matrix as putty composite (©Synthes, Inc. USA).

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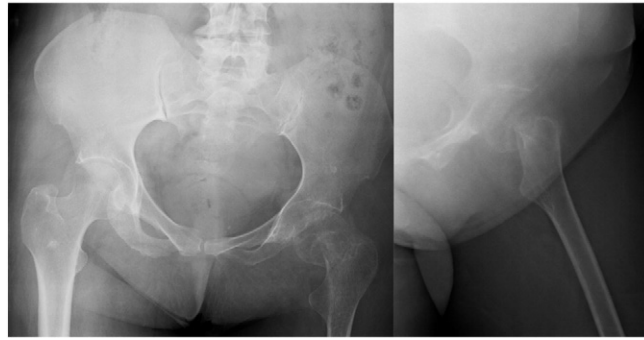


Fig. 1. An AP and LAT X-rays that show the displaced femoral neck fracture.

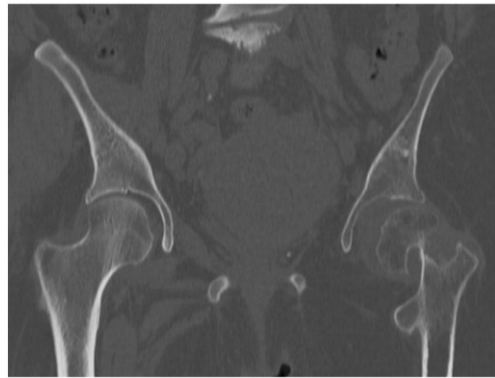


Fig. 2. CT coronal shows reabsorption of the border of the fracture.

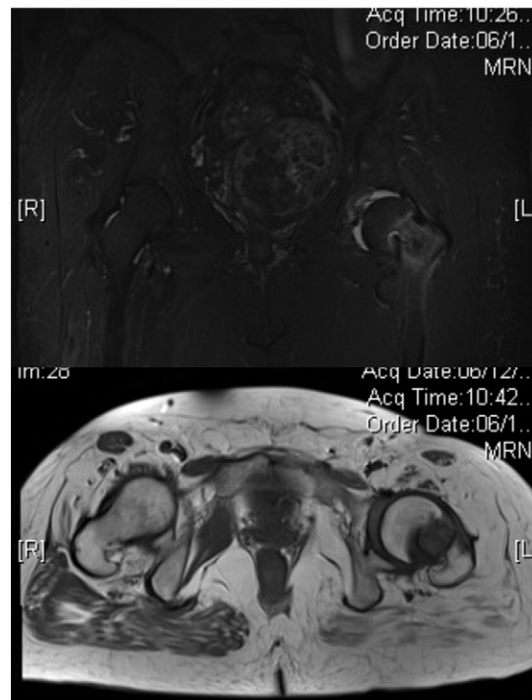


Fig. 3. a) T2 coronal MRI and T1 axial MRI that excluded the vascular compromised of the femoral head.

### Operative procedure

Under general anesthesia, the patient was positioned on a fracture table, the fracture was reduced by means of traction and internal rotation, the fracture position seemed to be satisfactory with a remarkable bone reabsorption on the lateral aspect of the femoral neck and a slightly valgusization. The fracture was fixed using a partially threaded compression cannulated screw first on the medial and inferior aspect of the neck and then another two cephalic to the first, using the inverted triangle configuration technique (Fig. 4). At this stage an iliac crest bone marrow aspirate was obtained with the use of the Sepax® (Sepax Technologies, Inc. USA) in order to obtain the Total Nucleated Cell (TNC) fraction with a high cell concentration in the final product via centrifugation and light absorbance to separate them. This device provides a fully-automated method to separate the cellular product into its components, allowing a safe, reproducible and user independent procedure.

The cell concentrate was mixed with demineralized bone matrix as putty (©Synthes, Inc. USA) and then under fluoroscopy, a hollow cannulated wire was located under fluoroscopic guidance and the graft composite was injected to the bone loss site (Fig. 5). An additional cannulated screw was added to enhance the fixation.

### Postoperative care

We started range of motion exercises and muscle strengthening on the first post operative day with non weight bearing for 6 weeks. Weight bearing was allowed after six weeks and an intensive hydrotherapy and physiotherapy regimen was initiated. The patient was in follow-up visits at 2, 6, 12 weeks after surgery and 3, 6, 12 and 18 months (Figs. 6 and 7). By six months, the patient was able to stand from a sitting position and to climb stairs with use of handrails and she re-gained her former ambulatory state.

### Discussion

We present a rare case of a missed intracapsular fracture of the femoral neck which led to non-union in a patient with a history of poliomyelitis of the ipsilateral leg. The patient underwent close reduction and internal fixation of the non-union site with injection of a composite graft with demineralized bone marrow and concentrate of TNC to the nonunion site. The fracture eventually healed and the patient returned to her base line ambulatory status.

In a normal scenario, this patient at the age of 70 years old without any neuromuscular disease would have been treated by total hip replacement of the affected leg [1,2] with good results, resulting in a direct relief of pain and immediate full weight bearing.



Fig. 4. Intraoperative fluoroscopy images with the fracture reduced and the fixation done.

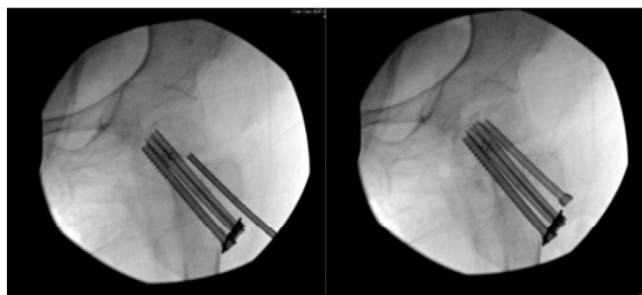


Fig. 5. a) Injection of the composite through a cannulated guide wire under fluoroscopy guidance.



Fig. 6. AP and lateral X-ray views at 6 months of follow-up.



Fig. 7. 18 months of follow-up showing a healed fracture and no signs of avascular necrosis.

The incidence of femoral neck pseudarthrosis following displaced intracapsular fractures varies between 10 and 30%. There are no evidence-based treatment guidelines for femoral neck pseudarthrosis [3].

Fractures of the femoral neck in elderly patients could be treated with internal fixation, hemiarthroplasty, or total hip replacement (THR), depending on the degree of fracture displacement, the patient's age, functional demands and risk profile, such as level of cognitive function and degree of physical fitness [4].

Because of this the risk of postoperative complications, mainly hip dislocation due to flaccid paralysis of muscle, we were reluctant to perform THA in our patient with the residual poliomyelitis despite there are very few cases reported in the literature treated with this modality [5,6].

The addition of a preserved vascularization in the femoral head helps us to finally dismiss the arthroplasty procedure and choose a head preserving technique despite the fracture pattern. We followed the principles of internal fixation of a non union, absolute stability and biologic addition Frank et al. described an operative method with autologous bone cylinder transplantation in combination with re-insertion of cannulated screws in young patients with delayed fracture healing of the femoral neck [7].

Our group recently described a novel technique for the treatment of delayed fractures unions using aspirated bone marrow-enriched MSCs-graft into the fracture site for prevention non union and promoting fast fracture union [8] but this treatment is still not ready for routine clinical use.

We also think that the role of physical and occupational therapists in rehabilitation of this patients with musculoskeletal weakness, impaired balance, and difficulty walking specially after a surgical procedure is crucial specially in the immediate and the postoperative course.

## Conclusion

We presented this case for its uniqueness and its clinical relevance in this relatively rare condition.

Femoral neck pseudoarthrosis in and old polyo affected leg was successfully treated with absolute stabilization and autologous cell therapy mixed with DBM. This is a safe procedure with minimal potential complications. This seems to be a good solution in this complicated, yet, rare case.

## References

- [1] I.S. Aleem, P.J. Karanicolas, M. Bhandari, Arthroplasty versus internal fixation of femoral neck fractures: a clinical decision analysis, *Ortop. Traumatol. Rehabil.* 11 (2009) 233.
- [2] J.F. Keating, A. Grant, M. Masson, N.W. Scott, J.F. Forbes, Randomized comparison of reduction and fixation, bipolar hemiarthroplasty, and total hip arthroplasty: treatment of displaced intracapsular hip fractures in healthy older patients, *J. Bone Joint Surg. Am.* 88-A (2006) 249–260.
- [3] V. Mathews, M.E. Cabanela, Femoral neck nonunion treatment, *Clin. Orthop. Relat. Res.* 419 (2004) 57–64.
- [4] J. Tidermark, Quality of life and femoral neck fractures, *Acta Orthop. Scand. Suppl.* 74 (2003) 1–42.
- [5] H.U. Cameron, Total hip replacement in a limb severely affected by paralytic poliomyelitis, *Can. J. Surg.* 38 (1995) 386.
- [6] B.-H. Yoon, Y.-K. Lee, J.J. Yoo, H.J. Kim, K.-H. Koo, Total hip arthroplasty performed in patients with residual poliomyelitis: does it work? *Clin. Orthop. Relat. Res.* 472 (3) (11/2013).
- [7] C. Frank, M. von Au, B. Vock, A. Wentzensen, P.A. Grützner, T. Guehring, Autologous bone cylinder transplantation with cannulated screw re-stabilization: a new treatment option for delayed fracture healing of the femoral neck, *Arch. Orthop. Trauma Surg.* 131 (11) (2011 Nov).
- [8] M.L.J. Schroeder, R. Mosheiff, Z. Gazit, Z. Yoram, L. Rasooly, A. Daskal, A. Khoury, Y. Weil, S. Beyth, Stem cell-based therapy for prevention of delayed fracture union: a randomized and prospective preliminary study, *Mol. Ther.* 21 (8) (Aug. 2013) 1631–1638.