Case 77: Reconstruction of Failed Allograft Reconstruction with Combined Technique (Low-Grade Osteosarcoma)

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Abstract

Bone tumors in the long bones are successfully treated either with prosthetic replacement or with biologic reconstruction techniques. Following resection of all the tumoral tissues, the defect needs to be reconstructed with distraction osteogenesis and/or allografts.

1 Brief Clinical History

- A 33 year old male patient complaining of a progressing distal thigh mass referred to our clinic. The mass had been noticed early as the patient was himself a surgeon (Fig. 1a–d). Following initial radiological assessment, tru-cut biopsy had been performed. Low-grade osteosarcoma had been diagnosed after histopathologic evaluation. Three cycles of preoperative chemotherapy had been indicated. The initial surgical treatment had consisted of resection of the tumoral tissue and reconstruction with hemicylindrical allograft medially and stabilization via a retrograde intramedullary nail 3 years ago (Fig. 2a–c).
- The patient presented to our clinic with pain and limping at this stage. The plain X-rays revealed the IM nail was broken (Fig. 3a, b). At his point we wanted to differentiate between tumoral recurrence and atrophic nonunion. Thus, we obtained three-phase bone scans, which showed increased uptake (Fig. 4).
- The tru-cut biopsy was performed and the result was negative for tumoral recurrence.

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S.R. Rozbruch, R.C. Hamdy (eds.), *Adult Deformity/Tumor/Upper Extremity*,
DOI 10.1007/978-3-319-18020-5_272

Fig. 1 (**a**) Preoperative X-ray (*AP view*) of the left femur depicting periosteal reaction. (**b**) Preoperative X-ray (*lateral view*) of the same patient. (**c**) Preoperative MRI scan (*frontal view*) showing the bone mass. (**d**) Preoperative MRI scan (*axial view*) of the same patient

2 Preoperative Clinical Photos and Radiographs

See Figs. 1, 2, 3, and 4.

3 Preoperative Problem List

- History of a low-grade osteosarcoma of the distal femur
- Atrophic nonunion of the distal 1/3 femoral diaphysis
- Instability due to broken IM nail
- Limb length discrepancy of 2 cm
- Valgus deformity

4 Treatment Strategy

1. Removal of the broken IM nail and the locking screws.
2. Resection of the atrophic nonunion site along with the allograft.
3. Retrograde insertion of a new IM nail with customized holes for locking of the transported bone segment at the second session.
4. Percutaneous corticotomy at the proximal 1/3 femoral diaphysis.

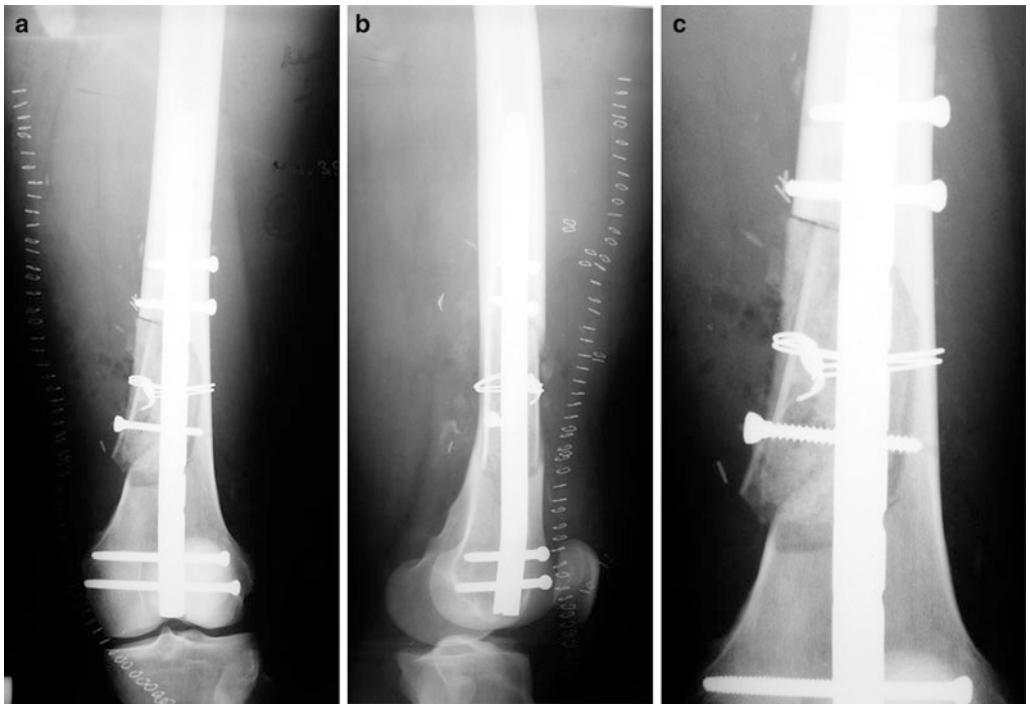

Fig. 2 (**a**) Immediate *AP view* following the initial reconstructive procedure consisting of resection of the tumoral tissue and reconstruction with hemicylindrical allograft medially and stabilization via a retrograde IM nail. (**b**) Immediate *side view* following the initial reconstructive procedure. (**c**) Close *AP view* of the same patient

Fig. 3 (**a**) Orthoroentgenogram of the patient showing the broken nail and the femoral valgus deformity. (**b**) *Side view* showing the broken nail and the nonunion. Note the periosteal activation at the posterior aspect of the nonunion

Fig. 4 Tc99 bone scan shows increased uptake at the nonunion site

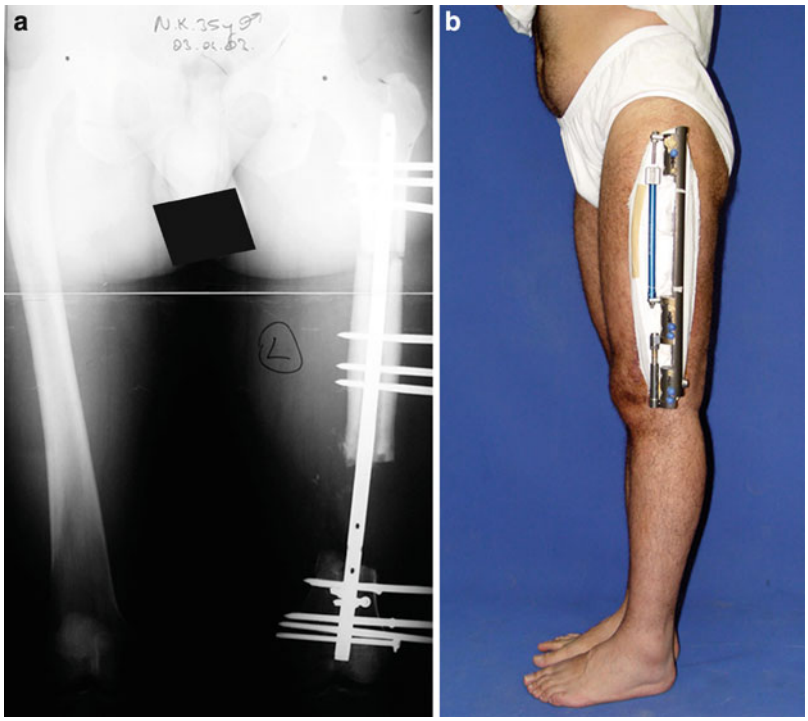

Fig. 5 (**a**) AP X-ray following the reconstruction consisting of wide resection of the nonunion side and retrograde IM nailing while preserving the current length of the femur. A proximal osteotomy is performed for bone transport and lengthening (bone transport via combined technique). (**b**) Clinical side view during ex. fix. period

Fig. 6 (**a**) Orthoroentgenogram after removal of the ex. fix. and locking of the IM nail. (**b**) AP X-ray showing the new bone formation 2 months later. (**c**) AP X-ray showing the new bone formation 3 months later. (**d**) *Side view* showing the bone formation

5. Application of a unilateral external fixator (Orthofix limb reconstruction system type) to all three segments of the bone (Fig. 5a, b).
6. When the desired amount of lengthening has been achieved, the remaining interlocking screws are inserted and then the external fixator is removed at a second session (Fig. 6a–d). Following removal of the external fixator, the patient is not allowed to bear full weight until consolidation is established radiographically (Fig. 7a–d).

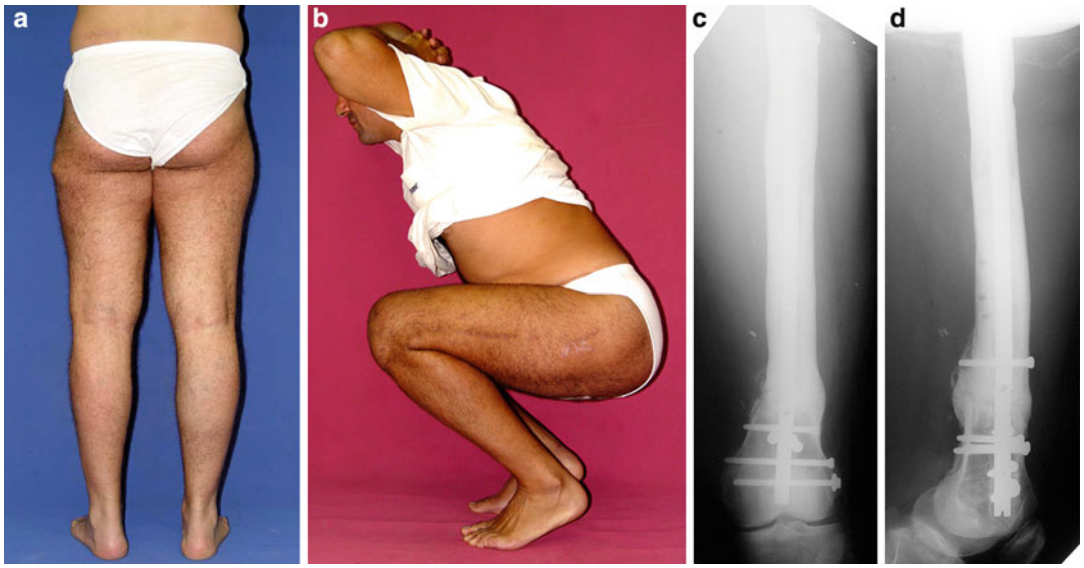

Fig. 7 (**a**) Clinical picture at the end of the treatment. (**b**) Functional clinical picture. (**c**) AP X-ray after complete bone healing. (**d**) Side view X-ray after complete bone healing

5 Basic Principles

1. All the nonviable avascular bones should be removed. This is established by the presence of the so-called paprika sign.
2. The medullary canal should be over-reamed by 2 mm larger than the IM nail.
3. A paper tracing is required to determine the customized holes on the IM nail for locking of the transported segment.
4. Usually the IM nail is introduced further through the piriform fossa proximally. This enables that enough length of the IM nail is still left inside the proximal segment after the bone transport and lengthening.

6 Images During Treatment

See Figs. 5 and 6.

7 Technical Pearls

- Over-ream the femoral canal by 2 mm to allow smooth sliding of the IM nail.
- Schanz screws are placed perpendicular to the IM nail (anatomical axis) on both planes.
- To prevent any contact between the Schanz screws and the IM nail, cannulated drill technique should be utilized for precision.
- Minimal invasive percutaneous corticotomy technique should be performed to obtain new bone formation of good quality.

8 Outcome Clinical Photos and Radiographs

See Fig. 7.

9 Avoiding and Managing Problems

1. Over-reaming is of paramount importance as without its implication the transport system may stuck and not work.
2. Likewise, if the long axes of the IM nail and the external fixator are not parallel to each other on both planes, then the system will not work as well.
3. To avoid spreading of a pin tract infection into the medulla, the pins of the external fixator must not touch the IM nail. There should be at least 1 mm distance between the pins and the IM nail.

10 See Also in Vols. 1 and 2

Case 9: Adolescent with Segmental Bone Defect Secondary to Grade IIIB Open Tibial Fracture Treated by Oblique Wire Bone Transport (Vol. 1)
Case 7: A 12 cm Traumatic Femoral Defect Treated with a Long Oblique Diaphyseal Femoral Osteotomy and Lengthening Over a Nail (Vol. 2)

References and Suggested Reading

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