

Management of Large Infected Bone Defects around the Ankle with Bone Transport over a Retrograde Nail

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Background

Ankle fusion is a good treatment for complex pathology around the ankle¹. However, both trauma and infection can create large bone defects making fusion difficult to achieve². We describe two cases with large infected defects around the ankle, managed with a novel technique.

Case One

A 64 year old woman had a total ankle arthroplasty for generative arthritis in 2013. It functioned well for 9 years. In 2022, she presented with a large abscess over the dorsum of the foot, loss of ankle movement, pyrexia and nausea. The abscess was drained and fluid plus tissue samples were sent for microbiology culture. The abscess communicated with the ankle implant which was loose in very soft tibial bone, confirming a late acute prosthetic joint infection.

Cultures grew *Staph. aureus*, treated with IV Vancomycin. She was then referred to the Oxford BIU after 10 days of therapy.

At referral, she was systemically well with a lot of pain in the ankle and a discharging wound (Fig 1). Plain x-ray showed the loose implant with osteopenic bone (Fig 2). Treatment options were discussed and she opted for removal of the loose infected prosthesis and ankle fusion.

At surgery, the loose implant was removed with 5.2cm of grossly infected dead bone. The fibula was preserved.

Five deep samples were taken and empiric antibiotics given. An Ilizarov frame was applied to allow bone transport. A retrograde tibial nail was passed through 10mls Cerament G*, injected into the calcaneum to coat the nail and protect it from colonisation³.



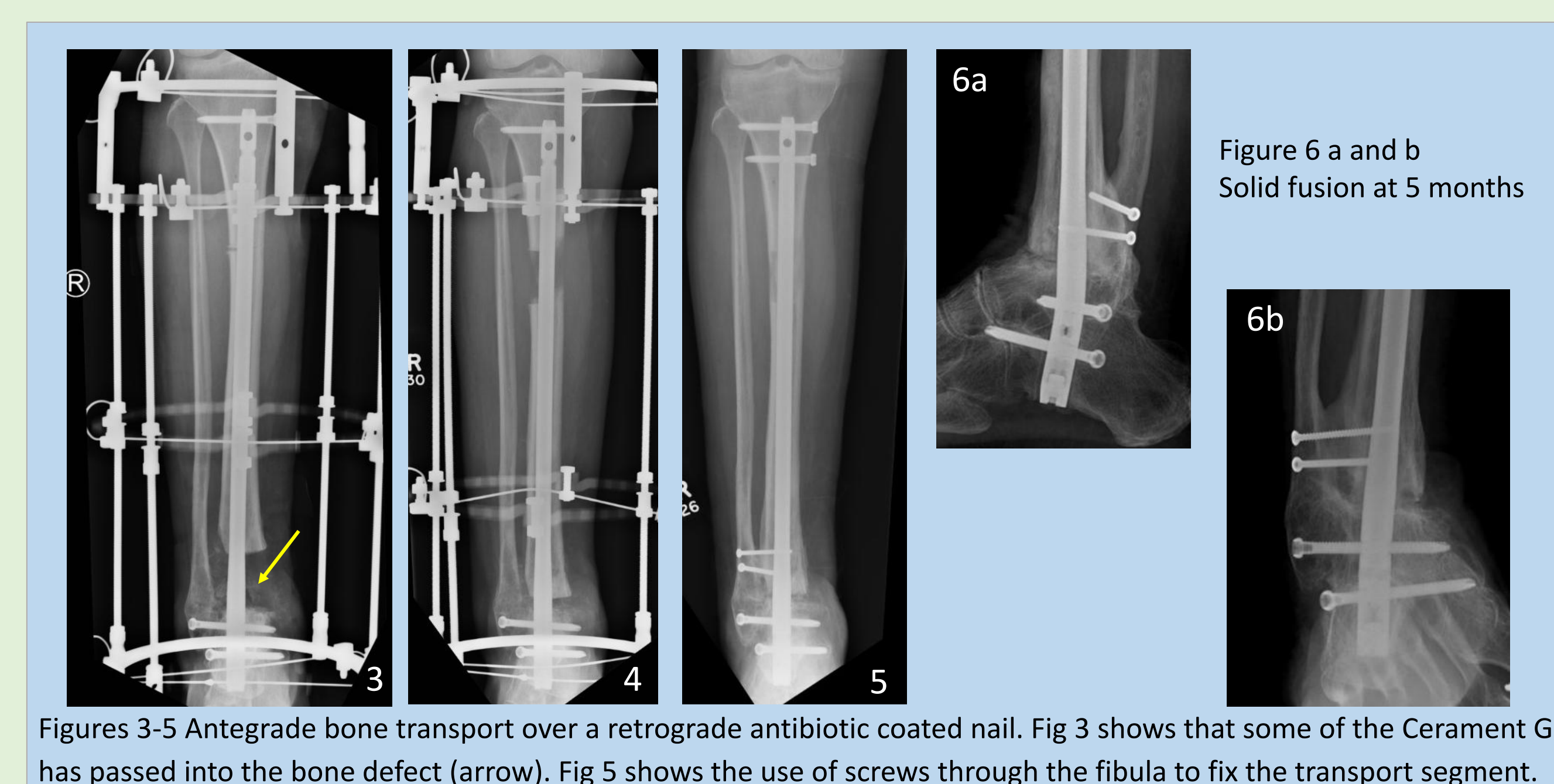
Figures 1 and 2 Initial presentation

A corticotomy was created in the upper tibia and the central segment transported at 1mm/day (Fig 3).

Cultures grew *Staph. aureus* and *Pasteurella canis*, treated with oral antibiotics for 6 weeks.

After 54 days, the docking site was secured with 2 screws through the fibula and the frame removed (Figs 3-5). Total frame time was 61 days. The tibial regenerate and ankle fusion consolidated over 3 months.

At 39 months, she was infection-free and united (Fig 6a & b). Her only symptom was mild mid-foot discomfort. She walked up to 3km with a simple in-shoe heel cushion only.



Figures 3-5 Antegrade bone transport over a retrograde antibiotic coated nail. Fig 3 shows that some of the Cerament G has passed into the bone defect (arrow). Fig 5 shows the use of screws through the fibula to fix the transport segment.

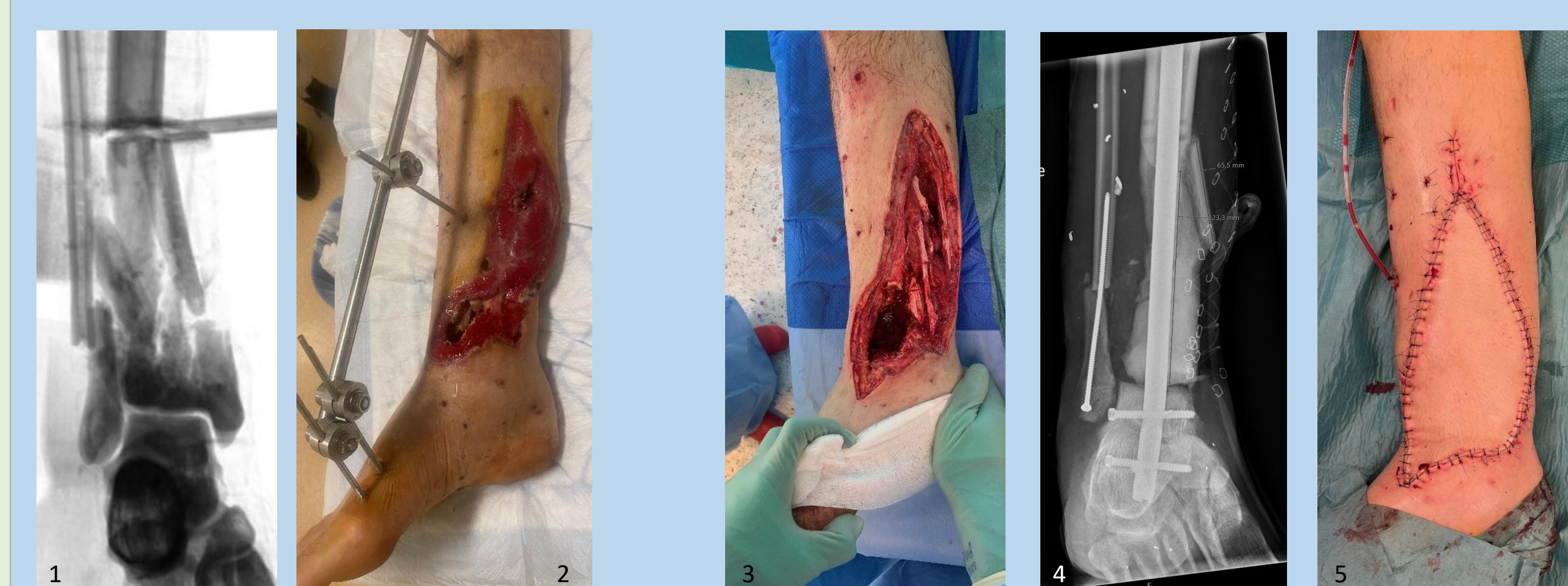
Discussion

Many techniques have been described to manage bone loss around the ankle, but all have major complications and involve prolonged time in treatment. These cases illustrate a reliable technique for this very difficult problem, with acceptable treatment times. Full weight-bearing can be allowed once the heel wound from nail insertion is healed. It can be performed as a single stage procedure, as in case one, but we recommend coating the nail in local antibiotics to reduce the risk of recurrent infection.

Case Two

A 32 year old man sustained a blast injury to both lower limbs while serving in the Ukrainian armed forces. He was evacuated to Norway 3 weeks after injury. At presentation, he had severe open fractures with bone and soft tissue loss in the right distal tibia (Fig 1). He was otherwise well but smoked 30 cigarettes/day.

Initial treatment was with debridement, deep sampling, empiric local and systemic antibiotics and external fixation (Fig 2). Cultures grew multi-resistant polymicrobial bacteria from the initial debridement and fungus from the last debridement.



Figures 1 and 2. Appearance upon arrival

Figs 3-5 Excision, insertion of PMMA spacer, IM nail and ALT flap

The first step of definitive treatment was insertion of a hindfoot nail and defect filling with a temporary PMMA spacer, performed 25 days after the initial debridement. The wound was closed with a free antero-lateral thigh flap (ALT) (Figs 3-5). Six weeks later, the spacer was removed, the IM nail exchanged to a retrograde tibial nail and a bone transport frame was applied (Fig 6). Transport progressed at 1mm/day after an 8 day latent period, to fill the 8cm defect. At 130 days, the ankle arthrodesis was performed with a plate, autologous bone graft and BMP-2 (Figs 7-10).

Antibacterial therapy was given for a total of 11 weeks and antifungals for 1 year. However, resampling at the time of ankle arthrodesis revealed a Coagulase-negative staphylococcus requiring an additional 12 weeks of antibiotic therapy.

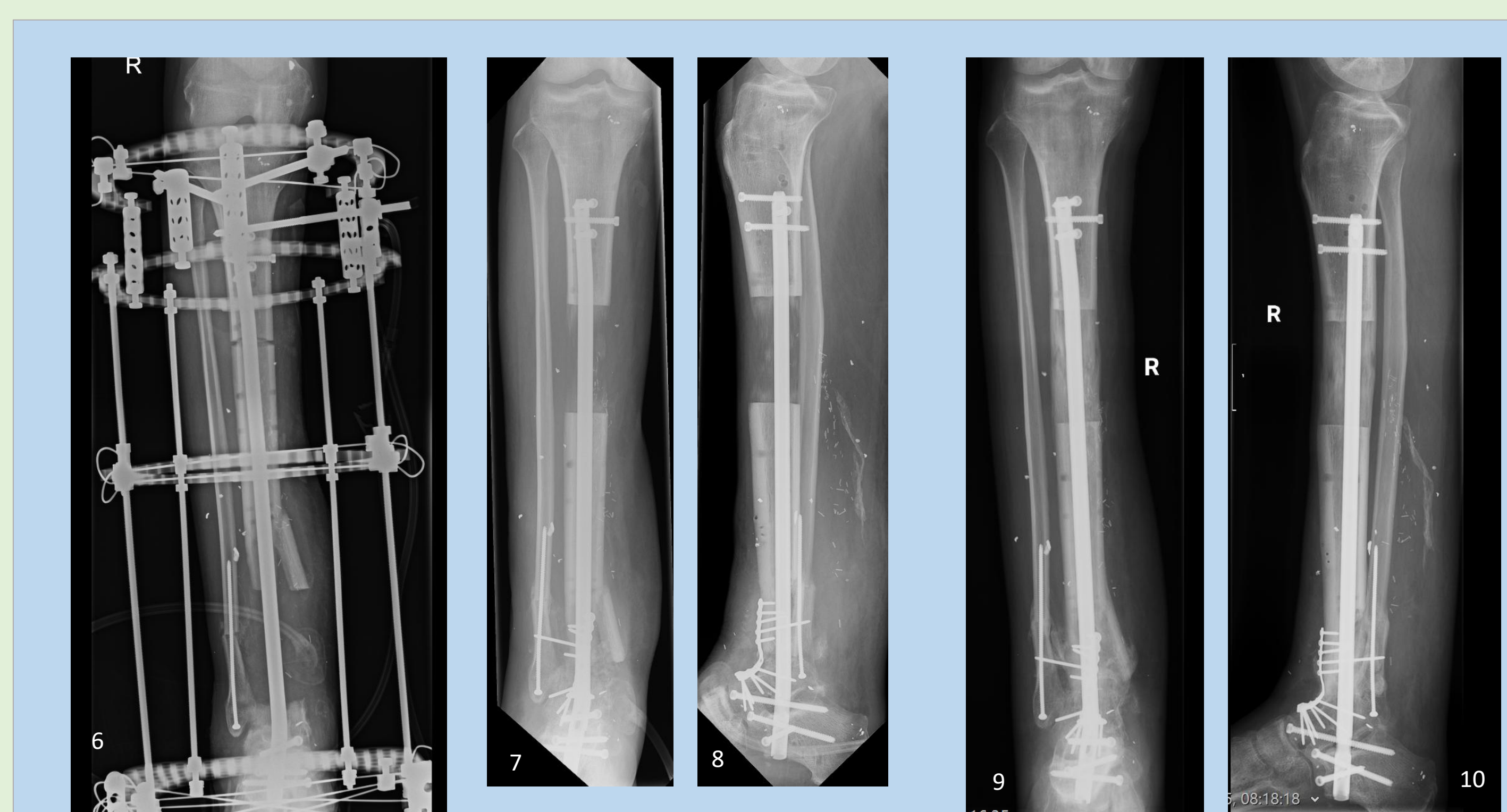


Fig 6 Transport over a retrograde nail

Figs 7 and 8 Arthrodesis after transport

Figs 9 and 10 6 months later with well consolidated fusion and regenerate

Six months after ankle arthrodesis, the patient is fully weight-bearing with walking distance up to 4-5km. He remains infection-free.

Conclusion

Bone transport to ankle fusion gave good clinical outcome in these severe infections with bone and soft tissue loss of the distal tibia even in the setting of multi-resistant microbes. It is probably an advantage to avoid delay from initial debridement to definitive treatment due to risk of infection evolution.

References

1. Kugan R, et al. *J Bone Joint Surg[Br]* 2013; 95-B: 371-377.
2. Gross C, et al. *Foot & Ankle Specialist* 2015;8(2): 143-151.
3. Pomeroy E, et al. *J Ortho Sci Res.* 2024; 5(1): 1-7.

* Cerament with Gentamicin, Bonesupport AB, Lund, Sweden