



The Avascular Proximal Pole Nonunion: is there a role for core decompression and biophysical treatment in bone union?

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INTRODUCTION

There is still no consensus on definition of **avascular necrosis of the proximal pole**. Many optimal means to determine vascular supply have been described, X-ray, CT, MRI, histology or bleeding points at surgery, even if the absence of proximal pole bleeding seems to be the main diagnostic element for a true vascular impairment. In the literature, we find acceptable union rates in fixing the proximal pole with a **non-vascularized bone graft (NVBG)** from iliac crest even in the presence of poor or absent vascular supply.

Moreover, success of scaphoid non union surgery has been recently shown to be **independent of proximal pole vascularity**, because of the presence of trabecular viability with tissue viability capable of remodeling activity. If the scaphoid non union is properly stabilized together with fresh non-vascularized graft from radius and rigid fixation, the vascularized bone graft is seldom required to get union.

Generally, NVBG may be preferred as it is less technically demanding, and the compression exercised by a Herbert-type screw fixation is capable of compensating for the greater biological stimulus of the **vascularized bone graft (VBG)**, but which is otherwise more fragile, mostly fixed with Kirschner wires so producing a less stable fixation. We always must remind that stable fixation means revascularization of avascular bone through the creeping substitution process.

Moreover, a traditional volar NVBG, that is to say **“Graft what you really need”**, allows an easier anatomical reconstruction, saving more easily partially or completely the volar ligaments, compared to a VBG, which requires a more extensive volar approach, with the tendency to remove more bone than what you really need.

There is a general consensus about the **indications of a VBG**: a truly avascular necrosis in the proximal pole and a secondary reconstruction after failed fixation with NVBG. The most utilized techniques proposed for avascular proximal pole scaphoid reconstruction are dorsal pedicled VBG, volar pedicled VBG and free corticocancellous MFC graft, and for the less common proximal pole replacement are free osteochondral MFC graft, free coracoid graft and free osteochondral rib graft.

Since some years, **arthroscopy** has been proposed for proximal pole nonunion, even with vascular impairment, without bone graft or using a spongius NVBG to fill the emptied PP, with very good results, proving once again that it is stability of fixation, by means of screw or Kirschner wires, which creates the conditions for the revascularization of the proximal pole.

It is well known that the **metaphyseal core decompression** of the distal radius can incite hyperaemia and, more recently underlined, can stimulate regional bone regeneration factors, such as the Bone Morphogenetic Protein-2 (BMP-2) to accelerate revascularization of a necrotic lunate and this approach has been proposed for avascular proximal pole non union (APPN), even without grafting.

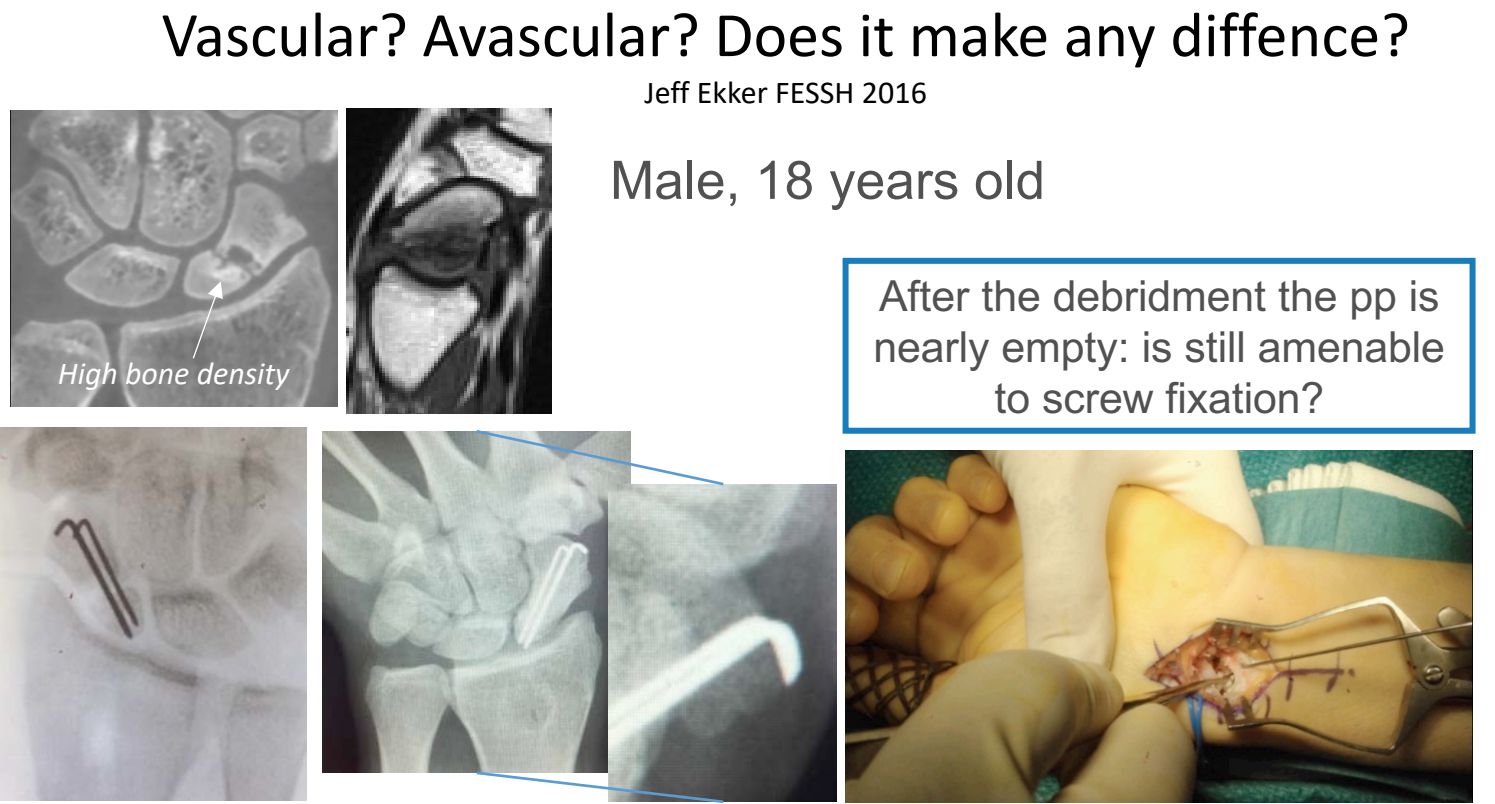
Even the biophysical treatment with physical stimuli has been recognized to be able to stimulate BMP-2 and to enhance bone healing in Avascular Necrosis of the Femoral Head in combination with Core Decompression, and the great advantage of this tool can be applied very early during the first period of immobilization.

OBJECTIVE

Evaluate an alternative treatment to Vascularized Bone Grafts (VBGs) in Avascular Proximal Pole Nonunions (APPN) using a stable fixation and radius bone graft harvested with Illarramendi core decompression concept, in association to Biophysical Stimulation for promoting bone regenerator factors.

METHODS

13 patients, between 18 and 30 years, with APPN confirmed at surgery by the absence of bleeding points, with obvious need for volar grafting detected by CTCTB, has been treated through a mini-invasive volar approach, characterized by: -a volar NVBG, spongius or corticospongius (only in case of shortening of the bone), harvested from distal radius, producing a metaphyseal core decompression. - a stable fixation by means of an headless screw with a short leading thread, or 2 Kirschner wires, when the proximal pole, after debridment in nearly emptied, making impossible a volar screw fixation. Technical details of Kirschner wires stable application in order to be left in situ even for many years without any functional limitation, are shown. - an early biophysical treatment therapy, for at least 2 months.



RESULTS

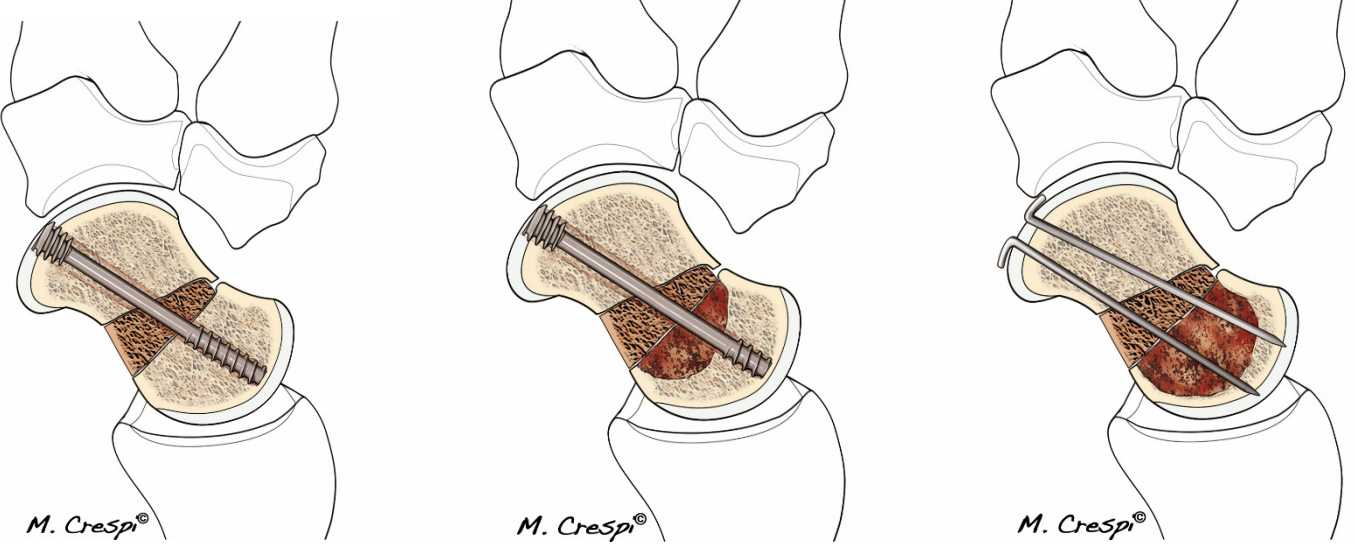


RESULTS

Radiological union was obtained in all patients with obvious proximal pole revascularization, detected by CBCT or MRI, with gadolinium when need, with respect of the morphology of the scaphoid. Optimal ROM recovery was observed, without any functional limitation, even when Kirschner wires is still in place after many years.

CONCLUSIONS

The technical aspects of this approach are similar to the increasingly popular Arthroscopic Bone Graft in APPNs. Performing a stable fixation is easier with mini-open surgery, even with the “evergreen” Kirschner wires, but they must be inserted correctly in order to obtain just as stable fixation as that obtained with the headless screw. In practice, as long as the proximal pole is intact and the cartilage is good it is possible to have its revascularization. Considering the literature concerning this controversial topic, VBG still remains a correct indication in APPN and in secondary reconstruction after failed fixation with NVBG, but it is not an absolute indication.



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