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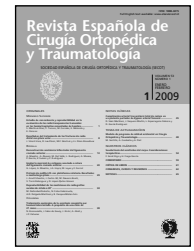

COMMENTARY

Pseudoarthrosis of the carpal scaphoid. Therapeutic considerations

I was very interested to read the paper by Drs. Fernando Seral Iñigo and Hector Fraga García. The study is based on their experiences at the prestigious Rizzoli Institute. The authors review the causes that may contribute to scaphoid pseudoarthrosis and propose a possible solution. The treatment of scaphoid pseudoarthrosis remains a challenge even today. Conservative treatment of scaphoid fractures has a low but persistent rate of pseudoarthrosis (5–12% in scaphoid waist fractures and up to 30% in proximal pole fractures)[1].

The authors review the factors that contribute to scaphoid pseudoarthrosis and identify the mechanical and the biological factors. This reveals the interest of Prof. Fernando Seral in Biomechanics and Basic Science, which he later developed further in his University Chair in Zaragoza. The article underscores the fact that the scaphoid acts as a connector between the first and second carpal rows. Although there are other forces that act at that level (rotation, etc.), the flexion forces are the main ones acting at that level and those that may lead to a flexion deformity with a residual dorsal bump, a common finding in untreated pseudoarthrosis.

Because of its structure, the scaphoid bone usually heals *per primam*. The lack of periarticular soft tissues, the abundance of cartilaginous tissue and the absence of periostium cause healing to be based on the penetration of the cutting cones in order to achieve a bone bridge. The lack of a peripheral fracture callus undermines structural stability vis-à-vis shear and flexion forces during the initial healing stages, which means that micromotion could disrupt the repair process. Prolonged treatment is therefore necessary for the treatment of these fractures.

In this short patient series, the authors use compressive screws in 6 cases and a cortical graft from the ipsilateral radius in 9 cases, with no compression. Their results were good in 10 cases, fair in one and poor in 4, but they do not analyze the possible causes for their failures. These results are comparable with those of subsequent series[2]. The associated lesions understandably overshadow the patients' prognosis and the authors concluye that this type of treatment is not indicated for comminuted fractures or for very small fragments. The natural history of untreated scaphoid fractures is arthritis in 100% of patients at 10 years[3-5].

We currently know that those osteosynthesis methods that can withstand shear and flexion stresses will obtain the best results. Bone grafting, Kirschner wires and intramedullary implants have been used. Mc Laughlin spread the use of screws as an osteosynthesis device and, in 1962, von R. Steli introduced percutaneous osteosynthesis. The current attitude with regard to bone grafts is to supplement them with some type of fixation device, although in some cases this may be technically challenging. The choice of the graft will depend on the type of pseudoarthrosis —stable or unstable—, although it seems that osteosynthesis is beneficial to all patients[6]. Some authors think that incorporation of tricortical bone is slow[7]. Ideally, the implant to be used should obtain interfragmentary compression, it should be as long as possible and it should be placed at the center of the scaphoid bone in order to more efficiently withstand deformation[8]. The use of cannulated implants can facilitate placement even more. In some selected cases with little perilesional sclerosis it is possible to apply the bone percutaneously. In case of deformity, the use of strut grafts is the most advisable option. In cases of proximal pole ischemia, it is essential to determine if such a condition is temporary or permanent. In cases of temporary ischemia, obtaining a rigid osteosynthesis will solve the problem. If the ischemia is permanent, obtaining a vascularized graft is probably the most appropriate option; the graft may be based on Zaidemberg's artery[9] or on flaps that include a part of the pronator quadratus.

In cases of comminuted fractures or in proximal pole injuries, some authors inhibit midcarpal mobility by means of a K-wire or a screw either between the distal pole and the capitate or between the hamate and the lunate; the screw is removed once healing can be ascertained through the bone defect. This additional fixation is necessary to inhibit mobility between the 2 carpal rows and ease stresses on the repaired area[10]. It should be said that in proximal pole injuries it is more favourable, from the biomechanical point of view, to introduce the screw from proximal to distal but even if this is done we may on some occasions find that only 2 or 3 turns of the thread engage with the proximal fragment, which undermines the stability of the osteosynthesis.

A styloidectomy should nowadays be reserved for the early stages of a SNAC *(scaphoid non-union advanced collapse)* wrist, characterized by minor degenerative changes that usually result in the sharpening of the tip of the scaphoid. The extent of such a styloidectomy is a moot point, but it is possible to resect up to 1 cm without

significant mechanical consequences. Currently, it is possible to carry out a styloidectomy safely through an arthroscopic approach[11]. Other options for pseudoarthroses with initial SLAC changes include a partial distal scaphectomy, a "four corner" arthrodesis, a proximal row carpectomy or a radiocarpal arthrodesis. An analysis of these options is beyond the scope of this paper.

Successful treatment of scaphoid pseudoarthrosis is based on early detection of acute injuries since this enhances their healing potential[2]. Minimally invasive techniques, which currently allow the application of bone grafts and the use of arthroscopy to evaluate the viability of the proximal pole and determine the best treatment of concomitant lesions[7], will probably help reduce the morbidity associated with the procedure and improve current results. Computer-assisted navigation is already being tested for scaphoid screw placement. Appropriately designed studies are needed to determine whether these new modifications go beyond the principles laid down in the classic paper by Drs. Seral and Fraga García.

References

1. Clay NR, Dias JJ, Costigan PS, Gregg PJ, Barton NJ. Need the thumb be immobilised in scaphoid fractures? A randomised prospective trial. J Bone Joint Surg Br. 1991;73:828-32.
2. Merrell GA, Wolfe SW, Slade JF. III: Treatment of scaphoid nonunions: quantitative meta-analysis of the literature. J Hand Surg. 2002;27A:685-91.
3. Dias JJ, Brenkel U, Finlay DBL. Patterns of union in fractures of the waist of the scaphoid. J Bone Joint Surg Br. 1989;71:307-310.
4. Lindström G, Nyström A. Natural history of scaphoid non-union, with special reference to "asymptomatic" cases. J Hand Surg Br. 1992;17:697-700.
5. Ruby LK, Stinson J. Belsky MR. The natural history of scaphoid non-union. A review of fifty-five cases. J Bone Joint Surg Am. 1985;67:428-32.
6. Munk B, Larsen CF. Bone grafting the scaphoid nonunion. Acta Orthop Scand. 2004;75:618-29.
7. Slade JF, Geissler WB, Gutow AP, Merrell GA. Percutaneous internal fixation of selected scaphoid nonunions with an arthroscopically assisted dorsal approach. J Bone Joint Surg Am. 2003;85-A:20-32.
8. McCallister WV, Knight J, Kaliappan R, Trumble TE. Central placement of the screw in simulated fractures of the scaphoid waist: a biomechanical study. J Bone Joint Surg Am. 2003;85-A:72-7.
9. Zaidemberg C, Siebert JW, Angrigiani C. A new vascularized bone graft for scaphoid nonunion. J Hand Surg Am. 1991;16:474-8.
10. Stern PJ, Markiewitz AD. Current perspectives in the management of scaphoid nonunions. Instr Course Lect. 2005; 54:99-113.
11. Yao J, Osterman AL. Arthroscopic techniques for wrist arthritis (radial styloidectomy and proximal pole hamate excisions). Hand Clin. 2005;21:519-26.

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