Mid-term outcomes of scaphoid nonunion surgery
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Backgrounds
The management of scaphoid non-union represents a challenge that can lead to wrist functional impairment and radiologic degenerative changes if neglected. Several techniques have been proposed for scaphoid non-union, but the ideal treatment remains a controversy.

Objectives
The purpose of this study was to assess functional and radiological outcomes of scaphoid nonunion surgery in a series of 32 patients treated by 3 different procedures: non-vascularized bone grafting from iliac crest, vascularized bone grafts from the distal radius and percutaneous pinning.

Methods
Between 2010 and 2015, 42 consecutive patients, all males, were operated for scaphoid non-union. Results were collated and analyzed in a retrospective manner. According to surgeon preference, the operative procedure was selected. Wrist motion was measured pre and post-operatively. Wrist radiographs served to confirm and classify the non-union, and to evaluate the level of osteoarthritis and the carpe alignment. Final functional results were assessed using modified Mayo wrist score at latest follow-up visit.

Results
The mean patient age at surgery was 29 years old. Twenty-five injuries involved the dominant wrist (78%). The mean interval between non-union diagnosis and surgery was 10 months and the mean follow-up period was 49 months. Twenty-seven cases of nonunion were located at the middle third of the scaphoid. We noted 11 cases of Dorsal Intercalated Segment Instability (DISI). Thirteen patients presented advanced arthritis changes.

After surgery, 69% patients reported satisfaction. The mean modified Mayo Wrist score was 81. Vascularized bone grafting was associated with non significantly higher arthritis score ($p=0.52$).

The mean scapholate angle decreased significantly from 62° to 55° ($p<0.01$). Revision was necessary in 7 cases (16.7%). Percutaneous pinning was associated non significantly with the highest rate of revision surgery.

Discussion
Despite many reports, there is currently no consensus as to the best form of management of scaphoid nonunion. In this paper we noted a higher likelihood of union in non smoking patients. Same findings were reported by Little 1 and Waitayawinyu 2. Smoking habit seems to be a systematic factor that may delay union of scaphoid. In our series, the relationship between the time to surgery and the development of arthritis was interesting to assess. Longstanding nonunion had more arthritic changes and may affect the functional outcomes in the long term. This has been reported in other studies as well. 3

The main finding of our study is the significant higher rate of union with vascularized bone grafting compared to other procedures. In a systematic review, Pinder 4 reported 92% union rate with the use of vascularized bone grafting compared to 88% with non-vascularized bone graft. Considering the fact that the vascularized bone grafts were used for complex nonunion with bone loss, proximal pole avascular necrosis and humpback deformity, he concluded that this may have skewed the results in favor of non-vascularized grafts.

Conclusions
Using an appropriate surgical technique, suitable fixation devices, and a careful immobilization protocol, successful outcomes can be achieved. According to our study, union likelihood seems to be enhanced in early diagnosed non-smoker patients, in the absence of advanced arthritis and instable nonunion and every time we used vascularized bone grafting.

References