



Surgical Treatment of Scaphoid Non-Unions

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ABSTRACT

Scaphoid fracture, untreated or badly treated, progresses to non-union. The treatment of scaphoid non-union is surgical. This work aims to discuss and analyze different techniques used in the treatment of scaphoid non-unions and their functional outcomes. Our study focuses on fifteen observations collected of scaphoid non-union in the Rabat Ibn Sina Hospital's department of traumatology-orthopaedic, over a period of six years (2007-2012). The analysis focused on the epidemiological, clinical, radiological data, surgical techniques and post-operative evaluation. The average age is 30 years, with a male predominance. One third of patients are manual workers, the dominant hand is affected in 67% of cases. The average trauma - treatment delay is 50.1 months. All patients presented pain and functional impairment with decreased range of motion. The X-ray made in all patients found, according to the classification of Alnot, 40% stage IIA, stage IIB 46.6%, 6.7% stage IIIB and stage IV 6.7% other. Most of our patients (13 out 15 cases) were treated by the Matti Russe operation, the iliac graft was in 11 cases, and radial in 2 cases. Resection of the first carpal row was performed in 2 cases. The evolution was marked by the disappearance of pain in 12 patients and improvements of motion in 10 patients. The Matti Russe operation is an excellent technique for treatment of scaphoid non-union without necrosis or osteoarthritis, this technique gives good functional results. However, only early diagnosis and adequate treatment of scaphoid fracture before non-union can recover normal mobility and avoid aftermaths.

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Introduction

Fractures of the scaphoid represent 70 to 80% of carpal injuries. In order of frequency, scaphoid fracture occurs immediately after fracture of the distal radius. The discretion of the initial symptoms and rapid resolution are that they are still today often detected and treated late despite the increasing improvement of imaging methods. The particular shape of the scaphoid and deep conditions make it difficult to analyze radiographs. (1, 2) nonunion of the scaphoid bone is defined as non-union of a fracture of the scaphoid treated or not, after 6 to 8 months, with the finding of particular radiological appearance suggesting the impossibility of consolidation and despite the continuation of an asset the natural history of scaphoid nonunion is inexorably toward the development of degenerative wrist. The treatment of scaphoid nonunions is not unique and may use different techniques, particulars of which are based on the site of the initial fracture and the existence or not of a misalignment, osteoarthritis, or a necrosis. The aim of our study is to determine and analyze through a retrospective study of 15 cases received and treated at the hospital trauma-orthopedics service ibn sina in rabat over 6 years, between 2007 and 2012 , epidemiological, diagnostic and therapeutic aspects of scaphoid nonunions. His interest is to relate the experience of service in the management of these fractures, to compare our results with those of other series, and analyzing the results of different therapeutic methods.

Material and method

A retrospective consecutive series of 15 patients treated in the trauma-orthopedic service at the ibn sina hospital in rabat for scaphoid nonunion between 2007 and 2012 was evaluate.l'evaluation postoperative, However, the average is 2.5 cases per an.l'age our patients is between 21 and 39 years. The average age of our series is 30 years. In our series, all of our 15

patients were male, the male is very clear. 5 of 15 patients are manual workers. The right side was achieved in 9 cases, the left side in 6 cases; the dominant side was achieved in 10 cases, or 67% of cases. In our series, all patients reported a notion of an old trauma. As to the time between the initial trauma and nonunion treatment, 7 of 15 patients reported trauma wrist less than a year earlier, 67%, 5 of them report a period of 1 year and 10 years and the remaining 3 reported a delay of more than 10 years. The average time between the initial trauma and the treatment of nonunion was 50.1 months. In our series, 6 patients received treatment following initial trauma; there is a tenderness of the outer edge of the wrist achieved in all patients, particularly during palpation of the snuffbox anatomique. par addition, 11 of 15 patients in our series show a decreased mobility of the wrist, 75% of cas.tous patients in our series underwent a standard radiography, with implications for front, side and a picture of schneck. These images allow staging of scaphoid nonunion according to the classification of alnot:

As regards the classification of schernberg et al. ; found 2 cases of 6 cases of nonunion of the scaphoid with stage iia related type ii schernberg et al. 3 cases of type iii and type iv 1 case. For cases of nonunion of the scaphoid stage iib, there are 2 cases with stroke type ii schernberg et al. 4 cases of type iii and type iv 1 case. In our series, one patient underwent ct in the assessment of the lesions and to indicate the resection of the first row of the carpus. The ct showed lodwik type ib osteolysis of the bone hook associated with nonunion of the scaphoid. In our series, all cases of nonunion of the scaphoid received surgical treatment.

The intervention of matti-russe was performed in most cases, 11 cases of the 15 patients operated. Two patients

Underwent resection of the 1st row of the carpus, the other two have benefited from the intervention of matti-russe modified with graft from the radial styloid. In our series, 11 patients have benefited from the matti-russe technique that involves the establishment of a cortico-cancellous graft from the iliac crest between the two fragments of the scaphoid after freshening the banks of these, 2 others patients benefited from the technique of modified matti-russe which differs from the technique matti-russe by the nature of the graft from the radial styloid. In the other two cases, the resection of the first row of the carpus was put to the associated lesion of the hamate in case number 15 and necrosis of the scaphoid in the case number 8. In our series, all patients operated benefited from a fixation with pins or screws. In our series, the asset is by headline plastered by brachiocephalic antebrachio-volar plaster splint or earlier.

Average hospital stay: 2.4 days (between 1 and 4 days) average down time: 31.4 days (between 21 days and 2 months) no immediate postoperative complication was noted. Postoperative monitoring is based on clinical and radiological images at 6 weeks, 3 months, 6 months and 1 year of surgery. Thus, it is based on the score michon mayo wrist score and for post operative clinical evaluation. Michon score: pain, noting the disappearance of pain in 12 patients, or 80% of cases, the other 3 patients showed a slight pain. The magnitude and strength: we note the improvement in range and strength in 67% of patients. l'evaluation according to the mayo wrist score displays the following results: excellent: in 2 cases. Good: in 11 cases. Middle: in 2 cases. Radiologically, there has been consolidation between 3 months and 6 months in all patients operated on using the technique of matti-russe or technique of matti-russe amended, and the decrease in carpal height for the 2 patients who underwent resection of the first row of the carpus.

Discussion

Nonunion of the scaphoid mainly concerns the young. Thus, the average age of our patients is 30.13 years between 21 and 39 years, which is comparable to the series bellec and alnot (2008) where the age is on average 29 years old, and slightly higher the mean age of the series of lenoir (2011) that in 26 years at the time of the intervention. (7, 8, 9). Thus, all of our patients are male. There are also a male in the series of bellec and alnot (2008) with 87.2% of men, and in the series of lenoir (2011) with 92% men. The male predominance could be attributed to the frequent exposure of humans to work accidents and sports. (7, 8, 9). In our series, 33.33% of patients are manual workers, which is comparable to the series of bellec and alnot (2008) with 40% and less than 48% of manual workers found in the series of lenoir (2011). (7). In our series, the dominant side is achieved in 67% of cases. Slightly higher than the average found in the series of bellec and alnot (2008) with 53% and comparable to the average found in the series of jessu (2008) with 60% reaching the dominant side. (7, 9). In our series, the average time between the initial trauma and the treatment of nonunion was 46.7 months between 6 and 192 months, which is above the average found in the time series of bellec and alnot (2008), of 34.6 months, between 3 and 144 months, but significantly higher than the average time found in the series of lenoir (2011) which is of 18 months, between 2 and 84 months. (7, 8). In our series, 40% of patients received treatment during the initial trauma, this is close to the average found in the series of bellec and alnot (2008) is 32%. (7). Nonunion of the scaphoid can be revealed by symptoms such as chronic pain in the wrist, or functional impairment, as it may be asymptomatic incidental findings. In our series, all patients had wrist pain or worsening of chronic pain, which is higher than the average found in the series of

bellec and alnot (2008), which is 76.5%. Furthermore, 67% of patients complain of functional impairment, and 60% of stiffness. With months and years, the wrist gradually loses strength and range of motion. The pain majorem and become debilitating. This is the onset of osteoarthritis, which marks the end of the evolution of this pathology. (7, 8, 9, 10). The examination of the wrist reveals external wrist pain to palpation of the anatomical snuffbox, loss of mobility and strength. Thus, there is pain in the wrist palpation in all patients. (4, 7, 8, 9, 10). In our series, there is a deficit of flexion / extension in 40% of patients, 33% deficit of the movements of pronation and supination, and 13% suffer from a deficit of radial / ulnar deviation movements. This limitation of range of motion is due to osteoarthritis of the wrist. (10) the radiological assessment typically includes radiographs of the front and side wrist. The scanner allows precise study of nonunion and deformation of the scaphoid, while mri is used to evaluate the blood supply to the bone, which is sometimes affected by the fracture. Arthrography allows, in addition to the study of the bone, to assess the quality of the articular surfaces and ligaments. Ct arthrography allows cuts in the three spatial planes (coronal, sagittal, axial) for better ligament and cartilage assessment, and occult fractures. (17, 18, 19) arthroscopy is both a diagnostic and therapeutic tool for wrist pathology. This examination is performed under regional anesthesia of the upper limb, the operating room, outpatient hospitalization. Arthroscopy of the wrist that was popularized by whipple in 1986, has become a routine examination. The patient is supine under tourniquet, the arm is laid flat on an arm table to which it is attached. The elbow is bent at 90 °. The forearm is pulled into the shaft with a "japanese" hand. The patients were operated on under local anesthesia and tourniquet outpatient surgery. The arthroscope is inserted through an inlet 3-4 radiocarpal allowing exploration of the joint. A 6r radio carpal input allows the treatment of lesions encountered and ulnar-lunar conflict. (20, 21, 22, 23) an optical 2.7 mm and the number of usual ancillary instruments (hooks, palpateurs, prehensile grippers, shavers, etc.) Is enough to achieve an endoscopy wrist. The examination is performed on distraction turn to explore both the radiocarpal joint, medial carpal and distal radioulnar. All intra-articular structures (bone, cartilage, ligament) are accessible. The surgical approach consists of simple skin speckles, allowing the introduction of optics and ancillary instruments, these gateways avoid tendon and neurovascular structures. (20, 21, 22, 23, 24, 25) in our series, no patient received arthroscopy. The magnetic resonance imaging is used to study the soft parts more accurately, search osteonecrosis (evaluation of the vitality of the lunate and scaphoid), a tendon defect or fracture radiographically occult. It prefers arthrography in the study of ligament and cartilage injuries of the wrist. (19, 26, 27, 28, 29) it enables the diagnosis of scaphoid nonunion in patients with standard radiographs was not possible to make the diagnosis. Especially scintigraphy has a negative predictive value because it lacks specificity. (15, 27)

Anterior approach

This approach was advocated by russian (1960) for bone grafting technique to reduce the risk of injury to the vascular supply of the scaphoid. To carry out this route, the forearm is placed supine, the skin incision is longitudinal length of 3cm, located at the trough of the pulse outside of the terrain of the flexor carpi radialis tendon. The incision can be extended either by an external distal hook to the tubercle of the scaphoid or by an internal hook for enlarging the incision opening the carpal tunnel. (30, 31, 32). First, we identify the radial artery and the tendon of the flexor carpi. After freeing the superficial fascia, the

wrist is flexed thereby release the tendon tension. We carefully recline the radial artery and external tendon of flexor carpi within. Can then address satisfactorily the entire anterior surface of the radius and carpus. The preparation of the scaphoid: before taking the graft is prepared scaphoid in order to determine the size of the defect. After putting a field rolled under the wrist to put in extension and ulnar deviation, the anterior capsule is opened next to the scaphoid between the front edge of the radius and the distal tubercle of the scaphoid. Nonunion area is often the site of a bone defect. According to its importance there is sometimes a vicious attitude of the scaphoid flexion. The reduction of the scaphoid is done with a chisel placed between the 2 scaphoid fragments and asking help to achieve traction in the axis of the thumb. The very existence of this loss of past substance justifies the anterior approach to repair the scaphoid. In case of significant loss of substance, it may be necessary to maintain the reduction in the use of temporary pin one placed between the proximal pole and the lunate, and the other between the distal tubercle and the large bones. The actual area is curetted nonunion. To enable the consolidation it is possible to make small holes with a pin 10. Once the loan scaphoid, it can be worn on the front of the radius in order to raise the graft. (30, 31, 32, 33, 34)



Figure 1. Cliche de face d'un de nos patients montrant une pseudarthrose du scaphoïde stade iia avec trait de type ii



Figure 2 . voie d'abord anterieure

Cortico-cancellous graft avascular matti-russe technique

The treatment of scaphoid nonunions is not unique and may use different techniques, particulars of which are based on the site of the initial fracture and the existence or not of a misalignment, osteoarthritis, or a necrosis. The principle of treatment of nonunion of the scaphoid bone graft in 1928,

attributed to adams. In 1936, matti suggested the removal of cancellous grafts to the greater trochanter and interpose between the two fragments of the scaphoid dorsally. It was not until 1960 that russian, while remaining faithful to the cancellous grafts taken at the iliac crest, called the anterior approach. Then verdan and narakas in 1968 and fisk en1970 and mehdi 1979 (vault shaped cavity) modified intervention matti russian, using either cancellous graft but corticocancellous, interlocked by the anterior route into the scaphoid so as to restore the height of the latter in case of previous kinking. (5, 37, 38) the corticocancellous graft is either of the radial styloid either of the iliac crest. When the cortico-cancellous graft is harvested from the iliac crest, a general anesthesia is required. Thus, in our series, the eleven cases with iliac graft was received general anesthesia. An anterior approach is performed. Then, after longitudinal capsulotomy, the trait pseudarthrosis is highlighted by placing the wrist in hyperextension. In tight nonunion, intramuscular needle for the type of nonunion home is helpful. A rectangular window straddles the line nonunion, is bounded by the technique of "postage stamp" (the anterior cortical perforation of the scaphoid using a thin pin mounted engine); this window is then cut using a narrow osteotome. The scaphoid is excavated using small sharp curettes and fine bone forceps. (5, 37, 38) the strength of the proximal fragment of the scaphoid should be assessed by checking its bleeding after dropping the withers (recommended by green) or mri (trumble). A standard radiography, a simple condensation can be reversible, and is neither sensitive nor specific for bone necrosis. Only the total and old necrosis of the proximal fragment renders illusory the scaphoid bone grafts. The cortico-cancellous graft is taken from the peak or the radial styloid. In our series, an iliac graft was used in 73% of cases, while it was used in 100% of cases in the series of bellec and alnot (2008), while the percentage was 44% in the series of lenoir (2011). The radial sampling would avoid practicing an additional incision iliac, radial styloid being accessible to the surgical approach. As to the iliac crest, on the one hand it has a spongy tissue better and more abundant for easy removal, and secondly, the levy to the level possible to avoid traumatizing the advantage wrist area on the occasion of a levy at the radial styloid. (7, 8) the graft is cut so as to be able to fit perfectly between the proximal and distal fragments, positioning the cortical forward. Small cancellous chips complete filling of the scaphoid. This set is stabilized by the introduction of two thin axial pin, introduced by the tubercle of the scaphoid and fixed in the proximal fragment. Then, the length and placement of pins, the lunate position and height of the scaphoid are verified by radiography or fluoroscopy. (5, 35, 37, 38) finally, the wound is closed layer by layer without forgetting the establishment of a suction drain. Capsular suture made with wire slow resorption. The scaphoïdiennes pin (and possibly radio-lunar) are bent and positioned so as not to cause cutaneous or tendon injury. (35) a brachiocephalic antebrachio-volar splint is crafted. It is kept until the removal of the drainage, and a circular plaster is introduced (or a resin column taking the thumb until the inter-phalangeal joint). The eventual lunar radio pin is removed about six weeks. A cuff is then placed until bone healing. (35) in our series, downtime was on average 31.4 days (from 21 days to 2 months), whereas in the series bellec and alnot duration is on average three months. Cortico-cancellous graft matti-russe is recommended before the stage osteoarthritis. It aims to establish a bridge between the two bone fragments of the scaphoid and maintain its height, to restore carpal anatomy, thus avoiding a move towards intra-carpal arthrosis. In our series, 13 cases of the 15 patients received the intervention

matti-russe. The other two cases received resection of the first row of the carpal scaphoid necrosis seen in the first and the lesion of bone associated hooked in the second. In the series of bellec and alnot (2008), for stages iia, according to the score of michon, found 23% of excellent results, 55% good and 8% average, which is close to the results in our series; 13% excellent, 74% good and 13% average.



Figure 3. Image radiologique post opératoire d'un patient de notre série

Mobilities in the range of bellec and alnot (2008) were normal in 26% of cases, which is close to the 33% recorded in our series, but with a decrease in all amplitudes compared contralateral side (the extension, flexion, ulnar and radial deviation). Grip strength and thumb-index also improved clamp. Regarding postoperative pain, its disappearance is noted in 80% of cases in our series, which is close to the 82% recorded in the series bellec and alnot (2008). The intervention of matti-russe provides satisfactory functional results. It helped to improve post operative pain and score michon. Stiffness and decreased grip strength and thumb-index clamp remain acceptable. These results are better in the absence of pen-scapoid osteoarthritis. It provides good consolidation. If the consolidation fails, a second transplant may be considered. In this case, the realization of a vascular graft will envisagee. The height restoration of the scaphoid and the correction of intra-carpal malalignment are guarantors of good long-term functional outcome. They are obtained more easily in the case of pseudoarthrosis which are not accompanied by pen-scapoid osteoarthritis. Thus, in the series of bellec and alnot (2008), the restoration of the height of the scaphoid and correcting the misalignment is not sufficient in 21.3% of cases where a pen osteoarthritis was associated with scaphoid nonunion scaphoid. Besides these good results in terms of consolidation, few complications have been reported in the literature: idou et al reported a case of reflex sympathetic dystrophy, herbert et al a case of superficial infection and two cases of injuries the palmar cutaneous branch of the median nerve. Carpentier et al report eight cases of pain in contact with a belt on the iliac crest and hypoesthesia 14 at this level. (59, 60, 61).

Conclusion

Treatment of nonunion of the scaphoid includes several surgical techniques including the indication depends on the stage. Thus, before the stage osteoarthritis or necrosis, and absence of associated injuries, we advocate a cure. Vascularized bone graft or not technical (this series in this case) give satisfactory results both symptomatic and functional. Palliative treatment will be put on the stage of osteoarthritis, in the case of necrosis or other bone lesions associated carp.

In these cases, the resection of the first row of the carpus is the intervention of choice. Treatment with anterior graft and synthesis by pins in the scaphoid nonunion after fractures type ii, iii, and iv without osteoarthritis without necrosis (the most frequent case) gave good results in our series. Functionally, the results were satisfactory noting a slight decrease in mobility, mainly radial tilt. All these techniques work well with pain relief and improved mobility, but do not fully recover mobility, hence the need to treat scaphoid fractures before the stage of nonunion (radiological monitoring of all trauma wrist shots at 10-15 days of trauma) or, at the latest, in the early stages of nonunion in order to preserve the amplitudes of the wrist.

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