

Surgical Treatment of Carpal Scaphoid Pseudarthrosis by Matti-Russe Technique

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Abstract

Original Research Article

Twenty-one patients diagnosed with carpal scaphoid nonunion received treatment by the Matti-Russe surgical technique. The average postoperative follow-up was 46.5 months, with extremes of 14 and 74 months. The average duration between the initial trauma and the first consultation was 16 months with extremes between 1 year and 3 years. The overall consolidation rate in our series was 100%. We noted 2 patients who developed the complex regional pain syndrome and patient who presented a migration of pins without secondary displacement. Michon's score was excellent in 11 cases or 52%, good in 6 cases or 29% and medium in four cases or 19%.

Keywords: Carpal scaphoid, Pseudarthrosis, Matti-Russe.

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INTRODUCTION

Fractures of the carpal scaphoid account for 70 to 80% of wrist trauma. In order of frequency, the fracture of the scaphoid comes immediately after the fracture of the lower extremity of the radius [1]. Between 5 and 10% of them do not consolidate definitively and thus evolve towards pseudarthrosis. [2]. Untreated scaphoid pseudarthrosis progresses to scaphoid plication with carpal collapse and in the long term to degenerative osteoarthritis of the wrist also known as "Scaphoid Non-union Advanced Collapse" (SNAC) [4, 5]. The management methods of carpal scaphoid pseudarthrosis are many and varied, but the management method of choice is still debated. Treatment depends on the stage of management of nonunion. In this context; the technique of MATTI-RUSSE is still considered as the management method of choice and has given good results. Nevertheless, the failure rate varies between 15 and 20% in all published series [6]. Our work presents the results of a retrospective series of 21 cases of carpal scaphoid pseudarthrosis treated surgically by non-vascularized corticocancellous spongiosal graft of Matti-Russe, managed in our orthopedic and traumatological surgery department during a period of 9 years between January 2010 and December 2018. The interest of our study is to evaluate the results of this series and compare them with data from the literature. We will discuss the epidemiological and radio-clinical profile of carpal scaphoid pseudarthrosis and the modalities of surgical

treatment, highlighting the interest of the MATTI-RUSSE technique.

MATERIALS AND METHODS

The exploitation was followed by a casuistic study which allowed the collection of sociodemographic, clinical, paraclinical, therapeutic and evolutionary data. We used the Schernberg classification and that of Alnot to fractures and nonunion respectively; and the score of Mayo Wrist to evaluate the functional result 46.5 months after the surgical procedure. The questionnaire included questions assessing pain intensity, functional status, range of motion, and grip strength. The scores were in four groups: 90-100: Excellent, 80-90: Good, 60-80: Satisfactory, less than 60: poor. the Michon and Quick Dash scores were also used for the evaluation of the functional result.

The objective of the study was to retrospectively evaluate the clinical, radiological and functional results of the treatment of carpal scaphoid nonunions by the Matti-Russe non-vascularized spongiosal corticosis technique stabilised by pins and compare them with data from the literature.

The included patients underwent surgical treatment by cortical spongy transplantation not vascularized anteriorly. Included were all patients with Alnot stage IIA and IIB carpal scaphoid pseudoarthrosis

who underwent surgical treatment with the Matti-Russe technique during the period from 2010 to 2018 in our department. Patients whose lesions corresponded to the other stages of nonunion and those with associated lesions such as perilunate dislocations were excluded. We also excluded subjects with simultaneous fracture of other wrist bones and / or apparent degenerative changes in wrist bones. To make this study easier, we established an operating record where all parameters and patient information were noted.

RESULTS

Epidemiological study

In our series, all our 21 patients were male, so the male predominance was very clear. The average age of our patients was 27 years, with extremes of 19 years and 52 years. The right hand was affected in 11 cases, or 52% of cases and the left hand in 10 cases, or 48% of cases. The dominant hand was affected in 10 cases, which represented 48%. In this study, we noted the high frequency of work-related accidents (11 cases or 52%), followed by sports accidents (9 cases or 43%), and in third place was a road accident (either 5%). With regard to the associated lesions, we found only one case of

clavicle fracture that had undergone S-plate osteosynthesis. The average duration between the initial trauma and the first consultation was 16 months with extremes between 1 year and 3 years. Regarding the initial management of the fracture, it went unnoticed in 19 cases or 90% and received orthopedic treatment in 2 cases or 10%.

Clinical and paraclinical data

Exercise and palpation pain sitting preferentially at the level of the anatomical snuffbox was the main symptom, constituting the main reason for consultation in our series (100%), and 4 out of 21 patients had a limitation of wrist mobility or 19%.

Conventional radiography was the first examination performed to confirm nonunion. The fracture of the carpal scaphoid in our series according to the Schernberg classification was of type II in 7 cases or 33% of cases, type III in 11 cases or 53% of cases and type IV in 3 cases, or 14% of cases. Eleven or 52% of patients had Alnot IIA-grade non-union, while 10 or 48% had Alnot IIB-type nonunion. In our series, only one patient had a CT scan showing Alnot IIB scaphoid pseudarthrosis and no patients had MRI.



Fig-1: Standard radiograph of the right wrist: face and profile showing pseudarthrosis of scaphoid stage IIA



Fig-2: Standard radiograph of the right wrist: face and profile showing pseudarthrosis of scaphoid stage IIB



Fig-3: Scanning images of carp showing pseudarthrosis of scaphoid Stage IIB

Surgical technique

In our series, all cases of scaphoid pseudarthrosis were treated surgically. This was the Matti-Russe intervention with graft from the iliac crest and fixation by pins. All patients were supine, under general anesthesia, limb placed on a tablet and all were approached anteriorly. Graft removal was done in all patients from the ipsilateral iliac crest. The scaphoid was exposed by an anterior approach. The two banks of nonunion were sharpened. A recess of the two fragments was performed, a filling with iliac cancellous bone and a bypass of the focus with a cortico-cancellous graft recessed according to the technique of Matti-Russe. The assessment of bone loss was made by

the LINSCHIED maneuver, which consists of attaching the lunate to a Kirschner pin at the radius, the wrist being in a position of slight flexion to put the semilunar into the axis of the radius. When the wrist was extended 35 °, there appeared the loss of bone substance graft to restore the scaphoid to its normal height. Stabilization was by pinning osteosynthesis, a field clamp held the two fragments of the scaphoid securely to prevent rotation, and the pin was inserted from the scaphoid tubercle. In our series, stability was obtained by pinning in all patients. No patient was styloidectomised and all patients benefited from careful closure of the joint capsule followed by plane closure.



Fig-4: Radioscopic control of wrist profile fixed by two pins



Fig-5: Radioscopic control of the wrist face fixed by two pins

Postoperative

Antibiotic prophylaxis was used in all patients postoperatively. Postoperative analgesia was provided by administration of NSAIDs and first-level analgesics. All the patients of our series benefited from a postoperative immobilization of 03 months using a plastered cuff taking the metacarpophalangeal joint of the thumb is 100%. The average hospital stay was 02 days.

We noted in our series two patients who developed algodystrophy or complex regional pain syndrome (9.5%), whose evolution was favorable under medical treatment with a well-conducted rehabilitation. We noted a case of migration of osteosynthesis material without displacement.



Fig-6: Standard radiograph of the right wrist: face and profile showing the migration of the osteosynthesis material

The mean postoperative follow-up was 46.5 months, with extremes of 14 months and 74 months. This is an important step back to affirm consolidation. Indeed, some cases occurred at 6 months with very promising images of consolidation, but control at 1 year could show an iterative pseudarthrosis with almost complete resorption of the graft. The overall consolidation rate in our series was 100%. All our patients were treated with a cortico-cancellous graft and osteosynthesis to give the scaphoid its initial height.

In our patients, the functional results were evaluated by several scores. The Michon score was excellent in 11 cases (52%), good in 6 cases (29%) and average in 4 cases (19%). Mayo Wrist's score was excellent in 14 cases and good in 7 cases. The results of the average Quick-Dash were 15.25 (range: 10-26)

DISCUSSION

In this study, we evaluated 21 patients with Alnot stage IIA and IIB carpal scaphoid pseudoarthrosis, admitted for surgical treatment according to the Matti-Russe technique in our orthopedic and traumatological surgery department between January 2010 and December 2018. The functional results were mostly excellent according to the different scores used.

Sociodemographic data

The average age of our patients was 27 years (with extremes between 19 and 52 years) which is comparable to the series of Chantelot C *et al.* where the

mean age was 26.7 and slightly higher than the average age of patients in the Merghani *et al.* who was 26 at the time of the intervention. All patients in our series were male. There is also a male predominance in the series of Bellec and Alnot with 87% of men, and in the series of Honning VD *et al.* with 96% of men. The clear male predominance could be attributed to the frequent exposure of men to work-related accidents (52%) and sport accidents (43%).

Clinical data

Scaphoid pseudoarthrosis can be revealed by symptoms such as chronic wrist pain, or partial functional impotence. It can also be asymptomatic or discovered by chance. In our series, all patients had wrist pain, which is higher than the 76.5% average found in the Bellec and Alnot series. Moreover, this pain is most often accompanied by a decrease in the grip strength of the affected hand compared to the healthy hand, that a significant loss of wrist mobility. With months and years, the wrist gradually loses strength and range of motion. The pains increase and become disabling. It is the appearance of osteoarthritis that marks the end of the evolution of this pathology [9, 11, 12]

In our series, the dominant hand was affected in 48% of cases. Slightly below average found in the series of Bellec and Alnot with 53%. The average duration between the initial trauma and the first consultation was 16 months with extremes between 1

and 3 years. This frequency was similar to that of Merghani HW *et al.*

The fracture diagnosis was made for 10% of the patients in our series. These results are close to those obtained in the Chantelot C *et al.* which are 22%. It is important to emphasize the importance of initial diagnosis in the face of all wrist trauma.

Imaging data

The respective frequency of the different fracture varieties was relatively homogeneous in our personal analysis, and in the other series of the literature [7, 9]. For anatomical analysis, the most common type has been grouped under the term medium fractures, it includes types II, types III and types IV. These 3 types represent 96% in our series and in the other two national series respectively 94% and 100%. The same results are found in the other works of the literature [7, 10, 9, 13].

Treatment

In our series, all patients were operated under general anesthesia (100%), for reasons of comfort of the orthopedic surgeon [14], and the need for an iliac approach. In the El Ghazouli N *et al.* series, the majority of patients were undergoing general anesthesia (86%). All patients in our series were operated by anterior approach. This approach has several advantages; it first allows the preservation of scaphoid vascularization, which is predominantly dorsal [9]. The anterior approach is adopted in most series.

All grafts were taken from the iliac crest, because this type of graft seems to have a better compressive strength [9]. The bone sample at the radius, rather than the iliac crest, allows shorter operative time and less morbidity. Levadoux *et al.* [15] emphasizes the risk of articular fractures of the radius during the removal of a large graft, especially at the beginning of the learning curve. The size of a radial graft is limited by the proximity to the radial articular surface. In pseudarthrosis with significant loss of bone substance, this graft could be insufficient, unlike an iliac graft that is not limited in size. The bone of radial origin, with respect to the iliac bone, is structurally of lesser quality and presents a weaker cellular renewal [15]. For Straw *et al.* [16], a radial graft is more friable and less robust than an iliac graft. For Gabl *et al.* Also, the pelvic bone is of better quality than the radial bone and therefore is more favorable for consolidation [16].

In our work 100% of the cases (21 patients) benefited from spindle osteosynthesis which was easy and non-traumatic for the scapho-trapezium joint, the non-union site and the proximal pole. These results are similar to that of Le Bellec Y *et al* and Rachid K.

Consolidation

Postoperatively, consolidation was found in 100% of our patients, we do not find much difference compared to studies that used the same surgical technique

Comparison between a conventional graft and a vascularized graft

Several studies have shown the superiority of the vascularized bone graft technique compared to conventional grafting with or without osteosynthesis. The consolidation rate in several series is 100%. [16, 21, 22] But this technique requires a trained surgeon and learning is more difficult compared to that of non-vascularized grafts, which are more accessible to young operators, in addition to the limits of grafts of radial origin compared to iliac grafts [15].

Complications

The complications in the 14% of the cases were: 2 cases of algodystrophy, a case of migration of osteosynthesis material without displacement. No cases of consolidation failure or infection were observed. This result is broadly similar to that found in the various publications of the literature [7, 10, 8, 13, 17].

Functional results

Patients do not complain directly about their non-union, but about its consequences (pain, decreased mobility, strength, etc.), hence the importance of functional scores. All our patients resumed their previous work, the improvement focused on pain, mobility was often decreased, strength was also decreased on average but improved after consolidation and rehabilitation. Overall, non-vascularized cortico-cancellous grafts give excellent subjective results

CONCLUSION

The intermediate position of the carpal scaphoid between the first and the second row acting as an external lock of mediocarpal articulation, largely explains its susceptibility to trauma. The pseudarthrosis of the carpal scaphoid exposes the wrist to a great risk of osteoarthritis and compromises the function of the hand, the purpose of its treatment is to obtain the indolence of the wrist and to prevent the appearance of this osteoarthritis. For this it is necessary not only to obtain the consolidation of the scaphoid, but to restore its height, its morphology, to obtain the bone fusion, and to correct the dorsal rocking of the associated lunatum. During a period of 9 years, between January 2010 and December 2019, 21 cases of alnot carpal scaphoid pseudoarthrosis were treated in our department of orthopedic surgery and traumatology, by the technique of Matti-Russe. The consolidation was obtained in all cases, ie 100%. The anterior graft associated with pin stabilisation as a treatment of scaphoid pseudoarthrosis in addition to its ease of realisation, allowed us to cope with all eventualities, and to have consistently satisfactory results.

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