



The Sauvé-Kapandji procedure for posttraumatic disorders of the distal radioulnar joint

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The authors report their experience with the Sauvé-Kapandji procedure for the management of posttraumatic disorders of the distal radioulnar joint in 20 patients. The mean age was 39 years (range, 19 to 62 years), the mean duration of follow-up was 76 months (range, 60-97 months) and the mean time interval between initial injury and the Sauvé-Kapandji procedure was 24 months (range, 6-120 months). Postoperatively all patients experienced relief of pain. Rotation of the forearm increased to near normal values. The patients scored an average of 77 points on the Modified Mayo Wrist Score (range, 65-95 points). Three patients had an excellent result, six had a good result, seven had a fair result and one had a poor result. There were no major complications. Fifteen of seventeen employed patients had returned to work. Eighteen of nineteen patients were very satisfied or satisfied by the result of surgery. The procedure performed satisfactorily in addressing posttraumatic problems of the distal radioulnar joint, but must still be considered a salvage procedure.

INTRODUCTION

Fractures of the distal radius may lead to chronic derangement of the distal radioulnar joint resulting in ulnar pain, instability, subluxation, dislocation and reduced grip strength and range of movement (4,5,8,15). Malunion of the fracture itself may lead to posttraumatic osteoarthritis and positive ulnar variance and further disruption of the intricate anatomy of the region. The Sauvé-Kapandji procedure and its modifications have demonstrated considerable versatility in addressing a variety of

pathological conditions of the region (1,7,10,13,14,18). It has been used in the treatment of rheumatoid arthritis of the wrist and distal radioulnar joint (3,17), for Madelung's deformity (4), for osteoarthritis of the distal radioulnar joint (12), and for various posttraumatic disorders of the distal radioulnar joint (2). In its classic form (7), the procedure consists of a) decortication and cancellous screw fixated arthrodesis of the distal radioulnar joint, b) resection of about 15 mm of the distal part of the ulna including or excluding the periosteal sleeve, and c) advancement of pronator quadratus into the ulnar pseudarthrosis. There have been many modifications of the procedure, including tenodesis of the flexor carpi ulnaris to the distal part of the ulnar shaft to avoid instability (8), partial tenodesis of the extensor carpi ulnaris for the same purpose (11), and concomitant radial osteotomy to correct posttraumatic malalignment of the distal radius (4), to name a few. It seems that many authors regard a modified Sauvé-Kapandji salvage procedure as first choice procedure for distal radioulnar derangement after fractures of the distal radius in the younger, active patient. Darrach's resection of the ulnar head or Bowers' interposition

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arthroplasty may be reserved for the elderly patient with low functional demands (8). While no prospective, randomised studies of treatment procedures of posttraumatic disorders of the distal radioulnar joint exists (5), we are still dependent upon descriptive studies.

The current authors report a review of the Sauvé-Kapandji's procedure for posttraumatic radioulnar derangement in 20 younger patients.

MATERIAL AND METHODS

The Sauvé-Kapandji procedure was performed in 20 patients with posttraumatic derangement of the distal radioulnar joint between 1993 and 1997. The surgery was performed by three senior hand surgeons, including one of the authors (P.L.). There were five men and fifteen women. The mean age was 39 years (range, 19 to 62 years), and the mean duration of follow-up was 76 months (range, 60 to 97 months). The mean time interval between initial injury and the Sauvé-Kapandji procedure was 24 months (range, 6 to 120 months).

Patients were considered for the Sauvé-Kapandji procedure if measures such as the administration of nonsteroidal antiinflammatory medication and hand therapy or occupational therapy had not relieved pain that was localised to the distal radioulnar joint, managed instability of the distal radioulnar joint or restored range of movement of the wrist and forearm after fractures involving the distal radius and the distal radioulnar joint. Additionally, arthroscopic debridement of lesions of the triangular fibrocartilage complex was performed in four patients and corrective osteotomy of the distal radius or ulna in three patients. Only patients with high demands on hand function were considered candidates for the procedure.

The initial injury and treatment is documented in table I.

At the time of the latest follow-up 17 of 20 patients underwent full radiographic and clinical examination by the authors. Two patients declined outpatient review, but accepted interview by telephone. One patient had died of unrelated causes. Preoperative data were obtained from hospital records and confirmed by each patient. The combined subjective and objective assessment of pain, function, range of movement and grip strength was evaluated according to the Mayo Modified Wrist Score (MMWS) (2). A score of 90 to 100 points was considered excellent, a score of 80 to 89 points was considered good, a score of 65 to 79 points was considered fair, and

a score less than 65 points was considered poor. Preoperatively, no consistent clinical scoring was recorded. Range of movement was recorded preoperatively. In addition to the clinical assessment, the patients' overall satisfaction with surgery was recorded at the latest follow-up. The range of movement was measured with a goniometer and grip strength with a Base Line Hand Dynamometer (Fabrication Enterprises Inc./Smith & Nephew, Irvington N.Y.) with the humerus in neutral abduction/adduction, the forearm in neutral rotation and the wrist in neutral flexion/extension. Grip strength was expressed as percentage of normal side. Postoperative radiographs were assessed for length of the pseudarthrosis, collision between ulna and radius, ulnar variance, solid union of the distal radioulnar joint, degeneration, and signs of ossification within the pseudarthrosis.

SURGICAL TECHNIQUE AND POSTOPERATIVE MANAGEMENT

Surgery was carried out with the patient in the supine position under general anaesthesia or regional axillary block with tourniquet control. Inflation pressure of the tourniquet was set at 100 mm Hg above the patients' systolic blood pressure. A dorsoulnar incision of about 6 cm was made over the distal ulna, curving dorsally to the tip of the ulnar head. Care was taken to avoid tension on the dorsal sensory branch of the ulnar nerve. Subperiosteal dissection of the distal ulna was followed by opening of the fifth extensor compartment to expose the joint properly. The distal ulna was stabilised by a towel clip or a Kirschner wire. Osteotomy of the ulna was performed followed by excision of a 15-mm segment of the distal end of the ulna. The radial sigmoid notch and the distal ulnar articular surface against the radius were debrided using rongeurs and small osteotomes. Final decision was made about the degree of ulnar shortening to achieve a neutral or slightly ulnar-minus variance and the position was secured by one or two Kirchner wires. The distal ulnar fragment was then fixed to the radius by one or two cannulated 4.5 mm cancellous screws under fluoroscopic guidance. If possible, cancellous chips were obtained from the removed ulnar segment and inserted into the sigmoid notch as an aid in solid fusion. Tenodesis was performed in three patients to address

instability of the distal ulnar stump. The capsule was then repaired and the pronator quadratus muscle was interposed into the osteotomy site.

Postoperatively the wrist was immobilised in a bulky dressing and a below elbow cast. After two weeks the dressing and sutures were removed in the outpatient department, postoperative radiographs were obtained and the patient was provided with hand therapist guidelines and a removable wrist orthosis that was used additionally for 6 to 8 weeks. The patients' exercises and progression was supervised in the hand therapists' outpatient clinic.

RESULTS

Clinical results

Preoperatively all patients had moderate or severe pain in the region of the distal radioulnar joint. At the latest follow-up three patients had no pain in the region, eleven patients had mild and occasional pain with flexion and extension of the wrist, and five patients had moderate but tolerable pain in the region.

Preoperative grip strength had not been recorded consistently. At the latest follow-up grip strength averaged 77% (range, 50-100 %) of that on the unaffected side. The mean pronation had improved from 74° (range, 0-90°) preoperatively to 86° (range, 46-90°) in the 17 patients available for clinical examination. The mean supination had improved from 43.5° (range, 0-80°) to 70° (26-90°) at the latest follow-up examination. The range of movement of pronation/supination had improved by an average of 34° (range, -20-60) at the latest follow-up examination. The preoperative flexion of the wrist had averaged 42.3° (range, 0-65°), and the preoperative extension of the wrist had averaged 50° (range, 0-80°). At the latest follow-up examination the values of the range of flexion/extension remained substantially unaltered. Eight of 19 patients were very satisfied by the surgery, 10 patients were satisfied and one patient was not satisfied by the end result. This patient scored a poor result in the Modified Mayo Wrist Score (60 points). Postoperative radiographs in this patient showed a positive ulnar variance and collision between the ulnar styloid and the carpus and colli-

sion between the proximal ulnar stump and the radius, and the patient had pain of movement and reduced grip strength.

Six patients experienced a painless "clicking" sensation at the ulnar resection site in the extremity of the pronation/supination range of movement. The 17 patients available for clinical examination scored an average of 77 points according to the Modified Mayo Wrist score (range, 65-95 points). Three patients had an excellent result, six had a good result, seven had a fair result and one had a poor result of surgery (table II). Asked if they would undergo a similar procedure in our department if necessary in the future for the same pathology and symptoms, 17 of 19 patients said that they would, and two patients were not sure.

At the latest follow-up examination eight patients had returned to their original occupation in full capacity. Two patients had returned to original occupation as secretaries but at 50% of the pre-injury capacity. Five patients had been forced to find employment in new occupations that were less physically strenuous. Two patients had retired and two patients were still unemployed.

Three patients underwent a second procedure. In patient number 3 the ulnar stump proved unstable and tenodesis was performed 18 months later. The end result was an MMWS of 80. The primary tenodesis in patient number 14 was too tight and thereby limiting rotation. After lengthening of the tenodesis the end result was excellent with a MMWS of 90 points. Patient number 18 had clinical and radiological collision between the ulnar stump and radius. Fascia lata tissue was interposed after nine months. The patient was unavailable to clinical review but he was interviewed by phone and expressed satisfaction with the final result.

There were no major complications in the series. One patient had a superficial wound infection that resolved uneventfully by the administration of antibiotics. Two patients had persistent sensory changes in the area innervated by the dorsal cutaneous branch of the ulnar nerve.

Radiological evaluation

In two cases postoperative radiographs showed a positive ulnar variance of 2.0 mm, and in one case

a positive ulnar variance of 3.0 mm. In 14 cases the ulnar variance was neutral or slightly negative. The ulnar pseudarthrosis was open in all radiologically examined cases, averaging a gap of 11mm. In three cases there were radiographic signs of non-union of the fusion at the distal radioulnar joint. However, one of these patients had an excellent Modified Mayo Clinic Wrist Score, one patient had a good score and the third patient had a fair score. In one patient mild reossification had developed in the pseudarthrosis gap, but no solid bridging. However, pronation was reduced to 46° and supination was reduced to 52°. The patient had moderate pain in rotation and had a poor Modified Mayo Wrist Score (60 points).

DISCUSSION

Kapandji himself defined posttraumatic stiffness and reduced range in the pronation/supination arc of movement of the forearm associated with malunited fractures of the distal radius as a major indication for the Sauvé-Kapandji procedure (7). Once the distal radioulnar joint is destroyed as a result of fracture in the region, it is unlikely that normal anatomy or function can be completely restored, despite refined diagnostics like magnetic resonance scanning, arthrography or arthroscopy. Disorders of the distal radioulnar joint may be of different origin; incongruity because of postfracture shortening of the radius, lesions of the triangular fibrocartilage complex, malunion of the ulnar styloid, instability of the ulnar head in the radial sigmoid notch and so forth. However, the treatment options of a multitude of pathologies remain rather restricted; arthroscopic debridement, the Darrach resection, Bowers interposition arthroplasty and the Sauvé-Kapandji procedure. The latter procedure addresses pain arising from the distal radioulnar joint by solid arthrodesis of the joint. It is able to correct excessive positive ulnar variance by shortening of the ulna, and it can restore rotation of the forearm by creating a pseudarthrosis (6).

Still, the current authors agree with Taleisnik (16) and Carter and Stuart (2) that the Sauvé-Kapandji procedure is a salvage procedure for very complex problems of the distal radioulnar joint. In the current series of posttraumatic disorders in younger

patients, the procedure yields satisfactory but not infallible results. Only eight of 20 patients were able to return to their former occupation in full capacity. However, 15 of 17 employed patients had returned to work, albeit not their original occupation in all cases. In the series reported by Carter of 41 patients with posttraumatic disorders of the distal radioulnar joint, two-thirds of the employed patients were able to return to work. In Carter and Stuart's series, most patients (86%), stated that they would have the operation again (2). In the current authors' series, 89% of the patients would have the surgery performed again for similar pathology and symptoms. Eighteen of 19 patients in the current series were very satisfied or satisfied by the result after a mean duration of follow-up of 76 months. Mean postoperative pronation was 86° and mean postoperative supination was 70°, which compares favourably with most series (2,6,8,9,12). Preoperatively all patients experienced moderate or severe pain in the region. Postoperatively, all patients experienced relief from pain and no patients complained of severe and disabling pain in the region. In the current series grip strength averaged 77% (range, 50-100%) of the unaffected side. However, the restoration of grip strength of the current series compares well with other studies of the Sauvé-Kapandji procedure for posttraumatic derangement of the distal radioulnar joint (2,8,9,12).

In the current authors' experience, the Sauvé-Kapandji procedure produces predictable results in the management of posttraumatic derangement of the distal radioulnar joint in this middle- to long-term follow-up, although its status as a salvage procedure is unaltered by the results of this series. Pain was effectively relieved in the majority of patients and forearm rotation was restored to a near normal range of movement. The procedure itself had no major complications and remains the procedure of choice in our clinic for management of posttraumatic disorders of the distal radioulnar joint, when other measures have failed.

REFERENCES

1. Bowers WH. Instability of the distal radioulnar articulation. *Hand Clin* 1991 ; 7 : 311-27.

2. **Carter PB, Stuart PR.** The Sauvé-Kapandji procedure for post-traumatic disorders of the distal radio-ulnar joint. *J Bone Joint Surg* 2000 ; 82-B : 1013-1018.
3. **Chantelot C, Fontaine C, Flipo RM, Migaud H, Le Coustumer F, Duquennoy A.** Synovectomy combined with the Sauvé-Kapandji procedure for the rheumatoid wrist. *J Hand Surg* 1999 ; 24-B : 405-409.
4. **De Smet LA, Van Ransbeeck H.** The Sauvé-Kapandji procedure for posttraumatic wrist disorders : Further experience. *Acta Orthop Belg* 2000 ; 66 : 251-254.
5. **Fornalski S, Lee TQ, Gupta R.** Chronic instability of the distal radioulnar joint : A review. *Univ Penn Orthop J* 2000 ; 13 : 43-52.
6. **Gordon L, Levinsohn DG, Moore SV, Dodds RJ, Castleman LD.** The Sauvé-Kapandji procedure for the treatment of posttraumatic distal radioulnar joint problems. *Hand Clin* 1991 ; 7 : 397-403.
7. **Kapandji IA.** The Kapandji-Sauvé operation. *Ann Chir Main* 1986 ; 5 : 181-93.
8. **Lamey DM, Fernandez DL.** Results of the modified Sauvé-Kapandji procedure in the treatment of chronic posttraumatic derangement of the distal radioulnar joint. *J Bone Joint Surg* 1998 ; 80-A : 1758-69.
9. **Mikkelsen SS, Lindblad BE, Larsen ER, Sommer J.** Sauvé-Kapandji operation for disorders of the distal radio-ulnar joint after Colles fracture. *Acta Orthop Scand* 1997 ; 68 : 64-66.
10. **Millroy P, Coleman S, Ivers R.** The Sauvé-Kapandji operation. *J Hand Surg* 1992 ; 17-B : 411-14.
11. **Minami A, Kato H, Iwasaki N.** Modification of the Sauvé-Kapandji procedure with extensor carpi ulnaris tenodesis. *J Hand Surg* 2000 ; 25-A : 1080-84.
12. **Minami A, Suzuki K, Suenaga N, Ishikawa J-I.** The Sauvé-Kapandji procedure for osteoarthritis of the distal radioulnar joint. *J Hand Surg* 1995 ; 20-A : 602-08.
13. **Nakamura R, Tsunoda K, Watanabe K, Horii E, Miura T.** The Sauvé-Kapandji procedure for chronic dislocation of the distal radio-ulnar joint with destruction of the articular surface. *J Hand Surg* 1992 ; 17-B : 127-32.
14. **Rothwell AG, O'Neill L, Cragg K.** Sauvé-Kapandji procedure for disorders of the distal radioulnar joint : a simplified technique. *J Hand Surg* 1996 ; 21-A : 771-77.
15. **Sanders RA, Frederick HA, Hontas RB.** The Sauvé-Kapandji procedure : A salvage operation for the distal radioulnar joint. *J Hand Surg* 1991 ; 16-A : 1125-29.
16. **Taleisnik JD.** The Sauvé-Kapandji procedure. *Clin Orthop* 1992 ; 275 : 110-23.
17. **Vincent KA, Szabo RM, Agee JM.** The Sauvé-Kapandji procedure for reconstruction of the rheumatoid distal radioulnar joint. *J Hand Surg* 1993 ; 18 : 978-83.
18. **Webber JB, Maser SA.** Stabilization of the distal ulna. *Hand Clin* 1991 ; 7 : 345-53.