



## Long term results of the Sauvé-Kapandji procedure in the rheumatoid wrist

Miklós PAPP, Levente PAPP, Balázs LENKEI, Zoltán KÁROLYI

*From Borsod County Teaching Hospital, Miskolc, Hungary*

**This retrospective long-term study evaluates the clinical and radiological results of the Sauvé-Kapandji procedure in rheumatoid wrists. Fourteen patients with rheumatoid arthritis who had undergone a Sauvé-Kapandji procedure were examined 10 to 16.5 years after surgery. Range of motion and grip strength were measured. The patients' complaints related with instability of the ulnar stump, the residual pain in the wrist, and the function of the operated hand were assessed. The review also included a radiological examination.**

**Pain was found to have decreased and the gripping strength of the hand to have increased in all the patients. The range of wrist rotation was significantly improved. On radiographs, there were no signs of increased ulnar translation of the carpus. We noted no instance of subluxation or dislocation of the ulnar stump.**

**In this long-term evaluation, the Sauvé-Kapandji procedure was found to provide long-term improvement of the function of the wrist-hand complex, by eliminating the distal radio-ulnar joint which is a major source of pain in the rheumatoid wrist.**

**Keywords :** rheumatoid arthritis ; caput ulnae syndrome ; Sauvé-Kapandji procedure.

### INTRODUCTION

Wrist involvement in rheumatoid arthritis usually begins on the ulnar side, in that complex anatomic

unit which is composed of the tendon sheath of the extensor carpi ulnaris (ECU) muscle and the distal radio-ulnar joint (DRUJ) (9). The ECU tendon runs separately ; its sheath is tightly attached to the triangular fibrocartilage complex (TFCC) and the triquetrum. This is important in the stabilization of the ulno-carpal joint (28). In rheumatoid arthritis the TFCC is weakened. Tenosynovitis develops in the tendon sheath of the ECU, which enlarges the tendon sheath, and the tendon subluxates volarly (27). The weakening of the ligamentous connection and the subluxation of the ECU tendon lead to dorsal subluxation of the ulnar head. This constitutes the caput ulnae syndrome, a term coined by Backhdal (1).

The symptoms are :

- weakness, and pain on pro-supination of the wrist,
- palpable and visible dorsal subluxation of the ulnar head,

---

■ Miklós Papp, MD, PhD, Orthopaedic Surgeon.

■ Zoltán Károlyi, MD, Orthopaedic Surgeon.

*Department of Orthopaedic Surgery, Borsod County Teaching Hospital, Miskolc, Hungary.*

■ Levente Papp, MD, Orthopaedic Surgeon.

*University of Miskolc, Medical University of Debrecen, Hungary.*

■ Balázs Lenkei, MD, Orthopaedic Surgeon.

*Hand Surgery Center Miskolc, Hungary.*

Correspondence : Miklós Papp, Estike str. 40, Miskolc 3525, Hungary. E-mail : drpapp.miklos@gmail.com

© 2013, Acta Orthopædica Belgica.

---

- reduced range of pronation-supination,
- swelling around the ulnar head and the 6<sup>th</sup> extensor compartment (synovitis, tenosynovitis),
- secondary tendon lesions, possible extensor tendon tear, volar subluxation of the ECU tendon.

The most common complaints are pain and function loss. The ECU tendon loses the ability to pronate and extend the wrist and to bring it into ulnar deviation. In a volar subluxated position, the tendon acts as a wrist flexor, and supinates the hand. It loses its ulnar-deviating function. The extensor carpi radialis longus (ECRL) muscle brings the wrist into radial deviation (27-28).

Early synovectomy in the radio-ulnar and ulno-carpal joints may be effective if performed before the development of erosive arthritis ; tenosynovectomy in the 6<sup>th</sup> extensor compartment is an important part of the procedure (10).

If the TFCC is intact, the ulno-carpal synovectomy is performed in the space between the triquetral bone and the triangular fibrocartilage. The stability of the wrist can be improved by fixation of the partially damaged TFCC and the radio-ulnar ligaments to the radius (10).

Swanson suggested to re-locate the volarly dislocated tendon of the ECU and to fix it with a flap from the extensor retinaculum (26).

For a long time the only treatment of the erosive osteoarthritis of the distal radio-ulnar and ulno-carpal joint was resection of the ulnar head, described by Darrach (8). The ulnar stump can be stabilised with the tendon of the ECU and FCU muscles, of which a strip is pulled through a drilled hole (3).

Swanson reported in 1972 his results with his ulnar head silastic prosthesis (26).

In 1936 Sauv  and Kapandji described fusion of the DRUJ combined with segmental resection of the ulna creating an artificial pseudo-articulation in the ulna proximal to the fusion site (24). Instability of the ulnar stump may however be a problem after the Sauv -Kapandji procedure as well. Other possible complications are nonunion or delayed union of the arthrodesis, radio-ulnar synostosis and fracture of the distal radius (18,20,21). To avoid painful instability and an ulnar side clunk, a tenodesis can be per-

formed with a tendon strip from the ECU or FCU (5,16). Synovectomy and tenosynovectomy are crucial parts of the procedures performed for treatment of erosive arthritis.

The aim of this study was to assess the long-term results of the Sauv -Kapandji procedure in rheumatoid wrists with caput ulnae syndrome.

## MATERIALS AND METHODS

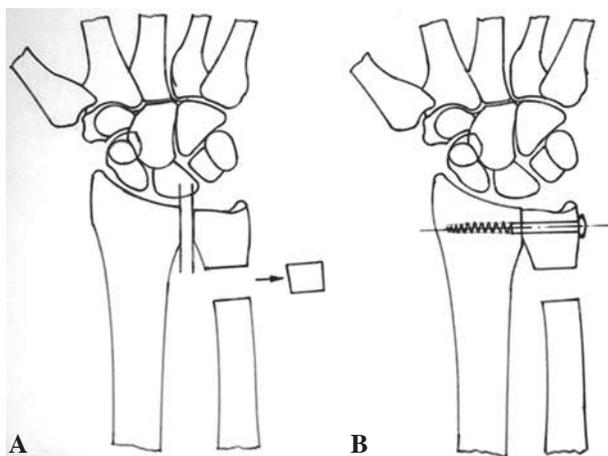
The study group included patients with rheumatoid arthritis who underwent a Sauv -Kapandji procedure in our department between 1994 and 2001. We excluded patients who failed to attend the long-term examination, and those who had also undergone surgery on the radio carpal joint.

The indication for the Sauv -Kapandji procedure was caput ulnae syndrome. Severe radio-carpal destruction and/or considerable ulnar translation of the carpus on the antero-posterior radiograph, and volar subluxation of the wrist on the lateral radiograph were considered contraindications for this procedure.

### Surgical technique

Surgery was performed under regional or general anaesthesia. Through a curved ulnar skin incision, the extensor retinaculum was opened ; synovectomy was performed in the DRU and the UC joints. A 10-15 mm segment of the ulna was resected proximal to the ulnar head. The cartilage from the DRUJ was removed, and the joint was fixed with one cancellous screw. Part of the pronator quadratus muscle was interposed between the two ends of the ulna to discourage bone healing. The ECU tendon was fixed on the dorsal aspect of the ulnar head with a flap from the retinaculum. A plaster splint was worn for 10 days after surgery. Active pronation-supination exercises were started on the first postoperative day ; unrestricted mobilisation was allowed after splint removal.

At the time of the follow-up examination the patients evaluated their pain on a visual analogue scale from 1 to 10 : 1 corresponds to a painless wrist, and 10 stands for severe pain even at rest. We compared the results with the preoperative values, collected from the patients' records. The patients estimated the change in their grip strength, and function of the extremity compared to the status before operation (key pinch, brushing hair, shaving etc.) (worse, unchanged, better, much better) The patients



**Fig. 1.** — A : The cartilage is removed from the distal radio-ulnar joint, and a 1-2 cm long part of the ulna is resected ; B : The ulna head is fixed to the distal radius with a cancellous screw.

also evaluated their complaints related with instability of the ulnar stump, as follows :

- no “clicking”, no instability feeling
- painless “clicking”, instability sensation
- mild pain
- moderate pain
- considerable pain on “clicking”, instability feeling

At the examination we noted the localisation of pain, the range of motion (flexion, extension, ulnar, radial deviation, pronation and supination) and any clicking on rotation of the forearm.

In the radiological examination, we looked on the AP views for signs of fusion in the DRU joint, and compared the ulnar translation of the carpus with the preoperative films ; we looked for signs of ossification or bone resorption at the ulnar stump ; on the lateral views we noted the position of the ulna in relation to the radius. The study was retrospective. Student’s t test was used for statistical analysis, with the significance level set at  $p < 0.05$ .

## RESULTS

A Sauvé-Kapandji procedure was performed in 21 rheumatoid patients between 1994 and 2001. It was combined in four patients with partial fusion of the radio-carpal joint ; 3 patients were lost to follow-up. These seven patients were excluded from the study. We thus report data from 14 patients (11 men, 3 women). Their mean age at surgery was 52.9



**Fig. 2.** — A : On the AP radiograph 12 years postoperatively, complete fusion of the distal radio-ulnar joint. No ossification around the ulna stump, no ulnar translation of the carpus ; B : The proximal ulna stump is not subluxated.

(44-59) years. The follow-up ranged from 10 to 16.5 years. There were no wound healing problems and no radius fractures. The screw used for the fusion was removed in all patients in the first post-operative year. At the review visit 10 to 16.5 years after operation the level of pain had decreased significantly compared to the preoperative values, from 6.9 to 2.6 on a 0-10 scale. The patients rated their grip strength as better in 3 cases, and much better in 11 cases compared to the preoperative status. The function of the hand had improved, as well as the grip strength. Twelve patients mentioned a painless clunk during rotation movements. Two patients also complained of mild pain and an instability feeling during rotation. Two patients mentioned discomfort about the ulnar stump area. The range of pronation and supination improved

significantly ( $p < 0.05$ ). The mean preoperative pronation was  $53.0 \pm 13.4^\circ$ , the mean preoperative supination was  $50.9 \pm 12.6^\circ$ ; the mean postoperative values were:  $75.2 \pm 9.3^\circ$  and  $68.7 \pm 9.3^\circ$  respectively. Radial deviation decreased significantly ( $p < 0.05$ ) from  $8.1 \pm 4.0^\circ$  to  $4.5 \pm 3.7^\circ$ . There was no significant decrease in flexion, extension, ulnar deviation: flexion decreased from  $50.1 \pm 8.5^\circ$  to  $43.4 \pm 8.7^\circ$ , extension from  $48.5 \pm 10.7^\circ$  to  $45.5 \pm 11.4^\circ$ , ulnar deviation from  $16.2 \pm 10.6^\circ$  to  $14.5 \pm 10.8^\circ$ .

Fusion of the DRUJ was achieved in all patients. There was no dislocation of the ulnar stump on lateral radiographs.

## DISCUSSION

For many years ulnar head resection has been the only solution for inflammatory disorders of the DRUJ. After this procedure, instability of the ulnar stump, extensor tendon wear or tear and ulnar translation of the carpus were reported by several authors (4,9,19,23,24,29). The ulnar stump can however be stabilised using the ECU and FCU tendons (3,6,15), and the stabilization decreases the risk of extensor tendon tear, but the wrist has anyway lost its bony support on the ulnar side. This will lead to increasing ulnar translation of the carpus (17,23). An ulnar head silastic prosthesis may be used to replace the bony support on the ulnar side of the wrist (26), but silastic synovitis has been reported as a frequent complication (19). Proper stabilisation of the prosthesis cannot be achieved in all cases because of the soft tissue destruction (22). The Sauvé-Kapandji procedure preserves the bony support of the ulnar side of the wrist; the load transmission thus remains close to normal (4). Pain upon rotation of the forearm is eliminated by the DRUJ fusion, as rotation will take place in an artificial pseudo articulation (29). The issue of instability of the ulnar stump can be addressed after the Sauvé-Kapandji procedure thanks to the pronator quadratus muscle (4,5,13); if the ulna resection is distal to the pronator quadratus attachment, the risk of instability is lower. If the ulnar stump is nevertheless unstable, a strip of the ECU and FCU tendons can be pulled into the ulnar stump through drill holes (6,16).

The Sauvé-Kapandji procedure has regained popularity over the past ten years: it has been used mainly for posttraumatic cases (4,6,7,15,17,19,23,29), but it may also be a valuable option in rheumatoid wrists (12,22).

In our opinion the modified Mayo score (2), which was designed to rate post-traumatic cases cannot be used to evaluate the outcome of surgery for caput ulnae syndrome in rheumatoid wrists: comparing the grip strength of the operated hand with the contralateral hand is not justified, as the latter is affected as well. Return to work is also influenced by the systemic disease.

Therefore we evaluated how the patients subjectively rated the change in their pain on a visual analogue scale, and also in grip strength, and overall function of their hand compared to the preoperative status.

Our results are in line with those of other authors (12,14,21). Pain level has decreased in all the patients, and all of them mentioned some improvement in the grip strength of the operated hand. As a result of these changes the overall function of the hand has also improved. "Clicking" with mild pain was present in two patients at final follow-up. A secondary tenodesis cleared these problems, so we believe that this could become part of the primary operation in the future. The range of pronation and supination has increased significantly. In this long follow-up period the range of flexion, extension, radial and ulnar deviation has slightly decreased, which may also be related with progression of the rheumatoid synovitis in the joints of the carpus. Radiological examinations have showed that the Sauvé-Kapandji procedure prevented ulnar translation of the carpus in all patients, and dislocation of the ulnar stump on the lateral radiographs was not noted. These findings are similar to those reported by Shimizu *et al* (25). The weak point of the present study is the small number of patients in the review. Furthermore, we had to use our own evaluating protocol, as the commonly used scoring systems are specially designed for post-traumatic cases. This report is however a useful addition to the scarce reports available on the long-term results of Sauvé-Kapandji operations on rheumatoid wrists.

Although rheumatoid arthritis affects every joint in the wrist, the Sauvé-Kapandji procedure increases

the overall function of the hand-wrist complex. In agreement with Zachee *et al* (29), we believe that the Sauvé-Kapandji procedure improves the function of the wrist-hand complex in the rheumatoid wrist, because it eliminates the distal radio-ulnar joint, which is a major source of pain in the rheumatoid wrist.

## REFERENCES

- Backhdal M.** The caput ulnae syndrome in rheumatoid arthritis. A study of the morphology, abnormal anatomy and clinical picture. *Acta Rheum Scand* 1963 ; 5 : 1-75.
- Bradway JK, Amadio PC, Cooney WP.** Open reduction and internal fixation of displaced, comminuted intra-articular fractures of the distal end of the radius. *J Bone Joint Surg* 1989 ; 71-A : 839-847.
- Breen TF, Jupiter JB.** Extensor carpi ulnaris and flexor carpi ulnaris tenodesis of the unstable ulna. *J Hand Surg* 1989 ; 14-A : 612-617.
- Carter PB, Stuart PR.** The Sauve-Kapandji procedure for post-traumatic disorders of the distal radio-ulnar joint. *J Bone Joint Surg* 2000 ; 82-B : 1013-1018.
- Chu PJ, Lee HM, Hung ST, Shih JT.** Stabilization of the proximal ulnar stump after the Darrach or Sauvé-Kapandji procedure by using the extensor carpi ulnaris tendon. *Hand* 2008 ; 3 : 346-351.
- Czermak C, Wittemann M, Germann G, Sauerbier M.** [Functional results after the Kapandji-Sauvé operation for salvage of the distal radio-ulnar joint.] (in German). *Handchir Mikrochir Plast Chir* 2007 ; 39 : 403-408.
- Daecke W, Martini AK, Schneider S, Streich NA.** Amount of ulnar resection is a predictive factor for ulnar instability problems after the Sauve-Kapandji procedure : A retrospective study of 44 patients followed for 1-13 years. *Acta Orthop* 2006 ; 77 : 290-297.
- Darrach W.** Anterior dislocation of the head of the ulna. *Ann Surg* 1912 ; 56 : 802-803.
- De Smet L.** The distal radio-ulnar joint in rheumatoid arthritis. *Acta Orthop Belg* 2006 ; 72 : 381-386.
- Feldon P, Millender LH, Nalebuff EA.** *Operative Hand Surgery*, 3<sup>rd</sup> ed. Green DB. : Churchill Livingstone. 1993, pp.1624-1637.
- Fernandez D L.** Reconstructive procedures for malunion and traumatic arthritis. *Orthop Clin North Am* 1993 ; 24 : 341-363.
- Fujita S, Masada K, Takeuchi E et al.** Modified Sauve-Kapandji procedure for disorders of the distal radio-ulnar joint in patients with rheumatoid arthritis. Surgical technique. *J Bone Joint Surg* 2006 ; 88-A suppl : 24-28.
- Haferkamp H.** Wrist para-articular radio-ulnar arthrodesis with distal Kapandji ulnar resection ] (in German). *Handchir Mikrochir Plast Chir* 1994 ; 26 : 313-318.
- Haferkamp H.** [Kapandji-Sauvé procedure with distal radio-ulnar fusion and segmental resection of the ulna] (in German) *Oper Orthop Traumatol* 2012 ; 24 : 13-22.
- Hui FC, Linscheid RL.** Ulnotriquetral augmentation tenodesis : a reconstructive procedure for dorsal subluxation of the distal radio-ulnar joint. *J Hand Surg* 1982 ; 7-B : 230-236.
- Kawabata A, Egi T, Hashimoto H, Masada K, Saito S.** A comparative study of the modified Sauvé-Kapandji procedure for rheumatoid arthritis with and without stabilization of the proximal ulnar stump. *J Hand Surg Eur Vol* 2010 ; 35 : 659-663.
- Lichtman DM, Ganocy TK, Kim DC.** The indications for and techniques and outcomes of ablative procedures of the distal ulna : the Darrach resection, hemiresection, matched resection and Sauve-Kapandji procedure. *Hand Clin* 1998 ; 14 : 265-277.
- Lluch A.** The Sauvé-Kapandji procedure : Indications and tips for surgical success. *Hand Clin* 2010 ; 26 : 559-572.
- Millroy P, Coleman S, Ivers R.** The Sauvé-Kapandji operation : technique and results. *J Hand Surg* 1992 ; 17-B : 411-414.
- Nagira K, Hagino H, Yamashita Y, Kishimoto Y, Teshima R.** Insufficiency fracture at the distaldiaphysis of the radius after synovectomy combined with the Sauvé-Kapandji procedure in a patient with rheumatoid arthritis. *Mod Rheumatol* 2010 ; 20 : 511-513.
- Ochi K, Horiuchi Y, Matsumura T et al.** Distal radius fracture after Sauvé-Kapandji procedure in a rheumatoid arthritis patient. *Mod Rheumatol* 2012 ; 22 : 290-294.
- Papp M, Róde L, Kazai S.** [Early experience with the Sauvé-Kapandji operative technique for caput ulnae syndrome developed in rheumatoid arthritis.] (in Hungarian). *Magyar Traumatológia Ortopédia Kézsebészet Plasztikai Sebészet* 1996 ; 39 : 275-280.
- Sanders RA, Frederick HA, Hontas RB.** The Sauvé-Kapandji procedure : a salvage operation for the distal radio-ulnar joint. *J Hand Surg* 1991 ; 16-A : 1125-1129.
- Sauvé L, Kapandji M.** [New operative technique for isolated recurrent dislocation of the the distal ulna.] (in French). *J Chir* 1936 ; 47 : 589-594.
- Shimizu H, Beppu M, Matsusita K, Arai T, Yoshida N.** The carpal stretch test at the rheumatoid wrist. *Hand Surg* 2012 ; 17 : 49-54.
- Swanson AB.** Flexible implant resection arthroplasty in the hand. *J Br Soc Surg Hand* 1972 ; 4 : 119-134.
- Tubiana R.** [Rheumatoid lesions of the carpus.] (in German). *Orthopäde*.1986 ; 15 : 135-149.
- Williams CS, Jupiter JB.** [The painful ulno-carpal joint.] (in German). *Orthopäde* 1993 ; 22 : 36-45.
- Zachee B, De Smet L, Roosen P, Fabry G.** The Sauve-Kapandji procedure for nonrheumatic disorders of the distal radio-ulnar joint. *Acta Orthop Belg* 1994 ; 60 : 225-230.