

Case Report

Modified Sauve-Kapandji procedure with stabilisation of the proximal ulnar stump using extensor carpi ulnaris tendon for treating distal radioulnar joint disorders: A case series

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ABSTRACT

ABSTRAK

Introduction: Distal radioulnar joint (DRUJ) disorders often lead to wrist pain, restriction of forearm rotation, and loss of grip strength. Several procedures are available to treat the disorder; however, there is no single procedure superior to another. In this study, we performed modified Sauve-Kapandji procedure with stabilisation of the proximal ulnar stump using extensor carpi ulnaris (ECU) tendon.

Methods: We evaluated three patients with DRUJ disorders. We performed modified Sauve-Kapandji procedure with ECU tenodesis to all patients. Functional outcomes, including range of motion, grip power, and visual analogue scale, were recorded prospectively.

Results: All patients had increased supination-pronation function with no reducing effect on grip power and no pain in the short term follow up. The benefits of the surgery were immediately shown following the day after the procedure. No complications occurred.

Conclusion: The modified Sauve-Kapandji procedure with ECU tenodesis could be an option in the management of DRUJ disorders. Further larger studies with controls are required to investigate the safety and efficacy of such procedure.

Pendahuluan: Kelainan sendi radioulna seringkali berakibat pada nyeri pergelangan tangan, restriksi rotasi lengan bawah, dan hilangnya kemampuan untuk menggenggam. Terdapat beberapa tindakan untuk menatalaksana kelainan tersebut; namun, tidak terdapat prosedur tunggal yang superior dibandingkan dengan lainnya. Pada penelitian ini, kami melakukan prosedur Sauve-Kapandji termodifikasi dengan stabilisasi stump ulna proksimal menggunakan tendon ekstensor carpi ulnaris (ECU).

Metode: Kami mengevaluasi tiga pasien dengan kelainan sendi radioulna. Kami melakukan prosedur Sauve-Kapandji termodifikasi dengan tenodesis ECU kepada seluruh pasien. Luaran fungsional, termasuk range of motion, kekuatan menggenggam, dan skala analog visual dicatat secara prospektif.

Hasil: Seluruh pasien memiliki peningkatan fungsi supinasi-pronasi tanpa penurunan efek kekuatan menggenggam dan tidak ada nyeri dalam follow-up jangka pendek. Manfaat pembedahan langsung terlihat sehari setelah prosedur. Tidak terjadi komplikasi.

Kesimpulan: Prosedur Sauve-Kapandji termodifikasi dengan tenodesis ECU dapat menjadi opsi untuk manajemen kelainan sendi radioulna distal. Studi selanjutnya dibutuhkan untuk menginvestigasi keamanan dan efektivitas tindakan ini.

Keywords: modified Sauve-Kapandji procedure, distal radioulnar joint disorder, extensor carpi ulnaris tenodesis

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INTRODUCTION

Disorders of the distal radioulnar joint (DRUJ), which often arise from various causes, such as rheumatoid arthritis, osteoarthritis, malunion of distal radius fractures, ulnocarpal abutment syndrome, and congenital malformation, occasionally cause numerous complications, including ulnar wrist pain, loss of grip strength, instability of the ulna, severe limitation of hand function, and inability to perform activities that require forearm rotation.¹⁻⁴ Although numerous surgical procedures have been proposed for the management of DRUJ disorders, no single procedure is superior to another. Moreover, as there is a broad spectrum of pathologies, different surgical techniques for each lesion are needed.^{2,5}

In 1936, Sauve, and later Kapandji, described an operation consisting of radioulnar joint fusion, creation of a pseudoarthrosis proximal to the fusion, and stabilisation procedure for the proximal ulnar stump.¹ This procedure is a very effective option for relieving wrist pain, increasing the range of forearm rotation, and improving grip strength in patients with various DRUJ disorders.⁵ Pain over the proximal ulnar stump, however, frequently develops during forearm rotation or lifting of heavy objects after surgery. This pain has been suggested to be caused by dynamic instability of the proximal ulnar stump secondary to resection of a small segment of the distal ulnar shaft.^{6,7} Tenodesis has been simultaneously performed with the Sauve-Kapandji procedure to stabilise the unstable proximal ulnar stump and thus, improving the proximal ulnar stump pain.⁸⁻¹³ Although satisfactory clinical outcomes have been observed by this method, the mechanism of pain relief remains unclear.⁵

To prevent instability of the proximal ulnar stump, Minami, *et al*¹¹ developed a modified Sauve-Kapandji procedure to treat osteoarthritis of the DRUJ; long-term follow-up was reported to have satisfactory functional outcomes. In 2008, Chu, *et al*¹⁴ treated 19 patients with chronic derangement of the DRUJ with modified Darrach and Sauve-Kapandji procedures involving stabilising the proximal ulnar stump with a half-slip of the ECU tendon. They found that, in a mean follow-up period of 77 months (ranging from 62 to 91 months), no patient complained about any symptoms due to proximal ulnar stump instability. Moreover, grip strength improved in all wrists after surgery. These findings suggested that stabilisation of the proximal ulnar stump with extensor

carpi ulnaris (ECU) tenodesis was an effective procedure for treating DRUJ after the Darrach and Sauve-Kapandji procedures. In our series, we performed modified Sauve-Kapandji procedure with ECU tenodesis to correct supination-pronation impairment after forearm fracture and DRUJ instability.

METHODS

We evaluated three patients with impaired supination-pronation after forearm fracture. One of the patients had persistent DRUJ dislocation in Galeazzi fracture after open reduction internal fixation (ORIF), and the other two developed such dislocation after ORIF in the distal radius and distal radius-ulna. We performed modified Sauve-Kapandji procedure with ECU tenodesis to all patients. Functional outcomes, including range of motion, grip power, and visual analogue scale, were recorded prospectively.

Surgical Procedure

The modified Sauve-Kapandji procedure was performed with the patient lying in a supine position under general anaesthesia and the affected upper extremity with the hand on a hand table in the prone position. We performed a longitudinal skin incision over the subcutaneous border of the ulna between ECU and flexor carpi ulnaris (FCU) tendons in 5 to 6 cm proximal to the prominence of the ulnar head and ending at the level of the pisiform. We identified and protected the dorsal sensory branch of the ulnar nerve. We created an alignment hole (perpendicular to the long axes of the radius-ulna) in DRUJ with an electric drill which exited anteriorly to the styloid process and ECU sheath. Afterwards, we performed osteotomy of the head of the ulna just at the proximal edge of the joint cartilage. Rotation of the head of the ulna into supination allowed visualisation of the sigmoid notch of the radius. Subsequently, malleolar screw is inserted perpendicular to the head of the ulna through the previously made drill alignment hole. The screw entered just anterior to the compartment of the ECU tendon, and its tip protruded 3 mm from the center of the denuded surface of the head of the ulna. Stabilisation of the distal ulna proximal segment/stump was conducted with ECU interposition. A distally based slip of the ECU tendon was then created by longitudinal division. This strip was passed through the ulnar collateral ligament in a dorsal-to-palmar direction and then through the medullary canal of the ulnar stump, exiting through the dorsal hole, and

finally through the interosseous membrane. The tendon strip was placed dorsally to the ulnar stump. The extensor retinaculum stabilised the ECU tendon over the dorsal aspect of the distal ulnar stump.

Table 1. Characteristics of the subjects and functional outcome following modified

No.	Sex	Age	Diagnosis	Functional Outcome after Procedure
1	M	28	Supination-pronation impairment in persistent dislocation of distal ulna after ORIF due to Galeazzi fracture	Increased supination-pronation arc, minimal reduce of grip power, no pain
2	M	39	Supination-pronation impairment after ORIF due to comminuted distal radius fracture	Increased supination-pronation arc, minimal reduce of grip power, no pain
3	F	41	Supination-pronation impairment after ORIF due to distal radius ulna fracture	Increased supination-pronation arc, minimal reduce of grip power, no pain



Figure 2. Preoperative clinical and radiological examination of the first patient



Figure 3. Postoperative clinical and radiological examination of the second patient

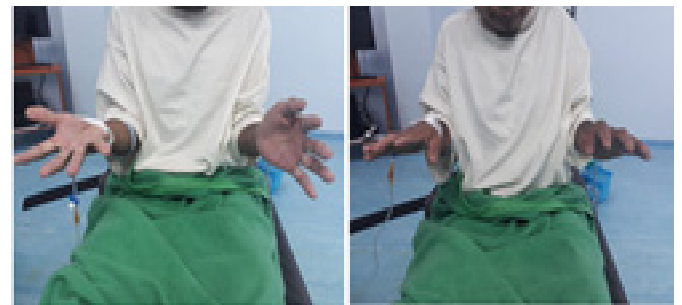


Figure 4. Preoperative clinical and radiological examination of the third patient

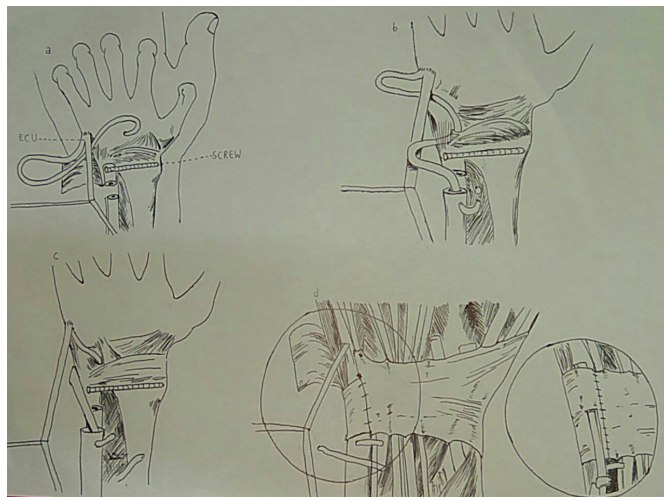


Figure 1. Scheme of modified Sauve-Kapandji Procedure with extensor carpi ulnaris tenodesis



Figure 5. Postoperative clinical and radiological outcome of the second patient



Figure 6. Preoperative and postoperative radiological outcome of the third patient

RESULTS

A total of three patients with supination-pronation impairment after forearm fracture and DRUJ instability were included in this series. Subjects consisted of two males and one female. Details of the patients' characteristics and functional outcome after the procedure are presented in Table 1. After undergoing modified Sauve-Kapandji procedure, all patients had increased supination-pronation function with minimally reduced grip power and no pain in the short term follow up. The benefits of the surgery were shown immediately on the next day after the procedure; all patients were able to perform full range of pronation and supination.

DISCUSSION

Various surgical techniques have been developed to treat instability of the DRUJ, including distal ulna resection, partial-resection with an interposition arthroplasty, and the Sauve Kapandji procedure. Though the aforementioned

procedures achieve satisfactory outcomes, there are some limitations including diminished grip strength, instability of the wrist, rupture of the extensor tendons, and ulnar carpal abutment.³

We found that the modified Sauve-Kapandji Procedure with ECU tenodesis is effective in treating supination-pronation impairment after forearm fracture and DRUJ instability. Complications of the Sauve-Kapandji Procedure include nonunion or delayed union of the arthrodesis, fibrous or osseous union at the pseudoarthrosis and painful instability of the proximal ulna segment.¹⁰ However, the modified Sauve-Kapandji procedure with stabilisation of the proximal ulnar stump using FCU or ECU tenodesis may prevent such instability.^{10,15,16}

Occasionally, the tenodesis performed in the modified Sauve-Kapandji procedure may use FCU or ECU or combination of FCU-ECU.^{10,12,14} Lamey *et al*¹² reported the technique of tenodesis with FCU following the Sauve-Kapandji procedure; however, all patients exhibited dorsal instability of ulnar segment/stump. Breen *et al*¹⁰ reported that combination of FCU-ECU tenodesis was a reliable procedure for stabilising segment/ stump following resection of the distal ulna. Chu *et al*¹⁴ reported that the technique of tenodesis with ECU tendon after Darrach or Sauve-Kapandji procedure was a reliable method for preventing unstable ulnar segment/stump in patients diagnosed with DRUJ disorders. In the present series, we performed ECU tenodesis to control ulnar stability, and none of the patients exhibited postoperative volar and dorsal instability of the ulnar segment/stump. We also used ECU tendon as the location, which was more superficial and easier for the surgeons. The grip strength also still worked well since the major extensors, including extensor carpi radialis brevis and extensor carpi radialis longus, were still in good function. Therefore, the modified Sauve-Kapandji procedure with ECU tenodesis is an effective and safe procedure for treating DRUJ disorders. Moreover, the benefit of surgery can be shown immediately on the next day postoperatively.

Our study was limited by a lack of controls and a limited number of subjects. Further larger studies with controls are required to investigate the safety and efficacy of modified Sauve-Kapandji with ECU tenodesis.

CONCLUSION

The modified Sauve-Kapandji procedure with ECU

tenodesis can be an option in the management of DRUJ disorders. Further studies with controls are needed to investigate the safety and efficacy of this procedure.

Conflict of interests

None declared.

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