

Original Research Article

Functional outcomes after modified Sauve-Kapandji arthrodesis for distal radioulnar joint dysfunction

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ABSTRACT

Background: The distal radioulnar joint (DRUJ) dysfunction manifests as pain, weakness and reduced range of motion. There are various treatments for DRUJ dysfunction. Modified Sauvé-Kapandji procedure involves arthrodesis of the distal radioulnar joint combined with the creation of a pseudarthrosis of the distal ulna to maintain forearm pronation and supination, and stabilization of proximal ulnar stump. This study was performed to evaluate the clinical outcomes of modified Sauve-Kapandji procedure for patients with DRUJ dysfunction.

Methods: Fourteen patients with DRUJ dysfunction were treated by modified Sauve-Kapandji procedure and followed up for 2 years post-operatively. Functional assessment was evaluated according to modified mayo wrist score (MMWS) system and severity of pain by visual analog scale. Posteroanterior and lateral radiographs were used to assess fusion.

Results: There was a significant improvement in VAS of wrist pain ($p < 0.001$) and MMWS ($p < 0.001$) at 2 years follow up. Excellent outcome was reported in 64.3% ($n=9$) patients. Radiographic fusion was seen in all 14 cases.

Conclusions: The modified Sauve-Kapandji procedure for DRUJ dysfunction is a safe and effective procedure with excellent radiological fusion and significant improvement in functional outcomes.

Keywords: Distal radioulnar joint, Modified Sauvé-Kapandji procedure, Modified mayo wrist score

INTRODUCTION

Distal radioulnar joint (DRUJ) dysfunction can result in pain of the wrist, decreased forearm rotation, instability of the ulna, and loss of function.¹ There are numerous salvage surgeries to treat instability of the DRUJ, including distal ulna resection by Malgaine and Darrach, partial-resection with interposition arthroplasty and the Sauve-Kapandji procedure and its modifications.²⁻⁷

The Sauve-Kapandji procedure involves fusion across the DRUJ with excision of a segment of the distal ulna. Theoretically, this preserves ulnar support of the carpus, the distal radioulnar ligaments, and ulnocarpal ligaments. The extensor carpi ulnaris tendon is usually used to

suspend and stabilize the ulna shaft in the modified procedure.⁸⁻¹⁰ Retaining the ulnar head may allow for more normal transmission of force through the wrist, which may make this the preferred procedure in patients with “high-demand” wrists. While the DRUJ is fused, forearm pronation and supination are maintained or even improved by pseudoarthrosis of the ulna. Also, postoperative immobilization is shorter in the modified Sauve-Kapandji procedure, which is an added advantage for the patient.⁸

The aim of this study is to evaluate the clinical outcomes of modified Sauve-Kapandji procedure for patients with DRUJ dysfunction at a short term follow up of 2 years.

METHODS

Source of data

The study was conducted in the department of orthopedics, Vydehi institute of medical sciences and research center, Whitefield, Bangalore, following institutional guidelines and after ethical committee approval.

Patient demographics

The study was a prospective study of 14 patients conducted between June 2016 and December 2019, with a follow up of 2 years. All patients between ages 20 and 60 years, with DRUJ dysfunction, irrespective of etiology were included in the study. Patients with active infections, severe comorbidities, cognitive impairment and low functional demand were excluded from the study. Patient demographics including age, sex and side of dysfunction are summarized in Table 1.

Table 1: Patients demographics.

Variables	Values
Mean age (years)	39.4±9.4
Total number of patients	14
Male (%)	8 (57.1)
Female (%)	6 (42.9)
Side of dysfunction (%)	
Right	9 (64.3)
Left	5 (35.7)
Dominant side	12 (85.71)

Table shows summary of mean age of patients, number of male and female patients, side of DRUJ dysfunction.

Surgical procedure

Modified Sauve-Kapandji procedure has been performed using the standard described technique.^{5,8} Cannulated cancellous screw was used for arthrodesis of DRUJ joint. Pseudoarthrosis was created by excising a part of ulna proximal to the arthrodesis. Extensor Carpi Ulnaris was split along the fibers and one part was mobilized to stabilize the proximal stump acting as a sling. Postoperatively the limb is immobilized in an above elbow cast for 4 weeks with the forearm supinated about 45 degrees. Then, a short arm splint is applied until the fusion site has healed. Elbow and Wrist range of motion exercises were initiated at 4 weeks to prevent joint stiffness.

Outcomes measures

Functional assessment was evaluated according modified mayo wrist score (MMWS) system and severity of pain by visual analog scale (VAS). Comparisons were made between preoperative and 2 year follow up scores. Radiographic fusion was assessed by standard plain wrist postero anterior (PA) and lateral radiographs.⁵

Statistical analysis

Descriptive statistics were used. Data is analyzed and plotted using the JASP (Version 0.10.2, university of Amsterdam) software. P value less than 0.05 is considered statistically significant. Numerical values are expressed as mean ± standard deviation.

RESULTS

Clinical outcomes of the study are summarized in Table 2.

The mean pre-operative VAS score for wrist pain was 7.71±1.07 and at two years follow up was 0.78±0.69. There is a significant improvement (p<0.001) in pain post operatively as evident by VAS scores (Figure 1A) (Table 2).

The mean pre-operative MMWS was 27.14±6.11 and at two-year follow was 88.21±5.75. There is a significant improvement (p<0.001) in wrist function after the procedure as assessed by MMWS as shown in the Figure 1B and Table 2.

Overall outcome was assessed by final MMWS.⁵ Excellent outcome was reported in 64.3% (n=9) patients, good in 24.6% (n=4) and fair in 7.1% (n=1) patients as shown in the Table 2.

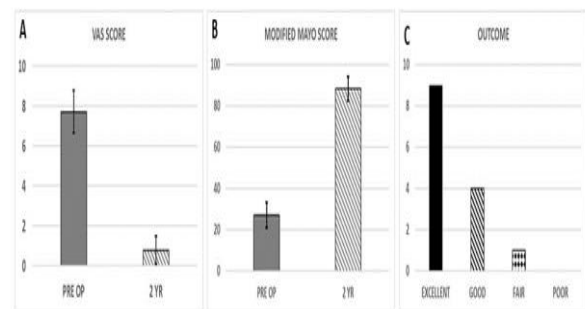


Figure 1: Functional outcome of modified Sauve-Kapandji procedure. (A) Comparison of VAS scores for wrist pain, (B) Modified mayo wrist score of patients before surgery and at 2 years follow up. (C) Overall outcome of patients at 2 years follows up.

Figure 2 (A-H) shows pre-operative, post-operative, 2 year follow up and post implant removal radiographs of modified Sauve-Kapandji procedure. Arthrodesis of DRUJ can be well appreciated in Figure 2G indicating a successful radiological outcome. Fusion was achieved in 100% cases.

Table shows summary of VAS scores, MMWS scores, overall outcome in modified Sauve-Kapandji procedure and Fusion rates.

Table 2: Clinical outcomes.

Scale	Pre-operative	2 year follow up	Percentage Improvement	Significance
Visual analogue scale	7.71±1.07	0.78±0.69	89.88%	p<0.001
Modified mayo wrist score (MMWS)	27.14±6.11	88.21±5.75	69.23%	p<0.001
Overall outcome based on MMWS (%)				
Excellent (MMWS 90-100)	9 patients (64.3)			
Good (MMWS 80-89)	4 patients (24.6)			
Fair (MMWS 65-79)	1 patient (7.1)			
Poor (MMWS <65)	0			
Radiological outcome				
Fusion of DRUJ (%)	100			



Figure 2: Radiographs of Sauve-Kapandji procedure. (A, B): Pre-operative antero-posterior and lateral radiographs of wrist showing DRUJ instability with dorsal displacement of Ulna. (C, D): Immediate posterior operative radiograph showing arthrodesis of DRUJ with cannulated cancellous screws and resection of part of ulna proximal to the arthrodesis. (E, F): Radiographs at 2 year follow up showing fusion at DRUJ. (G, H): Radiographs after implant removal showing fusion at DRUJ and anatomical alignment of proximal ulna in antero-posterior and lateral radiographs.



Figure 3: Functional outcome modified Sauve-Kapandji procedure. Radiographs and clinical pictures post implant removal after 2 years. (A, B): Antero-posterior and lateral radiographs of wrist of fusion at DRUJ. (C, D): Supination and pronation of forearm. (E): Dorsiflexion of wrist. (F): Palmarflexion of wrist.

Figure 3 (A-F) shows final radiological and functional outcome of a patient who underwent modified Sauve-Kapandji procedure. Figure 3A and 3B showing radiological fusion. Figure 3C-3F shows range of motion of forearm and wrist.

There was no incidence of infections or any neurovascular deficits in any of the patients. One patient reported persistent minimal pain.

DISCUSSION

The DRUJ is a diarthrodial trochoid synovial joint between the ulnar head and the ulnar notch on the lower end of the radius. The main function of this joint is pronation-supination and load transmission across the wrist. Post-traumatic and degenerative joint disease of DRUJ may lead to pain and dysfunction. The Sauvé-Kapandji procedure was originally described as a surgical treatment for DRUJ dysfunction due to rheumatoid arthritis which was followed by various modifications specially to stabilize the proximal stump.⁵⁻⁹ However, this procedure has since been widely used as a salvage operation after failure of other treatment methods for DRUJ disorders or distal radius fractures.^{8,11,12}

We treated 14 patients with DRUJ dysfunction by Modified Sauve-Kapandji procedure of which 8 patients were male and 6 were female. We operated 9 right wrists and 5 left wrists of which 12 (85.71%) were dominant side.

Carl 2018, in their study, where they compared Sauvé-Kapandji procedure with Darrach Procedure, showed a significant improvement (p<0.001) of pain in Sauvé-Kapandji group, with 72.7% patient having no pain at 1 year follow up.¹³ Minami et al, reported that 60% of the patients who underwent Sauvé-Kapandji procedure did not have any pain at 10 year follow up.¹² Tomori et al, 2018 also reported a significant improvement of pain post operatively in patients undergoing various modifications of Sauvé-Kapandji procedure.¹⁰ In our study, we observed a 89.88 percentage improvement in VAS scores for wrist pain with a statistical significance of p<0.001 at 2 year follow up.

MMWS was used to assess functional outcome. Guo et al, in their study on a modification of Sauvé-Kapandji procedure reported a significant increase in MMWS with a mean score of 91.67 ± 6.56 at 8 year follow up.⁵ Minami et al, reported a significant improvement in range of motion and grip strength at 10 year follow up.¹² Giberson-Chen et al, reported significant improvement in range of motion and overall functional outcome based on quick DASH score in patient who underwent Sauvé-Kapandji procedure.¹⁴ In this study, we observed a significant ($p < 0.001$) improvement in MMWS at 2 year follow up. The average scores improved by 69.23% compared to preoperative scores.

Guo et al, reported a radiological fusion of 70% within a mean of 7.8 months after the surgery.⁵ Lifchez has reported 100% fusion in Sauvé-Kapandji group.¹³ Minami et al, in their study showed that arthrodesis of the DRUJ was confirmed in all cases on radiographs taken within ten weeks of the surgery.¹² In our study also we have seen 100% fusion on radiographs taken at 2 year follow up.

There are many complications like persistent pain, persistent swelling, limited range of motion and rupture of extensor tendons have been reported with Sauvé-Kapandji procedures.¹⁵ We have observed a complication of persistent pain in one patient. There was no incidence of non-union or extensor tendon injuries.

Our study and our results are in comparison to most of the recent studies as discussed above. There are definitely some limitations of our study. We have included all the patients with DRUJ instability irrespective of etiology. Our sample size is small, but there are many studies with similar number of patients. Most of the studies were lasting from 7 to 15 years and ours is a short term follow of 2 years. In spite of these limitations, our prospective study with blinded analysis strengthens the current evidence on modified Sauvé-Kapandji procedure.

CONCLUSION

We have treated 14 wrists in the present study with modified Sauve-Kapandji procedure which demonstrated marked pain reduction and an improvement in wrist function. The osteoarticular reconstruction of the distal radius in this procedure could improve functional outcomes and decrease the severity of degenerative changes of the wrist. The Sauve-Kapandji procedure is now an established treatment option for symptomatic DRUJ dysfunction with various modifications. We conclude that the modified Sauve-Kapandji procedure for DRUJ dysfunction is a safe and effective procedure with significant improvement in functional and radiological outcomes.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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