

Sauvé-Kapandji procedure versus radio-lunate arthrodesis in the treatment of Madelung deformity. A case report

Technika Sauvé-Kapandji i artrodeza promieniowo-księżycowata w leczeniu deformacji Madelunga.
Opis przypadku

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CASE REPORT

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Abstract

Madelung deformity consists of excessive ulnar and palmar angulation of the distal radius. It may also involve the radiocapitellar joint and the sagittal bow of the radius. Commonly, the disease becomes clinically apparent in young adolescents with wrist deformity, pain and limited range of movement. There are multiple options for operative treatment. We retrospectively assessed a 14-year-old-girl treated in our department. The patient required treatment due to exacerbating pain in both wrists. The left hand underwent resection of the distal ulna; however, persistent pain led to the decision to perform the radio-lunate arthrodesis (RL). The right hand was treated according to the Sauvé-Kapandji procedure. Three years post-surgery, the patient was called for a follow-up examination. The assessment included measuring the range of motion using a goniometer, grip strength with a dynamometer, and evaluating follow-up wrist X-rays in lateral and posteroanterior views. The patient has also been evaluated using the Patient-Rated Wrist Evaluation (PRWE) and Disabilities of the Arm, Shoulder and Hand (DASH) questionnaires. Three years post-operation, the patient reported the absence of rest pain and occasional pain during loading. With the Sauvé-Kapandji procedure, a greater range of palmar flexion of the wrist and improved strength was achieved. The patient scored 5.83 points on the DASH scale, 9.5 points on the left hand, and 8.5 points on the right hand on the PRWE scale. In this patient's case, better outcomes were achieved by employing the Sauvé-Kapandji procedure. The patient's right-handedness may have influenced the results.

Key words: Madelung deformity, Sauvé-Kapandji procedure, radiolunate arthrodesis.

Streszczenie

Zniekształcenie Madelunga obejmuje nadmierne pochylenie łokciowe i odchylenie dłoniowe powierzchni stawowej dalszej kości promieniowej, może również obejmować staw promieniowo-łokciowy dalszy i zgięcie trzonu kości promieniowej. Choroba najczęściej staje się klinicznie widoczna u młodych nastolatków objawiając się: zniekształceniem nadgarstka, bólem i ograniczeniem zakresu ruchu. Istnieje wiele opcji leczenia operacyjnego. Opisano retrospektywnie pacjentkę z obustronną deformacją Madelunga leczoną operacyjnie w wieku 14 lat. Chora wymagała leczenia z powodu nasilającego się bólu w obu nadgarstkach. Po stronie lewej wykonano resekcję głowy kości łokciowej, a następnie artrodezę promieniowo-księżycowatą, a po stronie prawej operację metodą Sauvé-Kapandji. Ocena po 3 latach obejmowała pomiar zakresu ruchu za pomocą goniometru, siły chwytu przy użyciu dynamometru oraz ocenę radiologiczną nadgarstka w projekcjach bocznych i tylny-przednich. Przeprowadzono również ocenę za pomocą kwestionariuszy Patient-Rated Wrist Evaluation (PRWE) i Disabilities of the Arm, Shoulder and Hand (DASH). Trzy lata po operacji pacjentka nie zgłaszała bólu w spoczynku i tylko okazjonalny ból podczas przeciążania kończyn. Stwierdzono większą siłę oraz zakres zgięcia dłoniowego nadgarstka po stronie wykonanej procedury Sauvé-Kapandji. Chora uzyskała 5,83 punktów w skali DASH oraz 9,5 punktów w skali PRWE w ocenie lewej ręki i 8,5 punktu w ocenie ręki prawej. Lepsze wyniki osiągnięto dzięki zastosowaniu procedury Sauvé-Kapandji. Potwierdzają to lepszy zakres ruchu, większa siła i mniejszy ból podczas obciążania kończyny. Praworęczność pacjenta mogła mieć wpływ na uzyskane wyniki.

Słowa kluczowe: zniekształcenie Madelunga, technika Sauvé-Kapandji, artrodeza promieniowo-księżycowata.

Introduction

The disease described by Otto Madelung [1] is caused by growth disturbance of the radius. The majority of cases of Madelung deformity are idiopathic. About one out of every three cases of the disease can be attributed to genetic causes. Madelung's deformity can manifest independently or alongside syndromic diseases, which some authors refer to as pseudo-Madelung's deformity. The latter include dyschondrosteosis Léri-Weill, multiple hereditary osteochondromatosis, Turner syndrome, achondroplasia, mucopolysac-

charidosis type I–H (Hurler-Pfaundler syndrome) and type IV (Morquio syndrome), and multiple enchondromatosis (Ollier disease). Additionally, pseudo-Madelung deformities can occur following trauma to the wrists and may persist as post-traumatic residuals [2]. The Madelung deformity most commonly affects the distal radius (69%), although the whole radius might be involved. It involves pronounced radial and palmar angulation of the distal radius, the sagittal bow of the radius, dorsally prominent dorsal ulna and general shortening of the entire forearm [3]. The disorder becomes clinically apparent during adolescence, causing pain in the wrist, lim-

ited range of movement and the dorsally prominent distal ulna. In painful cases, surgical treatment is recommended. There are many options in skeletally mature patients ranging from osteotomies of the radius, distal ulna resections and Sauvé Kapandji procedure. The Sauvé-Kapandji procedure consists of the distal radioulnar joint arthrodesis and doing a pseudoarthrosis of the ulna just proximal to the arthrodesis. If there is sufficient growth, it is advisable to consider physiolyysis along with the release of the Vickers ligament (an abnormal palmar ligament tethering the lunate to the radius proximal to the physis)[4].

Aim

We want to present a bilateral Madelung deformity in 14-year-old girl treated in both hands differently with a 3-year follow-up.

Case Report

A 14-year-old girl was admitted to the ward due to increasing pain and Madelung deformity of both wrists. The symptoms manifested 2 years prior, leading to a formal diagnosis. Initially, the patient reported only weight-bearing pain and deformity; however, the symptoms had worsened over the last 6 months, particularly in the left wrist. The symptoms related to the right wrist were less prominent. The clinical examination of the left wrist revealed a dorsal bulge on the distal aspect of the ulna. Range of motion was decreased to flexion of 30°, extension of 45°, pronation of 90°, and supination of 70°. Radiographs demonstrated the typical features expected in cases of Madelung defor-

mity: a sagittal bow of the radius, dorsal luxation of the distal ulna, and the angulation of the articular surface of the radius in the radiocarpal joint (Fig 1 A, B). Due to the excessive protrusion of the ulna and pain located in this region, we decided to remove the distal ulna. An unsatisfactory decrease in pain after six months prompted us to perform a radio-lunate arthrodesis. This procedure had a satisfactory result, with pain only occurring when the limb was heavily burdened. Subsequently, the pain in the right wrist worsened, and the range of motion was limited to 70° flexion, 10° extension, 80° pronation and 80° supination (Fig. 2 A, B). On the right side, we decided to perform the Sauvé-Kapandji procedure. After three years of follow-up, the patient was examined radiographically (Fig. 3 A, B and 4 A, B) and clinically: Range of motion, strength, DASH and PRWE scores were assessed and compared (Table 1).



Fig. 1. A – Posteroanterior view of the left forearm before treatment; B – Lateral view of the left forearm before treatment.



Fig. 2. A – Posteroanterior view of the right forearm before treatment; B – Lateral view of the right forearm before treatment.

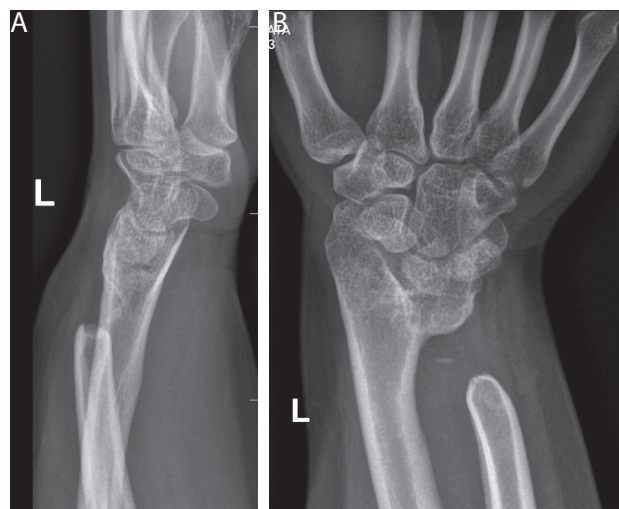


Fig. 3. A Posteroanterior view of the left forearm after radiolunate arthrodesis; B – Lateral view of the left forearm after radiolunate arthrodesis.

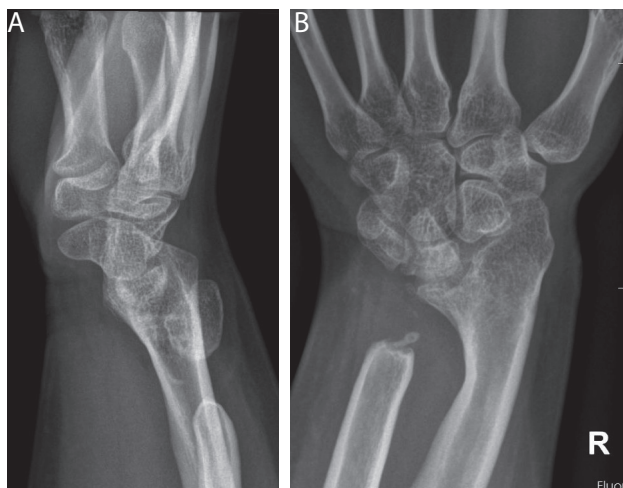


Fig. 4. A – Posteroanterior view of the right forearm after Sauvé-Kapandji procedure; B – Lateral view of the right forearm after Sauvé-Kapandji procedure.

Table 1. Comparison of the range of motion, results of PRWE, DASH scales, and grip strengths of both hands. Range of motion was assessed before surgery. Range of motion, DASH, PRWE, and grip forces were assessed at the last follow-up.

	Clinical evaluation	Sauvé Kapandji [Degrees]	Radio-lunate arthrodesis [Degrees]
	Dorsal flexion	-10	45
	Palmar-flexion	70	30
	Supination	90	90
	Pronation	80	75
	Ulnar Deviation	45	20
Before treatment	Radial deviation	-10	0
	Dorsal flexion	35	35
	Palmar-flexion	70	55
	Supination	90	90
	Pronation	75	75
	Ulnar deviation	45	45
	Radial deviation	-15	5
	PRWE	8,5	9,5
At the follow-up	DASH		5,83
	Grip strength	23	18,7
	Thumb adduction	5,7	2,8
Strength (kg)	Thumb flexion	6,8	6,2

Discussion

In cases of Madelung’s deformity, surgical intervention is recommended when pain is present or when open growth plates with sufficient growth potential allow for correction. Various procedures are proposed for treating this condition, such as the Sauvé-Kapandji procedure [5-8], along with opening, closing or dome osteotomies, and radioscapulohumeral arthrodesis (RSL). There is currently no

standardized treatment protocol for Madelung deformity, mainly due to the difficulty in comparing treatment outcomes across different methods [10]. Therefore, the choice of treatment method is primarily based on clinical assessment. The main objectives of surgery for Madelung deformity are to alleviate symptoms, enhance wrist range of motion, improve support for the lunate joint, and enhance the overall cosmetic appearance of the wrist. Based on our clinic’s experience, most patients present themselves shortly before or after the cessation of growth, making epiphysiodesis and Vickers ligament resection rarely feasible. Additionally, even after performing the procedure mentioned above, radial bone osteotomies are sometimes necessary to correct the positioning of the articular surface. Furthermore, pseudo-Madelung deformities exist where the Vickers ligament is absent, rendering the above method applicable to only a few patients. In our case, due to the patient’s skeletal maturity, this operation was not feasible.

The Sauvé-Kapandji procedure increases range of motion, improves cosmetics, and alleviates pain in 93.3% of cases [11]. Moreover, this technique allows for the restoration of support for the wrist bones and provides a favorable cosmetic outcome, thanks to the ulnar bone osteotomy. Radiolunate (RL) arthrodesis is described as a method for treating post-traumatic degenerative changes and those resulting from rheumatic diseases [13]. Cadaveric studies have shown that RL arthrodesis causes a loss of 47% of the range of motion in dorsal/palmar flexion of the wrist and 37% in ulnar and radial deviation [14]. In the case of Madelung deformity, the loss of range of motion is not as significant, mainly due to the considerable limitation resulting from the underlying disease. The challenge lies in performing arthrodesis in young patients, which may limit future treatment options. Another treatment method for Madelung deformity is radial bone osteotomy. In this condition, the deformity of the distal radius is multiplanar, with both volar and radial curvature of the radius necessitating a dome osteotomy. Such osteotomy requires significant expertise from the surgeon. By employing a locking plate for stabilizing the bones after dome osteotomy, we can promptly initiate postoperative rehabilitation and reduce the duration of limb immobilization in a cast [15]. On the other hand, Piek et al. compared the results of treating Madelung deformity with closing wedge osteotomy and radioscapulohumeral arthrodesis (RSL), and found no significant differences in postoperative pain, grip strength, or range of motion, except for reduced wrist extension in the RSL arthrodesis group.

In the presented case, we can compare both procedures performed on the same patient, allowing for a subjective assessment of treatment outcomes. Three years post-operation, the patient does not report significant superiority of either treatment method. In the case of the left hand, where arthrodesis was performed, mere excision of the ulnar head was insufficient. Although the initial discomfort

was primarily related to the ulnar head, it was essential from the outset to restore normal relationships between the radius and forearm bones. By performing a radiolunate arthrodesis, we were able to restore these relationships, alleviate pain, and improve wrist range of motion. In the contralateral hand, the Sauvé-Kapandji procedure enabled similar outcomes.

Conclusions

We demonstrated an example of the application of radiolunate arthrodesis in a case of Madelung deformity, where the resection of the distal ulna was insufficient. The result of our treatment is reduction of pain and improvement in the range of motion. By comparing the outcomes of both treatment methods, we concluded that the final effects are better using the Sauvé-Kapandji procedure. Right-handedness may have influenced the results.

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