Pyrocarbon Interposition after Capitate Head Resection

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Abstract

Background Isolated lunocapitate disease is a rare situation. It includes both capitulate arthritis and osteonecrosis of the capitate head. The management of this pathology is not defined yet.

Case Description We treated three patients by resection of the capitate head and interposition of a so-called capitulate Pi² implant (Tornier, BioProfile, Grenoble, France). We reported encouraging results at average follow-up of 4.8 years.

Literature Review Several procedures have been reported in this indication. All suffer from lack of follow-up. Four-corner fusion seems to be the most reliable solution at the expense of wrist stiffness.

Clinical Relevance case series

Keywords

- ▶ capitulate joint
- ▶ osteonecrosis
- ▶ pyrocarbon

Isolated lunocapitate disorder is a rare situation in midcarpal arthritis. Several surgical options have been described in the literature.^{1–7}

Midcarpal arthrodesis allows reliable and long-standing results at the expense of wrist stiffness. Interposition techniques have been proposed to preserve mobility.

The more recent uses of pyrocarbon implants in the wrist and thumb have shown they are a viable alternative at a medium-term follow-up.^{8–12} We have adapted this concept to treat lunocapitate arthritis in three patients.

Case Series

Three patients suffering from isolated lunocapitate arthritis underwent surgery in our department over the past decade.

Case 1

The first patient was a 29-year-old woman with osteonecrosis of the head of the capitate of her left wrist. She had no medical history and was a right-handed light worker. Her pain was 6 out of 10 using a Visual Analog Scale (VAS). The preoperative combined flexion and extension range of motion was 70°. The grip strength was 40% of the contralateral side, with poor preoperative Disabilities of the Arm, Shoulder, and Hand (DASH) score and Patient-Rated Wrist Evaluation (PRWE)

(▶ **Table 1**). The measured carpal height was 0.5 and scapholunate angle was 65°. She was treated by an open resection of the necrotic head of the capitate and interposition of a 7 × 14-mm capitulate Pi² implant (Tornier BioProfile, Grenoble, France). The patient was pain-free 5 months after surgery and returned to another job one year after the procedure. At the last follow-up of 8.2 years, she was very satisfied and was still working. The arc of combined flexion and extension was 90°. X-rays showed no bone loss or carpal collapse with good adaptability of the implant. The carpal height was 0.52 and the scapholunate angle 55°.

Case 2

The second patient was a 23-year-old man working as a carpenter. He had a 5-month history of a work-related painful posttraumatic avascular necrosis of the capitate head of his right wrist. The diagnosis of idiopathic necrosis of the head of the capitate of his right wrist was established by X-ray images (▶ **Figs. 1, 2**) and confirmed by magnetic resonance imaging (MRI) and scintigraphy. The pain was 5 on the VAS and he had stopped working. The combined wrist flexion and extension was 100°. The grip strength was 52% of contralateral side. The carpal height was 0.56 and scapholunate angle 60°. He was treated by an open resection of the necrotic capitate head and interposition of a 6 × 12.5-mm capitulate Pi² implant, size.

Table 1 Comparative clinical results

	Patient 1, age 29: oteonecrosis		Patient 2, age 23: traumatic necrosis		Patient 3, age 63: osteoarthritis	
	preop	postop	preop	postop	preop	postop
Follow-up		98		50		24
VAS	6	1	5	1	9	2
Flexion	40	35	70	50	60	50
Extension	30	55	30	45	40	60
RD	20	10	35	30	0	10
UD	20	30	10	20	25	30
Grip	8	12	26	43	12	22
DASH	68.18	25	45.45	25	72.73	2.27
PRWE	62	20	57,5	29	92	19

Legend: Age in years; follow-up in months; VAS = visual analog scale 1–10; flexion and extension in degrees; RD radial deviation; UD ulnar deviation; grip in kilograms.

He felt pain-free 4 months after surgery and went back to his previous job 6 months after the operation. At the last follow-up of 4.2 years, he was very satisfied and was still working. The VAS was 1. The arc of combined flexion and extension was 95°, grip strength was 84% of contralateral side. X-rays showed no bone loss or carpal collapse with a nice adaptability of the implant. The carpal height stayed the same and the scapholunate angle was 55° (►Fig. 3, 4, 5).

Case 3

The last patient was a 63-year-old retired woman with lunocapitate arthritis of her right wrist secondary to a chondrocalcinosis. She had a previous ipsilateral trapezometacarpal arthroplasty with a standard Pi² pyrocarbon implant 4 months before, with relief of her basilar thumb pain, but her wrist was still painful. The preoperative combined flexion and extension was 100°. The pain was 9 out of 10 on the VAS. There was carpal collapse with a carpal height of 0.48 and an increased scapholunate angle of 70°. She was treated by an

open resection of the capitate head, and the cavity was filled with a 6 × 12.5-mm capitolute Pi² implant. She was pain-free 3 months after surgery and was very satisfied with the operation at latest review of 2 years. The combined flexion-extension arc of motion was 110°. The carpal height measured 0.46, and the scapholunate angle was 60°. The correction of the DISI deformity was an interesting fact. It is probably the witness of the shapely adaption of the implant to the biomechanics of the carpal.

No implant dislocation was observed. The clinical results are reported in ►Table 1.

Fig. 1 Posttraumatic osteonecrosis of the capitate head, anteroposterior view.

Fig. 2 Posttraumatic osteonecrosis of the capitate head, lateral view.

Fig. 3 Lateral view of the implant in flexion.

Fig. 4 Anteroposterior view with the implant in place.

Discussion

Isolated arthritis of the lunocapitate joint remains a rare situation. It can be idiopathic, metabolic, or traumatic. Several previous publications discuss the surgical management of isolated lunocapitate arthritis. One important point is that this pathology occurs most of the time in young people. Several procedures have been described.^{1-7,13}

Partial wrist arthrodeses are logical solutions and include lunocapitate, scaphocapitate, and four-bone fusion, which can include the carpometacarpal fusion if the necrosis involves the entire capitate. Despite their reliability, an arthrodesis must be considered a palliative solution, as it limits the wrist range of motion. A partial wrist arthrodesis remain the most commonly used strategy of the authors to treat lunocapitate arthritis.^{2,5,6}

Bone resection with interposition has been proposed to preserve mobility. Interposition of a silicone implant has been reported by Bolton-Maggs et al with good short-term result.¹ Milliez et al also used a silicone implant in a 20-year-old woman with a long follow-up of 11 years.⁶ The patient was improved during 7 years, but massive bone reaction to silicone wear was noticed. Tendon interposition arthroplasty has also been described. Kimmel³ filled the cavity following resection of the capitate head with a palmaris longus tendon.

He reported good clinical and radiological result at 8 months follow-up. Lapinsky⁴ used the long extensor tendon of the fourth toe but had to revise this to a partial wrist arthrodesis at 6 months postoperatively.

Resection of the necrotic bone and drilling was reported by Murakami.⁷ Excellent clinical results were noted at the mid-term follow up of 1 year in two gymnasts. Still, early radiographic changes were noticed in both cases, with lateral translation of the distal carpal row and osteoarthritis.

The use of a pyrocarbon implant was reported by Dereudre et al.¹³ The authors filled the cavity of bone resection with an RCPI implant (Tornier, BioProfile, Grenoble, France). Good clinical results were reported at 22-month follow-up, but dorsal translation of the second row was diagnosed on X-rays. This implant was initially designed for capitate resurfacing after first-row resection. It is probable that its stem does not allow good adaptability to wrist stress in this indication with conservation of the proximal row.

Wrist denervation is another option for treatment.¹⁴ It may be effective for pain relief but it does not alter the natural evolution to carpal collapse and arthritis.

Based on our limited series, restoring the capitate head with capitollunate Pi² implant is another viable treatment alternative (►Fig. 6).

Fig. 5 Lateral view in extension.

Fig. 6 Operative view of the final implant.

Conflict of Interest

None

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