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Proximal row carpectomy associated with external fixation and biological arthroplasty: description of a case with severe arthritis following perilunar and transcaphoid dislocation

Carpectomia della prima filiera associata all'uso del fissato esterno e artroplastica biologica: descrizione di un caso con artrite severa secondaria a lussazione perilunata e transcafoidea

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Conflitto di interessi
Gli Autori dichiarano di non avere alcun conflitto di interesse con l'argomento trattato nell'articolo.

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Summary
Proximal row carpectomy is a common procedure used in wrist arthritis; a prerequisite for its surgical indication is integrity of cartilage surface of the capitate head and lunate fossa. We describe a case where proximal row carpectomy and biological arthroplasty have been associated to the use of external fixation in a patient with severe radio and midcarpal arthritis with long-term satisfactory results.

Key words: wrist arthritis, carpectomy, biological arthroplasty, external fixation

Riassunto
La carpectomia della filiera prossimale è una procedura comune usata nell'artrite di polso; un prerequisito per l'indicazione chirurgica è l'integrità della superficie cartilaginea della testa del capitato e della fossa lunata.
Descriviamo un caso dove la carpectomia della filiera prossimale e l'artroplastica biologica sono state associate all'uso del fissatore esterno in un paziente con grave artrite radio-carpica e mediocarpica con risultato a lungo termine soddisfacenti.

Parole chiave: *artrite del polso, carpectomia, artroplastica biologica, fissazione esterna*

Abbreviations
PRC: proximal row carpectomy
ROM: range of motion
RCPI: pyrocarbon prosthesis

Introduction

Prevalence of wrist arthritis is about 1-3% in the general population [1]. Two main surgical procedures are used for preserving wrist function: proximal row carpectomy (PRC) and scaphoid excision followed by four-corner arthrodesis [2] (4CF).
PRC is a widespread technique for the treatment of this diagnosis and it is capable of preserving wrist range of motion and strength, along with pain relieve. First described in 1944 [3], this surgical option is one of the main options for wrist arthritis followed by scaphoid excision and four-corner fusion.
The integrity of cartilage surface of the capitate head and the lunate fossa is a prerequisite for its surgical indication. The introduction of a pyrocarbon prosthesis (RCPI) has been described in this case as well as the combination with a capsular flap interposition arthroplasty [4-8].
Despite these alternatives, in some specific cases no a capsular flap or a RCPI is a valid option. The Authors describe a case where carpectomy and biological arthroplasty have been associated to the use of external fixation.

Case Report

A 57 year old manual worker man presented to our attention with history of trans-scaphoid perilunate dissociation with intra-articular fracture of the sigmoid notch of three months before which was treated at another institution by open reduction, external fixation and scapho-lunate repair. He complained of severe pain (VAS 7-8) with great limitation of pronation-supination and flexion-extension of the wrist: pre-operative ROM was 35° extension, 45° flexion, 10° radial deviation, 20° ulnar deviation. X-Ray showed with severe perilunate and periscaphoid arthritis (stage 4 according to Watson and Ballet), fragmentation of the proximal pole of the scaphoid, flattening of the lunate and malunion of the sigmoid notch fracture (Fig. 1). The study complies with national ethical standards and the Declaration of Helsinki. According to institutional protocols, the patient was given informed consent for surgery and for the collection of clinical data for scientific purposes at admission and before the surgery.

Surgical technique
Surgery was performed under loco-regional anesthesia.

Figure 1. Preoperative X-Rays.

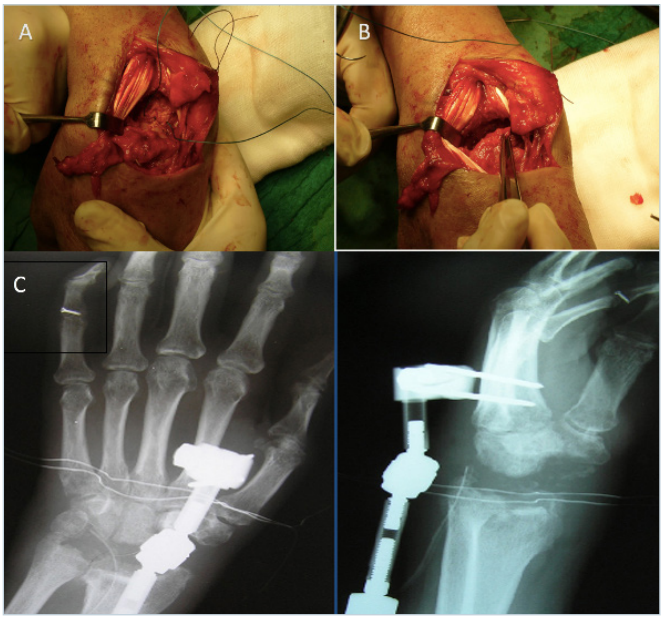

Figure 2. (A) Surgical image showing volar capsule after removal of the proximal row; (B) Distal based capsular flap including the interosseous dorsal ligament for the capitate and proximal based capsular flap for the lunate fossa; (C) Postoperative X-ray after proximal row carpectomy and external fixation.

Through a curved dorsal incision, we performed a proximal row carpectomy with a capsular flap covering the capitate head and lunate fossa together with distraction external fixation.
A 8 cm curved incision was performed on the dorsal aspect of the wrist, centered on Lister tubercule. A proximally based radial retinacular flap including the dorsal interosseous ligament freed from the triquetrum was prepared. Due to scarring related to the previous surgical procedure we could not identify the dorsal radio-triquetrum ligament which is commonly used as a flap for lunate fossa. The proximal row was then removed following the standard procedure.
Subsequently, the head of the capitate and the lunate fossa were prepared and covered the first with a distally based capsular flap and the former with the retinacular flap. The use of a capsular flap was necessary because of the severe condropathy on both surfaces. Both flaps were anchored to the volar capsule through non-absorbable sutures.
An external fixator (Stylo; MIKAI ITALY) was applied in distraction placing the hinge to the maximal isometric point of the new radio-capitate joint (Fig. 2).

Post-operative care

At 7 days post-op the hinge was opened and the wrist was passively mobilized by the physical therapist progressively. At 15 days active assisted ROM (range of motion) was allowed. At 21 days the hinge was left free and movements were allowed in all planes. The external fixator was removed at 6 weeks. Initial ROM was 35° extension, 45° flexion, 10° radial deviation, 20° ulnar deviation Physical therapy was encouraged till 6 moths post-op.

Results

Clinical result at three years were really unexpected: flexion 70°, extension 70°, radial deviation 15°, ulnar deviation 30°, pronation complete and supination -30°. 2 years follow-up XRAY (prededentemento è stato usato "X-Ray")showed good distraction and fair capitate surface, compared to the overall condition with no collapse or further arthritis.
Strength resulted 75% compared to the other side. Pain was absent (VAS 0).
During the following years, the patient continued his daily activities with no restrictions and without pain.
At our latest follow-up at 15 years, the patient continued to be free from pain and clinical examination revealed only a moderate restriction in flexion (75°) and x-rays showed progression of the osteoarthritic process as expected (Fig. 3).

Discussion

According to our knowledge, this technique has not been described for a similar condition.
In presence of a severe damage in the cartilage of the proximal pole of capitate and in the lunate fossa of the radius, PRC is usually followed by bad results, due to the worsening of the arthritic process.
In these cases, when pain is disabling, the procedures that are mostly indicated are wrist arthrodesis, if the patient wants to privilege strength, otherwise wrist arthroplasty, if movement is the final desiderated outcome.
Different alternative surgical procedures have been proposed in association with PRC when there is a damage of the proximal surface of the capitate.

Figure 3. (A) radiological results at 15 years; (B) clinical results at 15 years.

In 1996, Salomon et al.[10] proposed, in those cases of severe damage of proximal pole of capitate, the use of a capsular flap, offering an alternative to the surgeon instead of arthrodesis.
Later in 2009 capsular interpositional arthroplasty has been described by Kwon et al[5] in those case of severe cartilage degeneration of proximal capitates and/or lunate facet; they achieved a mean of 71.9° of flexion-extension arc and 66.8 % of grip strength respect the controlateral side. Ilyas et al[6] in 2010 described a modification of proximal row carpectomy with dorsal capsular flap for cases with severe midcarpal arthritis.
In our case, the contemporary use of capsular flap and external fixation, contributed to the extremely unexpected results both in terms of pain, arc of movement and strength.
The use of an external fixator in distraction allows to stabilize the new radio-capitate joint, protect the biological arthroplasty and permits an early articular joint motion.
Proximal row carpectomy remains the best option in case of severe arthritis as a salvage technique. Average post-operative ROM following this procedure, includes 41° of flexion and 46° of extension, 13° of radial deviation and 22° of ulnar deviation.
On the other hand four corner fusion can be an option for those eligible patients and when strength is our patient's priority. In this case average ROM is 32° of flexion, 29° of extension with 10°-16° of radial/ulnar deviation.
Despite being a single isolated case, our patient showed way better results compared to both procedures and presents as a promising and reliable technique.
In the presence of a young, active and particularly motivated patient, the described procedure could be a valid alternative to major surgical treatments.

Conclusions

We describe a case of a man with severe perilunate and periscaphoid arthritis, fragmentation of the proximal pole of the scaphoid, flattening of the lunate and malunion of the sigmoid notch fracture treated successfully with carpectomy, capsular flap and the use of an external fixator in distraction. At 15 years from the surgery, the patient is pain free and has only a moderate restriction in flexion.

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