CASE REPORT

More than 40 years' follow-up of an unconstrained metal lunate replacement for the treatment of Kienböck's disease

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Accepted 28 February 2018

SUMMARY

Kienböck's disease is characterised by avascular necrosis of the lunate bone, and over the years it has been a challenging disease to manage, with differing opinions on the best intervention. We present an interesting case of a metallic unconstrained lunate replacement that is still functioning well in a patient 40 years after surgery. This case report represents the longest follow-up of any such prosthesis.

BACKGROUND

Kienböck's disease is characterised by avascular necrosis of the lunate bone, resulting in significant pain and disability. The exact aetiology is unknown, but trauma, vascular, mechanical and anatomical factors may all contribute to its formation, leading to progressive degenerative changes to the carpus.¹ The symptoms include wrist pain, limited range of motion and decreased grip strength.² It has been classified radiologically in to four main stages (table 1).³ The treatment of this disease remains controversial, and no one treatment has been found

to be superior.⁴ One option is lunate excision and replacement, and was first reported in literature in 1951 by Danis⁵; further reports followed. Earlier implant designs were unconstrained (where the implant is inserted and not attached to surrounding structures) compared with recent semiconstrained implants (where bone sutures and anchors are used to stabilise the implant)⁶ (figure 1). Materials used for lunate replacements include silicone, acrylic, titanium and pyrocarbon.

Here, we present the 40-year follow-up of a patient with an unconstrained lunate replacement—the longest follow-up of its kind in the literature for this type of prosthesis.

CASE PRESENTATION

A 72-year-old car mechanic presented to the emergency department with right wrist pain. The patient reported he was trying to stop a heavy paint container from falling (5 kg) and the sudden movement and impact resulted in sharp pain at the wrist.

INVESTIGATIONS

Right wrist radiographs (figures 2 and 3) revealed a metallic lunate replacement with degenerative changes. No fracture was found.

TREATMENT

The patient was treated with anti-inflammatory drugs and splint immobilisation for 2 weeks, after which he was seen in clinic. Radiological and clinical assessment of the wrist was performed; visual analogue score (VAS) and function scores were obtained along with clinical images. Patient consent was obtained for publication.

OUTCOME AND FOLLOW-UP

At 2 weeks' follow-up, he was pain free and had normal use of his wrist. His VAS was 0/10, functional score was 9/10, grip muscle power was 5/5 and he denied any restriction or limitation of activities. He had a range of movement of 40 degrees wrist extension, 30 degrees flexion, with very limited radial and ulnar deviation (figures 4–6). Radiographs revealed moderate to advanced arthritic changes; the lunate replacement prosthesis was in situ.

DISCUSSION

The patient had an unconstrained lunate replacement done in the late 1960s by Mr Goodfellow

Figure 1 Example of a semiconstrained pyrocarbon lunate replacement, produced by Integra (Plainsboro, New Jersey, USA).⁶ The two holes allow passage of suture anchors to help stabilise the prosthesis.

To cite: Parwaiz H, Elnikety S. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-223546

Table 1 Lichtman classification of Kienböck's disease

Stage	Description
I	No visible changes on X-ray, changes seen on MRI
II	Sclerosis of lunate
IIIA	Lunate collapse, no scaphoid rotation
IIIB	Lunate collapse, fixed scaphoid rotation
IV	Degenerated adjacent intercarpal joints

(Oxford, UK) using a metallic prosthesis for advanced Kienböck's disease. He recalls being one of the first cohort to have this particular prosthesis.

Lunate excision alone has poor results and has fallen out of favour.⁷ Goodfellow states that the success of lunate replacement is largely due to preservation of the normal architecture and anatomy of the carpal row, which prevents further collapse of the carpal row and development of osteoarthritis.⁸ In his original paper, he described using an acrylic implant cast from cadaveric lunate bones of differing sizes. The technique involved a small dorsal transverse incision, excision of the lunate bone in its entirety (under radiological guidance) and insertion of the prosthesis. Complete excision of the bone is important to prevent new bone formation, as part of the biological response to retained bony fragments, which would affect function and outcome. No ligament or capsular repair was deemed necessary, and as part of the learning curve of this relatively new technique, patients were mobilised sooner and sooner to aid rehabilitation.

Figure 2 Posteroanterior radiograph of the right wrist showing the unconstrained metallic lunate replacement. Degenerative osteoarthritic changes can also be seen.

Figure 3 Lateral radiograph of the right wrist showing the unconstrained metallic lunate replacement.

Follow-up of these patients revealed good long-term relief of pain and good functional outcome, with little radiological evidence of carpal collapse or progression of osteoarthritis, and almost all his patients returning to demanding and heavy manual work without significant limitation.⁹

Lunate replacement is a salvage operation for end-stage Kienböck's disease. Alternatives include autogenous tendon replacement arthroplasty, revascularisation, radial shortening, ulnar lengthening, limited intercarpal arthrodesis, wrist denervation and proximal row carpectomy.² In comparison with an unconstrained lunate replacement, these newer measures add further comorbidity (tendon or bone graft harvesting), poor postoperative function (arthrodesis) and do not adhere to the principle of maintaining anatomy of the carpal row (lengthening and shortening procedures).

A review of the available literature reveals that multiple implant materials have been used such as acrylic, silicone, ceramic, metal, autologous tendon grafts, vascularised bone grafts and, more recently, pyrocarbon.^{2 3 8-15} Historically, studies have reported on lunate replacement with mixed results. A long-term follow-up of 22–36 years recommends that silicone lunate replacements should no longer be used due to high rates of silicone cyst and silicone synovitis formation.¹³ Good functional and radiographic outcomes have been reported following acrylic lunate replacement,⁸⁻¹⁰ and Mir *et al* show that using a vascularised scaphoid graft with partial arthrodesis has good results.¹⁴ In contrast, although a semiconstrained pyrocarbon implant was shown to have good functional outcomes, there are concerns regarding design and stability that only long-term studies will clarify.¹⁵

Figure 4 Appearance of the patient's wrists at fracture clinic review.

Ultimately, none of these studies reported a follow-up as long as 40 years for an unconstrained metallic lunate prosthesis, and our patient has had an extremely good functional outcome from this procedure. This case report shows that it is possible for this

Figure 5 Maximum achievable wrist extension—equal on both sides.

Figure 6 Maximum achievable wrist flexion—equal on both sides.

implant to have good longevity and outcome, even in a patient with high functional demand, and that the procedure is minimally invasive and technically straightforward.

Learning points

- ▶ Kienböck's disease is characterised by avascular necrosis of the lunate bone, resulting in significant pain and disability.
- ▶ Lunate replacement is a salvage operation for end-stage Kienböck's disease.
- ▶ Unconstrained metallic lunate replacement implants have the potential to last over 40 years even in patients with high functional demand, without complication.

Contributors HP analysed data, performed review of current literature and prepared and wrote the manuscript for submission. SE treated the patient who is mentioned in the case report, consented them for use of their data for publishing, helped to write the paper and obtained images used in the paper. Both authors have seen and approved of the manuscript proof prior to submission.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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