

## **Lunate excision, capitate osteotomy, and intercarpal arthrodesis should be used with caution for advanced Kienböck's disease**

Dear Sir,

Li et al. (2018) described their results of capitate osteotomy and transposition combined with an iliac bone graft to treat advanced Kienböck's disease with reference to Lu et al. (2006). The surgical procedures of Li et al. (2018) included excision of the necrotic lunate and proximal transposition of the proximal part of the capitate. The basic idea of this technique was described by Graner et al. (1966). Since that report, there have been several publications regarding this technique, its modifications, and their mid-term as well as long-term results (Bartelmann et al., 1998; Braun et al., 1988; Ehall et al., 1989; Facca et al., 2013; Hierner and Wilhelm, 2010; Nonnenmacher et al., 1982; Takase and Imakiire, 2001).

Graner et al. (1966) used this technique not only for lunate malacia (Kienböck's disease), but also for painful scaphoid nonunions and old carpal bone fractures with dislocation. In treating Kienböck's disease, they preserved or excised the lunate, depending on intraoperative viability of the lunate. If the lunate was viable, they kept the lunate and arthrodesed the capitate with its surrounding carpal bones using temporary K-wires and interposed cancellous bone chips. They did not perform a capitate osteotomy. This procedure became well known as the Graner I technique in Germany and France. The Graner I technique did not revascularize the lunate well. The outcomes of this procedures performed by other surgeons were not as good as Graner et al. (1966) reported. However, some surgeons did not publish their outcomes on this technique (Facca et al., 2013).

Graner et al. (1966) removed the lunate and cut and moved the proximal fragment of the capitate proximally, supported by cancellous bone graft, when the lunate was not viable. The proximal facet

of the capitate then contacted the lunate fossa of the radius. In addition, all carpal bones except the trapezium were arthrodesed. This procedure became known either as Graner II or the modified Graner procedure (Bartelmann et al., 1998; Takase and Imakiire, 2001). The Graner II procedure is very similar to the technique that Lu et al. (2006) and Li et al. (2018) used, except that the Graner II procedure included arthrodesis of the transected capitate with other carpal bones. The 5-year results of the Graner II procedure were comparable with those described by Li et al. (2018).

Fenollosa and Valverde (1970) reported on a variation of this procedure by limiting the intercarpal arthrodeses to the capitate and hamate, which reduced wrist motion less than the almost complete intercarpal arthrodeses created by the Graner I and II procedures. Their method, sometimes called 'Graner III', was criticized because it could induce carpal instability (Bartelmann et al., 1998) when the ligaments surrounding the capitate were destroyed or markedly weakened.

The 5-year results in the report of Li et al. (2018) were universally satisfactory. In contrast, Takase and Imakiire (2001) reported that 5 years after surgery 11 out of 15 patients undergoing Graner II procedure had good results according to the scoring system of Evans et al. (1986). Nonnenmacher et al. (1982) described how their own previously good results obtained at 2 years postoperative declined with time over 25 years follow-up. This procedure is no longer preferred in Germany and France because of the declining long-term outcome (Facca et al., 2013). As far as I know, this method is not used in Europe any longer. Therefore there have been no publications on this technique.

The clinical report of Facca et al. (2013) is in line with my personal experience, which was derived when I was a resident in Germany. My teachers told me that they stopped doing Graner II operations due to mediocre results. They had actually done what Li and colleagues (2018) have done: only transposing and fusing the capitate with iliac bone graft and K-wires without

the more invasive arthrodesis originally described by Graner himself. But even those modifications did not lead to satisfactory long-term results. This experience has unfortunately not been published or quantified as one would expect today.

Kienböck's disease, described over a century ago, is still difficult to treat. Although several treatments have been described, there is still no optimal treatment. Some methods have had acceptable results (Charre et al., 2018; Luegmair et al., 2017). The main problem is that Kienböck's disease occurs in young patients, and decades-long follow-up is needed to determine outcome. Notwithstanding the measurement parameters or the person measuring the outcome (surgeon, therapist, or patient), a satisfactory 5-year result may be good, but that is certainly not a long enough follow-up. Even after 25 years, the longest follow-up in the references, the patient may still have decades to live with his wrist. This leaves us with the quest for optimal treatment of this disease.

The European literature, including publications from Germany and France, documented outcomes of capitate lengthening osteotomy beginning about 50 years ago. These articles indicate that the capitate osteotomy did not have good long-term results. Consequently, this procedure was no longer widely used 20 years ago in Germany and many other European countries, where this procedure was originally advocated. Several of the references of this letter are available only in German or French, which makes it difficult for colleagues and authors throughout the world to access this knowledge. Understandably, the authors outside these European countries are unaware of the poor long-term outcomes of these procedures that have been known to many German and French hand surgeons for decades.

## References

- Bartelmann U, Richter N, Landsleitner B. Graner operation in therapy of semilunar bone necrosis. Review of the literature and personal results. *Handchir Mikrochir Plast Chir.* 1998, 30: 165–74. [in German].
- Braun C, Bühren V, Seiler H. The Graner capitate interposition arthroplasty in lunatic malacia. *Handchir Mikrochir Plast Chir.* 1988, 20: 314–7. [in German].
- Charre A, Delclaux S, Apredoai C, Aysel JE, Rongieries M, Mansat P. Results of scaphocapitate arthrodesis with lunatic excision in advanced Kienböck disease at 10.7-year mean follow-up. *J Hand Surg Eur.* 2018, 43: 362–8.
- Ehall R, Pierer G, Neubauer W, Stampfel O. Intercarpal pseudarthrosis as a complication of Graner's operation. *Handchir Mikrochir Plast Chir.* 1989, 21: 257–61. [in German].
- Evans G, Burke FD, Barton NJ. A comparison of conservative treatment and silicone replacement arthroplasty in Kienböck's disease. *J Hand Surg Br.* 1986, 11: 98–102.
- Facca S, Gondrand I, Naito K, Lequent T, Nonnenmacher J, Liverneaux P. Graner's procedure in Kienböck disease: a series of four cases with 25 years of follow-up. *Chirurgie de la main.* 2013, 32: 305–9.
- Fenollosa J, Valverde C. Results of intracarpal arthrodesis in the treatment of lunatic necrosis. *Rev Chir Orthop Rep Appar Mot.* 1970, 56: 745–54. [in French].
- Graner O, Lopes EI, Carvalho BC, Atlas S. Arthrodesis of the carpal bones in treatment of Kienböck's disease, painful united fractures of the navicular and lunatic bones with avascular necrosis, and old fractures dislocations of carpal bones. *J Bone J Surg Am.* 1966, 48: 767–74.
- Hirner R, Wilhelm K. Long-term follow-up of callotaxis lengthening of the capitate after resection of the lunatic for the treatment of stage III lunatic necrosis. *Strategies Trauma Limb Reconstr.* 2010, 5: 23–9.
- Li J, Pan Z, Zhao Y, Hu X, Zhao X. Capitate osteotomy and transposition for type III Kienböck's disease. *J Hand Surg Eur.* 2018, 43: 708–11.
- Lu L, Gong X, Wang K. Vascularized capitate transposition for advanced Kienböck disease: application of 40 cases and their anatomy. *Ann Plast Surg.* 2006, 57: 637–41.
- Luegmair M, Goetz F, Kalb K, Cip J, van Schoonhoven J. Radial shortening osteotomy for treatment of Lichtman Stage IIIA Kienböck disease. *J Hand Surg Eur.* 2017, 42: 253–9.
- Nonnenmacher J, Naett R, Ben Abid M. Intracarpal revascularizing arthrodesis with transposition of the capitate (Graner type II). *Ann Chir Main.* 1982, 1: 256–9.
- Takase K, Imakiire A. Lunatic excision, capitate osteotomy, and intercarpal arthrodesis for advanced Kienböck disease: long-term follow-up. *J Bone Joint Surg Am.* 2001, 83: 177–83.

**Mike Ruettermann<sup>1,2</sup>**

<sup>1</sup>University Medical Center Groningen, UMCG, Groningen, The Netherlands

<sup>2</sup>HPC, Oldenburg Institute for Hand- and Plastic Surgery, Oldenburg, Germany

Email: mikeruettermann@yahoo.com

© The Author(s), 2018.



Article reuse guidelines:

sagepub.com/journals-permissions

doi: 10.1177/1753193418807360 available online at <http://jhs.sagepub.com>