The arthroscopically assisted plate-fixation of the distal radius fracture.

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Abstract

In the aim to improve the treatment of the intraaticular or dorsally unstable fracture of the distal radius, we have combined the ORIF with a modified technique of wrist arthroscopy. In a prospective clinical study we have compared two groups, one treated with dorsal plate fixation alone, and one with additional wrist arthroscopy. We found the arthroscopy to ad no further improvement to the reposition achieved by fluoroscopy. On the other hand, we found no arthroscopy-related complications. In the arthroscopy group, there was a significant number of trauma-associated intraarticular lesions, that ware treated immediately. We conclude that further outcome improvement may not be achieved on the fracture side, but by more detailed access and immediate treatment of the associated intraarticular lesions.

The usefulness of an arthroscopy in the treatment of the distal radius fracture is being discussed controversially since the early 90ies [1,2]. Although investigated in many studies, arthroscopy is still rarely used. One reason is, that in all studies performed, arthroscopy is limited to assist reduction on a suspended wrist with traction, which technically only makes a k-wire stabilisation possible [3,4,5,6,7,8]. Additionally the vertical position usually requires the use of a special fluoroscopy appliance. This may be the reason, why no study on an arthroscopically assisted plate-fixation was reported until now. On the other hand, there is a wide agreement about wrist arthroscopy being the gold standard in detecting intraarticular soft tissue injuries [3,9,10,11,12]. Even arthrography and magnetic resonance imaging were proven by several studies to be less reliable, [13,14,15,16]. Although a wide

dorsal arthrotomy might also give a limited view into the radiocarpal space, it should be avoided because of serious disadvantages, like fragment devascularisation, joint denervation and capsular scarring followed by a limited flexion [17],[18],[19]. The incidence of intraarticular soft-tissue lesions associated with distal radius fractures varies in studies from 30% to 94% [20,21]. Their influence on the outcome is growingly emphasized, such as some authors even recommend to abandon the postoperative early active exercises, because of an intraarticular ligament lesion is rather the rule, than the exception [9],[21].

In the department for traumatology of the University Clinic Basel, ORIF on the distal radius is performed in a proprietary manner [22] without the joint capsule being opened. In this study, to control the reposition of the joint surface and monitor any accompanying intraarticular lesions, we have additionally applied a new technique of wrist arthroscopy, as developed previously in the hand-department of our clinic [23]. By abandoning distraction and the vertical position, it can be combined with any open procedure on the distal radius.

This prospective clinical study investigates the capabilities of the combined plate fixation and wrist arthroscopy by comparing the outcomes with the conventional procedure.

Material and methods

The study comprises 65 patients with an acute fracture of the distal radius, with a given indication for an open reduction and internal plate fixation from the dorsal approach according to our clinics criteria. These are all inraarticular fractures with a displacement of the joint surface of more than 1mm, or very distal and unstable fractures with dorsal dislocation. 31 patients (group-I) were selected by random to undergo a wrist arthroscopy in one session with the plate fixation. 34 patients (group-II) fulfilled the same criteria, but had no arthroscopy. All patients were operated between July 1999 and February 2001. Both patient groups were statistically equal with respect to the basic data like age (group-I = 53,5 years; group-II = 49,7 years), male to female relation (group-I = 0,75:1; group-II = 0,81:1) and surgery having performed in mean 2,1 days after trauma. For statistical comparison the student's t-test was used, with the level of significance set to ≤ 0.05.

ORIF:

The open reductions and internal fixations were performed by different surgeons, all fellows of the department of traumatology, but in a standardised manner according to the clinics policy. This comprises a modified dorsal approach between the third and fourth extensor sheath, with the sheath of the EPL tendon left closed if possible. The joint capsule is not opened, the fracture is displaced and the bony defect is filled up with a hydroxyapatite ceramic graft (Surgibone®). A correct reposition has to be achieved mainly with the graft. Stabilisation is than reached with two 2mm titanium plates [24]. For best stability, the plates must be placed into the first and the ulnar aspect of the fourth extensor sheath in an angle of 50° to 70° from the coronary point of view[25] **(figure 1)**. Fluoroscopy is used whenever needed.

Figure 1

Arthroscopy:

All arthroscopies were performed by one surgeon only. We started the arthroscopies after the plates were provisionally mounted. The arm was kept lying freely on the operating table without distraction. No change in the positioning after the ORIF was necessary. The joint capsule was perforated according to the approaches III-IV and IV-V and an accessory MCU-approach was set through the skin. The joint was filled with ringer's solution and intraarticular pressures up to 150mm hg ware applied. A 2.4mm arthroscope with a 30-degree angled field of vision was than entered with the blunt trocar. The wrist

remained mobile in all direction, making stress tests of the intercarpal ligaments under arthroscopic view possible. The fracture was than visualised and reposition was improved if necessary. Always both, the radiocarpal and the midcarpal space, were walked through in a standardised way **(figure 2)**. All arthroscopies were documented in a special protocol and photographically.

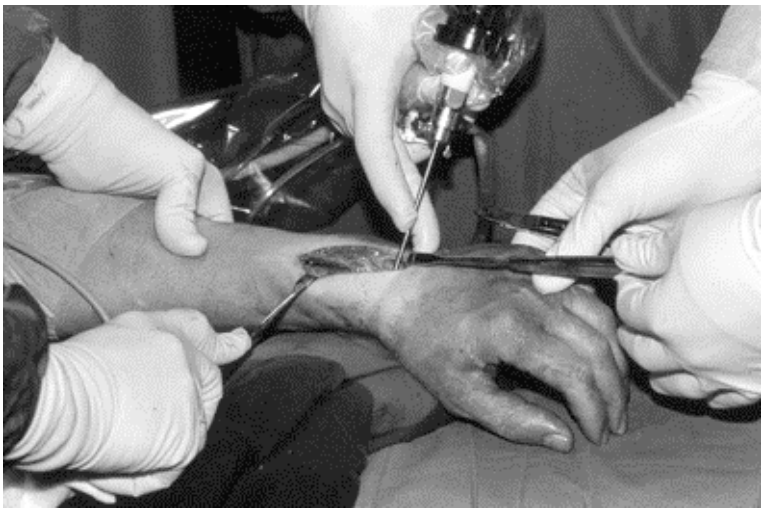

Figure 2

Closure and postoperative care:

The extensor retinaculum was split and a part was passed under the tendons of the fourth compartment to cover the distal aspect of the plate, and protect the tendons. The EPL-tendon was brought back into it's anatomical position. The remaining wound layers ware closed anatomically and a soft dressing was applied. Plaster fixation was added only if made necessary by an arthroscopical procedure, such as pinning the scapholunate ligament. In a routine case, a program of early active range-of-motion exercises was initiated.

Controls:

After the operation, routine controls were performed by the surgeon or by the clinic's registrars before discharge, after 4 weeks, after 6 months and eventually after 1 year. For the study's purpose all patients were assessed additionally by an independent examiner 3 months after surgery, with examination according to the upper limb DASH-Questionnaire[26] and the modified Green – O'Brien score[27],[28]. The grip strength was

measured with the JAMAR-dynamometer (TEC, New Jersey) on lever II. The pinch strength was measured with the PG30-dynamometer (B&L-Engineering, Santa-Fe).

Results

There were no statistical differences between the groups in any criteria, proving the arthroscopy not to alter the outcome **(table 1)**. On the other hand, in the group I, the arthroscopy unveiled 21 intraarticular accompanying lesions in 18 cases **(table 2)**.
9 of these lesions had a direct consequence for the treatment. During the operation, these were additional scapholunate pinning in 3 cases, and ones the correction of fracture reposition despite a normal picture in fluoroscopy. For the postoperative care, in 5 cases a brace had to be prescribed, despite a stable fracture fixation. With the numbers available, we did not find any correlation between the severity of the fracture according to the AO/ASIF classification and the frequency of intraarticular lesions. Even for the total scapholunate lesions, they occurred in intraarticular as well as in extraarticular fractures (A1, A1, C1, C2).

Green and O'Brien score	**Group-I n**	**Group-I %**	**Group-II n**	**Group-II %**
Excellent	16	51,6%	14	41,1%
Good	13	42,0%	18	53,0%
Fair	1	3,2%	2	5,9%
poor	1	3,2%	0	0

Table 1

Lesion type	n
Total scapholunate lesion (grade-IV by Geissler-Hempfling)[5,29]	4
Partial scapholunate lesion (grade-II or III by Geissler-Hempfling)	3
Discus lesion Palmer type A	2
Discus lesion Palmer type B	2
Discus lesion Palmer type D	2
Flake fracture	1
Significant cartilage lesion	6
Insufficient fracture reposition	1

Table 2

Complications:

In the group-I, there was one case of deep infection that had to be revised and the internal fixation abandoned. In the group-II, there was one case of implant failure with revision and one case of EPL-adhesion, that untied spontaneously under therapy. Statistically the complications were not group-related. For specific arthroscopy-related complications, the time of the operation and touniquet exceeded in 3 cases the limit of 2 hours, but in all cases the ORIF it self already took more than the average. There were no other arthroscopy-related complications, especially there was no case of CTS postoperatively, despite the relatively high intraarticular pressure used.

Conclusion

Open reduction and plate fixation on the distal radius, if performed correctly, delivers an excellent result, that is hard to beat. The fluoroscopy-controlled reposition of the articular surface is not significantly improved by arthroscopy. But wrist arthroscopy remains the only mean to reliably detect an accompanying soft tissue lesion at the time of treatment [5,14,15,16,20,21]. Like many other authors [3,5,7,9,11,20,30], we found a surprisingly high number of serious intraarticular injuries (33,2%). And like other investigators [5,9,10] we feel that they may be the explanation for some poor outcomes after seemingly well-healed fractures. If left untreated, ligament lesions may later lead into wrist instability and require a graft-reconstruction or a selective arthrodesis, that will no more bring comparable results [30,31,32,33]. After the planned follow-up of three months, there was no difference between the

groups' outcome, confirming the additional arthroscopy to cause no disadvantages or complications. The improved outcome in the group-I due to the treated intraarticular lesions may be detectable after a mid term follow-up, when eventually untreated instabilities in the control group have become symptomatic. The established plate fixation of the distal radius fracture may not leave much space for improvement. But in detecting and treating the associated intraarticular lesions in one session, further outcome improvements seem possible.

In our study, we have investigated a new technique of wrist arthroscopy combined with ORIF. The arthroscopy requires no more change in positioning and thus the amount of time and technical expenditure is reduced. Additionally, ligament instability can by dynamically visualised, due to the freely movable wrist. We think of our technique as simple and reliable to be adapted by every surgeon performing ORIF on the distal radius. We advocate the use of arthroscopy in selected fractures, arthrotomy should be abandoned. Trauma-associated inraarticular lesions should be treated immediately with the fracture.

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