Radial head fractures are common injuries, occurring mostly in active young people 85%. Treatment of the more complex radial head fractures (Mason type III and IV), appear to be challenging and remain a subject of controversy. Replacement of the radial head with a metal prosthesis imitates the stabilizing role of the radial head and has been considered as the treatment of choice. However, long-term results are scarce. We report our mid to long-term (mean 9.4 year) clinical and radiographic results after insertion of a Judet Bipolar Radial Head prosthesis. 34 patients were treated with the Judet Bipolar Head prosthesis between 2000 and 2008. In this study, 21 patients were re-examined after a mean period of 113 months (range, 174-84), ie, 9.4 years (range, 14.5-7). Follow-up examinations included both the Mayo Elbow Performance Index (MEPI) and Disabilities of the arm, shoulder and hand (DASH) score. Range of motion was measured with a hand goniometer. X-rays were evaluated for peri-articular ossifications, radiolucent lines and signs of proximal erosion, capitellar erosion.

Mean Mayo Elbow Performance Index was 88.6 (Range 100-50). According to the MEPI score we had 14 excellent, 1 good, 5 fair results and one poor result. One patient reported severe pain, 3 patients reported moderate pain, one patient reported mild pain and 16 patients reported no pain at all. Difference between pronation-supination range was noted between primary or secondary indication of the radial head, no other significant differences were found. Mean DASH score was 23.1° (Range 0-63) without difference between primary and secondary indication. Mean flexion was 121.8° (Range : 110-140), mean extension deficit was 24.8° (Range 15-40), mean pronation was 62.4° (Range : 50-80) and supination 58.8° (Range : 45-80). Ten patients showed signs of ulnoumural joint degenerative arthritis. One patient developed symptomatic ulna plus. One patient showed radiolucent lines surrounding the prosthesis with proximal bone erosion. There were no reports of dislocations of the prosthesis. One case of radiological signs of overlengthening was noted. Mainly good clinical results are achieved with the Judet bipolar radial head implant. Functional results after long term follow-up are, however less optimistic.
then the excellent results achieved after short- to mid-term follow-up. No clear link between radiological signs and functional results can be found.

Keywords: radial head prosthesis; judet.

INTRODUCTION

Radial head fractures are common injuries, they represent up to 1.7-5.4% of all fractures and 33% of all elbow fractures (9,10,15,16). Occurring mostly in active young people 85% the main mechanism is a fall onto an outstretched hand with the forearm in supination and the elbow in extension (9,10,15).

Strategy of treatment is based on the widely used Mason classification modified by Johnston (15) and Broberg Morrey (6,18). Treatment of the more complex radial head fractures (Mason type III and IV), appear to be challenging and remain a subject of controversy (3,11). Most type III and IV fractures are caused by high-energy trauma, they are often accompanied by ligament injuries. In these cases the radial head becomes the primary stabilizer of the joint (2,23,26).

Open reduction and internal fixation (ORIF) should be considered when encountering these fractures whenever possible in order to restore stability and anatomy of the elbow joint. ORIF can be a challenge in severely comminuted fractures. When stable fixation cannot be achieved, complications as non-union, limited forearm rotation and necrosis of the bone fragments might occur (20,21).

Alternate options when stable fixation cannot be achieved are radial head resection and radial head replacement. For a long time, radial head excision was the recommended type of treatment, but post-operative complications were frequent (2). If excision of the radial head is performed, this will lead to proximal radial migration and valgus instability, when accompanied by soft tissue damage. This will lead to a variety of symptoms such as pain, weakness, cubitus valgus, ulnar nerve neuritis, instability of the elbow and wrist problems (5,24,25,27). Replacement of the radial head with a metal prosthesis imitates the stabilizing role of the radial head (i.e. varus-valgus and axial fore-arm stability) and has been considered as the treatment of choice. By conserving the stability of the elbow joint, the previously mentioned complications can be prevented (1,4,7,8,17,19,22,28). Despite complications such as stem loosening, radiocapitellar erosion, radiolucent lines, heterotopic ossification and osteoarthritis, the clinical and radiographic short-term (<5 yrs) and mid-term (5-10 yrs) results of radial head arthroplasty are promising (1,4,5,8,17,20,21). However, long-term results are scarce. We, hereby, report our mid to long-term (mean 9.4 year) clinical and radiographic results after insertion of a Judet Bipolar Radial Head prosthesis.

MATERIALS AND METHODS

In our department, 34 patients were treated with the Judet Bipolar Head prosthesis between 2000 and 2008. In this study, 21 patients were re-examined after a mean period of 113 months (range, 174-84), ie, 9.4 years (range: 14.5-7). Prosthetic replacement was mostly performed as primary treatment method for comminuted fractures of the radial head and sometimes after primary osteosynthesis or radial head resection. Fourteen prosthesis were placed primarily, 3 were placed after radial head resection and 1 after failed osteosynthesis. Two prosthesis were placed after failure of a primary radial head prosthesis and one for destruction of the radial head caused by rheumatoid arthritis.

Of the 14 fractures (primary indication), 7 were classified as Masson III, 7 were classified as Masson IV with dislocation of the elbow joint. According to the Regan and Morrey classification there were 4 type I, 2 type II and 2 type III fractures of the coronoid. There was one radial head fracture associated with an open fracture-dislocation of the proximal humerus (Gustillo type II open fracture).

After approval by the ethics committee of the University Hospital of Antwerp (B300201523719), an informed consent was presented to each patient and subsequently signed. Antero-posterior (AP) and lateral X-rays of the elbow were made and follow-up examinations were performed.

Follow-up examinations included both the Mayo Elbow Performance Index (MEPI) and Disabilities of the arm, shoulder and hand (DASH) score. The MEPI score has a maximum of 100 points: pain (45 points), range of motion (20 points), stability (10 points), and function (25 points) are evaluated. The DASH score has a set of 30 questions concerning functional performance of the
patient. All patients completed the entire set of 30. Range
of motion was measured with a hand goniometer.

X-rays were evaluated for peri-articular ossifications
according to the Hastings and Graham classification for
heterotopic ossification of the upper-limb (14). Furthermore, we evaluated the X-rays for radiolucent lines and
signs of proximal erosion, capitellar erosion and suboptimal
placement of the Judet implant.

Hastings and Graham classification:

Class I: Without functional impairment
Class II: subtotal limitation
  Class IIA: limitation flexion / extension
  Class IIB: limitation pro/supination
  Class IIC: limitation both planes
Class III: complete bony ankylosis

Degenerative changes of the capitellum:

Grade I: Increased subchondral density
Grade II: Mild erosion
Grade III: Severe erosion

Degenerative changes of the ulnohumeral joint:

Grade I: Increased subchondral density
Grade II: Joint space narrowing
Grade III: Severe changes/ankylosis

RESULTS

Mean Mayo Elbow Performance Index was 88.6
(Range 100-50). According to the MEPI score we
had 14 excellent, 1 good, 5 fair results and one poor
result. One patient reported severe pain, 3 patients
reported moderate pain, one patient reported mild
pain and 16 patients reported no pain at all. Difference
between pronation-supination range was noted
between primary or secondary indication of the
radial head (Table I), no other significant differenc-
es were found.

Mean DASH score was 23.1° (Range 0-63) with-
out difference between primary and secondary indica-
tion. Mean flexion was 121.8° (Range : 110-140),
mean extension deficit was 24.8° (Range 15-40),
mean pronation was 62.4° (Range : 50-80) and sup-
pination 58.8° (Range : 45-80).

Fourteen patients showed radiological signs of
capitellar erosion. One was minor, showing only in-
creased subchondral density. 7 Patients showed
mild erosion on X-ray of whom only one was symp-
tomatic. The remaining 6 patients showed signs of
major erosion of whom 3 were symptomatic. Of the
fourteen patients with capitellar erosion, 4 indicated
pain on the MEPI score. All 4 patients with pain
showed radiological signs of ulnohumeral joint de-
generation, showing moderate to severe joint nar-
rrowing.

Ten patients showed signs of ulnohumeral joint
degenerative arthritis. (I:1 II:6 III:3). One patient
had a radial head replacement for destruction of he
radial head caused by rheumatoid arthritis (Fig. 1).
She happened to be our longest follow-up of
174 months, indicating no pain and having almost
perfect range of motion. She did show signs of
severe capitellar erosion and ulnohumeral joint
narrowing.

One patient developed symptomatic ulna plus.
This patient decided to be treated conservatively. 3
One patient showed radiolucent lines surround-
ing the prosthesis with proximal bone erosion
(Fig. 2). This patient was treated with resection of
the radial head prosthesis. There were no reports of dis-
locations of the prosthesis. One case of radi-
ological signs of overlenghtening was noted. This
patient was symptomatic with a MEPI score of 50
and a DASH score of 63. No radiological signs of
capitellar erosion were seen with this patient.

Table II shows the summary of our results (Ta-
ble II).

The radial head prosthesis was implanted be-
cause of a Mason IV fracture of the radial head.

Table I. — Results of primary and secondary indications
of the Judet radial head prosthesis

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DISCUSSION

Radial head prosthesis has found its place in treatment of complicated radial head fractures. Both monobloc and bipolar metal designs have proven to restore stability in the elbow joint (10,15,16,18).

A specific subgroup of patients showed good results after radial head resection Antuña et al (2)

Table II. — Results of our long-term follow-up of the Judet radial head prosthesis

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<th>Ext</th>
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F/U : months follow-up ; cap : capitellar erosion ; Cor : coronoid fracture ; UHJ : ulnohumeral joint arthritis ; HO : heterotopic ossification ; RLL : radiolucent lines.

Significant capitellar erosion and radiolucent lines were noted on the X-ray. He had radiological signs of third degree ulnohumeral osteoarthritis. The patient was severely limited in activities of daily life. A salvage operation was performed, resecting the radial head prosthesis. Photographs taken during the procedure indicates the level of capitellar erosion. 5 patients had significant capitellar erosion (Fig. 3).

Fig. 1. — Patient with 174 month follow-up, 66 year old female with rheumatoid arthritis. Note the significant, though asymptomatic, capitellar erosion pattern.
fore the first postoperative year. The other 16 were progressive, ending in loosening of the prosthesis in 5 cases.

Burkhart et al reported results of 19 patients treated with the Judet bipolar design in an 8.8 year follow-up (7). They had 6 excellent, 10 good and one fair result. No poor results were observed. No radiolucent lines were observed in their study. They too used the DASH and MEPI score, observing a score of 9.8 (DASH) and 90.83 (MEPI). No correlation has been found in past studies between radiolucencies and pain/loss of function (19,22). The observations of Popovic et al were interpreted as being the result of the cementing technique since they remained stable after the first post-operative year.

Our study, the longest running follow-up to our knowledge, showed, according to the MEPI score, one poor result. 20 other patients scored fair to excellent. The mean DASH score of 23.1 reflects a good functional result after 9.2 years. Mean MEPI of 88.6 is still regarded as good, though not excellent. DASH scores of 23.1 seem significantly higher than the above mentioned studies. However given
the fact that only 5 of our patients were treated for Mason 3 fractures and all others for complicated lesions such as Mason 4 with dislocations and several revision cases (even one conversion to total elbow prosthesis) one would expect a higher number than the general population which, according to Hunsacker, would score a mean 10.1.

Many radiological signs were found in our X-rays. We only observed one case showing radiolucent lines on X-rays and proximal bone erosion. This observation was recent, ending in loosening of the implant requiring removal. During revision surgery, we saw de visu large capitellar erosions, also evident on X-ray (Fig. 3 and 4).

One case of overlenghtening was noted, the patient was symptomatic but without radiological signs of capitellar erosion were seen with this patient. Since only one case of overlenghtening was noted, we cannot draw conclusions. Overlenghtening of the radius causing `overstuffing of the radio-capitellar joint, has been reported to cause loss of elbow flexion, capitellar erosions, pain, and early-onset osteoarthritis (28).

One interesting fact showed up in our results as it did in the previous study of Burkhart et al a large incidence of capitellar erosion and ulnohumeral joint narrowing became apparent. These radiological signs did not seem to translate into symptoms of pain. Even from the patients showing the more severe degenerative capitellar changes, only half indicated pain. However, out of all patients showing capitellar erosion every symptomatic patient had ulnohumeral joint degeneration on X-rays. From a total of 9 patients showing ulnohumeral degeneration we saw 5 patients being asymptomatic. The remaining four patients also showed signs of capitellar erosion.

CONCLUSION

Mainly good clinical results are achieved with the Judet bipolar radial head implant. Functional results after long term follow-up are, however less optimistic than the excellent results achieved after short- to mid-term follow-up. No clear link between radiological signs and functional results can be found.