Paper 24: Osteochondritis Dissecans of the Capitellum of the Elbow: A Comparison of Non-Operative and Surgical Outcomes at Long-Term Follow-up

Authors:
Zachary Braig, MD\textsuperscript{1}, Mason Uvodich, Sara Till, Anna Reinholz, Mark Morrey, Joaquin Sanchez-Sotelo, Shawn O'Driscoll, MD, PhD, Christopher Camp, MD\textsuperscript{1} Mayo Clinic\textsuperscript{1}

Objectives:
Osteochondritis dissecans (OCD) of the humeral capitellum is an often painful condition that typically affects the adolescent athlete. There is little consensus on treatment and a scarcity of long-term outcomes data. The purpose of this study was to (1) report the long-term outcomes associated with both operative and non-operative management of capitellar OCD, (2) identify factors associated with failure of non-operative management, and (3) determine whether delay in surgery affects final outcomes.

Methods:
All patients diagnosed with OCD of the capitellum from 1995-2020 within a defined geographic cohort were included. Medical records, imaging studies, and operative reports were manually reviewed to record demographic data, treatment strategies, and outcomes. Surgical treatment was considered delayed if it occurred more than 6 months after symptom onset.

Results:
A total of 50 elbows with a mean follow-up of 9.4 years were included. Of these, 7 (14%) were treated non-operatively and never underwent surgery during follow-up, while 43 (86%) underwent surgical intervention: 27 had early surgery and 16 underwent delayed surgery after ≥ 6 months of non-operative treatment. When compared to non-operative management, surgical management resulted in superior MEPI scores (90 vs 83, p=0.05), decreased persistence of mechanical symptoms (9% vs 50%, p<0.01), and better elbow flexion (141° vs 131°, p=0.01) at long-term follow up. Older patients had a trend toward increased failure of non-operative management (p=0.06). The presence of an intra-articular loose body strongly predicted failure of non-operative management (p=0.01; OR 13). Plain radiography and MRI had poor sensitivities for identifying loose bodies (27% and 40%, respectively). Differences in outcomes following early versus delayed surgical management were not demonstrated.

Conclusions:
Patients with capitellar OCD initially treated nonoperatively failed nonoperative management 70% of the time. Elbows that did not undergo surgery had slightly increased symptoms and decreased functional outcomes compared to those treated surgically. In this cohort, the greatest predictors for failure of non-operative treatment were older age and presence of a loose body; however, an initial trial of non-operative treatment did not adversely impact the success of future surgery at long term follow-up.

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|                         |       |
|-------------------------|-------|
| N                       | 50    |
| Non-operative cohort    | 7 (14%) |
| Delayed operative cohort| 16 (32%) |
| Operative cohort        | 27 (54%) |
| Follow up (years)       | 9.4 (0.7-24) |
| Age                     | 14.7 (9-24) |
| Sex                     |       |
| Male                    | 40 (80%) |
| Female                  | 10 (20%) |
| BMI                     | 23.7 (17.5-36.6) |
| Overhead athlete?       | 28 (56%) |
| Ethnicity               |       |
| White                   | 45 (90%) |
| Black                   | 2 (4%) |
| Other                   | 3 (6%) |
| Time from symptom onset to presentation (months) | 14.2 (0-96) |
| Laterality              |       |
| Right                   | 31 (62%) |
| Left                    | 19 (38%) |
| Dominant arm?           | 29 (52%) |
| Mechanical symptoms at presentation? | 30 (60%) |
| History of trauma       |       |
| None                    | 35 (70%) |
| Acute                   | 3 (6%) |
| Remote                  | 12 (24%) |
| Lesion grade on radiograph |     |
| 0                       | 7 (15%) |
| 1                       | 33 (69%) |
| 2                       | 3 (6%) |
| 3                       | 5 (10%) |
| Lesion stability        |       |
| Stable                  | 15 (31%) |
| Unstable                | 34 (69%) |
| Mean lesion diameter (mm) | 10.6 |
| Physical status         |       |
| Open                    | 10 (21%) |
| Closed                  | 37 (79%) |

Table 1: Baseline demographics for all patients
|                          | Non-Operative (N = 7) | Surgery (N=43) | P-value |
|--------------------------|-----------------------|----------------|---------|
| Follow up (years)        | 5.3 (0.7-13)          | 10.1 (1.6-24)  |         |
| Initial overall MEPI     | 71 (40-80)            | 69.4 (34-80)   | 0.72    |
| Pain (0-45)              | 23.6                  | 21             | 0.49    |
| ROM (0-20)               | 18.6                  | 19.3           | 0.49    |
| Instability (0-10)       | 9.3                   | 9              | 0.70    |
| Strength (0-20)          | 19.1                  | 19.9           | 0.10    |
| Final overall MEPI       | 83 (65-95)            | 89.9 (65-95)   | 0.05    |
| Pain                    | 33                    | 40.1           | 0.04    |
| ROM                      | 20                    | 20             | 0.99    |
| Instability              | 10                    | 9.9            | 0.74    |
| Strength                 | 20                    | 19.9           | 0.74    |
| Ongoing mechanical symptoms | 3 (50%)               | 4 (9%)         | 0.01    |
| Return to sport          | 4 (67%)               | 34 (79%)       | 0.54    |
| Same or higher level     | 2 (33%)               | 29 (67%)       |         |
| Decreased level          | 2 (33%)               | 5 (12%)        |         |
| Fail to return           | 2 (33%)               | 5 (12%)        |         |
| Range of motion          |                       |                |         |
| Flexion                  | 131                   | 141            | 0.01    |
| Extension                | 3                     | 3              | 0.99    |
| Pronation                | 77                    | 79             | 0.55    |
| Supination               | 84                    | 85             | 0.47    |
| Progression to osteoarthritis | 1 (17%)               | 8 (19%)        | 0.90    |
| Time from symptom onset to development of osteoarthritis (months) | 36 | 93.1 (14-263) | 0.44 |

Table 2: Long-term outcomes comparing patients treated non-operatively and those treated operatively
|                                | Non-Operative (N = 7) | Delayed Surgery (N = 16) | P-value |
|--------------------------------|-----------------------|--------------------------|---------|
| **Age**                        | 12.6                  | 15.2                     | 0.06    |
| **Sex**                        |                       |                          |         |
| Male                           | 5 (71%)               | 15 (94%)                 | 0.20    |
| Female                         | 2 (29%)               | 1 (6%)                   |         |
| **BMI**                        | 24.4                  | 23.9                     | 0.96    |
| **Overhead athlete?**          | 3 (43%)               | 10 (63%)                 | 0.38    |
| **Ethnicity**                  |                       |                          | 0.50    |
| White                          | 7 (100%)              | 14 (88%)                 |         |
| Black                          | 0 (0%)                | 0 (0%)                   |         |
| Other                          | 0 (0%)                | 2 (12%)                  |         |
| **Laterality**                 |                       |                          | 0.67    |
| Right                          | 5 (71%)               | 10 (63%)                 |         |
| Left                           | 2 (29%)               | 6 (37%)                  |         |
| **Dominant arm?**              | 3 (50%)               | 9 (64%)                  | 0.55    |
| **History of trauma**          |                       |                          | 0.11    |
| None                           | 2 (29%)               | 11 (69%)                 |         |
| Acute                          | 1 (14%)               | 0 (0%)                   |         |
| Remote                         | 4 (57%)               | 5 (31%)                  |         |
| **Time from symptom onset to** |                       |                          | 0.17    |
| **presentation (months)**      | 4.6                   | 11.8                     |         |
| **Mechanical symptoms**        | 4 (57%)               | 8 (50%)                  | 0.87    |
| **Range of motion**            |                       |                          |         |
| Flexion                        | 138                   | 140                      | 0.08    |
| Extension                      | 5                     | 8                        | 0.39    |
| Pronation                      | 76                    | 76                       | 0.40    |
| Supination                     | 83                    | 84                       | 0.67    |
| **Initial MEPI**               | 70.6                  | 71.3                     | 0.90    |
| **Lesion size (mm)**           | 14.2                  | 10.2                     | 0.10    |
| **Loose body?**                | 1 (14%)               | 12 (56%)                 | 0.01    |
| XR                             | 1 of 7 (14%)          | 3 of 16 (19%)            |         |
| MRI                            | 1 of 4 (25%)          | 2 of 5 (40%)             |         |
| CT                             | 1 of 1 (100%)         | 6 of 7 (86%)             |         |
| **Physseal status**            |                       |                          | 0.83    |
| Open                           | 2 (33%)               | 4 (28%)                  |         |
| Closed                         | 5 (67%)               | 12 (72%)                 |         |
| **Lesion grade on radiograph** |                       |                          | 0.32    |
| 0                              | 0                     | 4                        |         |
| 1                              | 4                     | 9                        |         |
| 2                              | 1                     | 2                        |         |
| 3                              | 1                     | 0                        |         |
| **Lesion Stability**           |                       |                          |         |
| Stable                         | 4 (67%)               | 7 (44%)                  | 0.33    |
| Unstable                       | 2 (33%)               | 9 (56%)                  |         |

Table 3: Baseline patient characteristics comparing patients successfully treated non-operatively versus patients who failed non-operative management.
(BMI: Body Mass Index, MEPI: Mayo Elbow Performance Index)
### Table 4: Interventions and final outcomes amongst patients undergoing delayed operative intervention or immediate operative intervention for osteochondritis dissecans of the humeral capitellum

| Intervention                          | Delayed Surgery (N = 55) | Early Surgery (N = 127) | P-value |
|--------------------------------------|--------------------------|-------------------------|---------|
| Follow up (years)                    | 12.5 (1.6-24)            | 8.0 (1.9-13.7)          |         |
| Surgical approach                    |                          |                         |         |
| Open                                 | 1 (4%)                   | 4 (11%)                 |         |
| Arthroscopic                         | 13 (24%)                 | 22 (18%)                |         |
| Both                                 | 2 (13%)                  | 3 (11%)                 |         |
| Operative intervention               |                          |                         |         |
| Debridement                          | 14 (85%)                 | 20 (74%)                |         |
| Loose body excision                  | 12 (75%)                 | 16 (50%)                |         |
| Fragment fixation                    | 7 (44%)                  | 4 (15%)                 |         |
| Microfracture                        | 0 (0%)                   | 11 (41%)                |         |
| OATS                                 | 1 (6%)                   | 1 (4%)                  |         |
| Concomitant Procedure                | 6 (38%)                  | 13 (48%)                |         |
| Capsulotomy                          | 2 (13%)                  | 2 (7%)                  |         |
| Synovectomy                          | 3 (19%)                  | 7 (25%)                 |         |
| Plica excision                       | 1 (6%)                   | 1 (4%)                  |         |
| Ulnar nerve decompression            | 0 (0%)                   | 1 (4%)                  |         |
| IKDC Grade                           |                          |                         |         |
| 0                                    | 0                        | 0                       |         |
| 1                                    | 3 (19%)                  | 11 (41%)                |         |
| 2                                    | 3 (19%)                  | 7 (25%)                 |         |
| 3                                    | 2 (13%)                  | 2 (7%)                  |         |
| 4                                    | 8 (50%)                  | 11 (41%)                |         |
| Improvement from preoperative MEPI   | 20.7 (0-35)              | 23.7 (0-56)             |         |
| Pain                                 | 42                       | 39.1                    | 0.27    |
| ROM                                  | 20                       | 19.8                    | 0.74    |
| Instability                          | 0                        | 0.8                     | 0.41    |
| Strength                             | 20                       | 20                      | 0.59    |
| Return to sport                      | 12 (75%)                 | 22 (82%)                | 0.87    |
| Same or higher level                 | 11 (69%)                 | 18 (67%)                |         |
| Decreased level                      | 0 (0%)                   | 4 (15%)                 |         |
| Fail to return                       | 2 (12.5%)                | 3 (12.5%)               |         |
| Range of motion                      |                          |                         |         |
| Flexion                              | 142                      | 140                     | 0.30    |
| Extension                            | 3                        | 2                       | 0.78    |
| Pronation                            | 81                       | 77                      | 0.94    |
| Supination                           | 86                       | 84                      | 0.34    |
| Progression to osteoarthrosis        | 3 (19%)                  | 5 (19%)                 | 0.98    |
| Time from surgery to development of  | 111 (14-265)             | 87 (25-228)             | 0.76    |
| osteoarthritits (months)             |                          |                         |         |
| Need for revision operation          | 3 (19%)                  | 4 (15%)                 | 0.74    |