A new “virtual” patient pathway for the management of radial head and neck fractures

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Background: Minimally displaced radial head and neck fractures are common and the outcome with conservative treatment is generally excellent. A new protocol was introduced to manage patients with these suspected fractures at a major urban hospital. Simple, undisplaced fractures without other associated injuries or instability were discharged with structured advice but no further face-to-face review. Patients with more complex injuries were reviewed at a “virtual clinic.” The aim of this study was to examine the outcome of this process in terms of patient flow, satisfaction, reattendance, and reintervention.

Methods: The 202 eligible patients, who presented during a 1-year period from October 2011 to October 2012, were identified retrospectively from a prospectively collected administrative database. Mason type III and IV fractures were excluded. A questionnaire was administered by mail or phone call to assess satisfaction with the process, information received, and function.

Results: Twenty (10%) patients required face-to-face review in a clinic, whereas 182 (90%) were managed with direct discharge; 155 patients responded to the survey (77%). The overall satisfaction rate was 96% in the suspected fracture group and 87% in the definite fracture group ($P = .08$). Satisfaction with the information provided was 95%. Two (1%) required late surgical intervention.

Conclusion: In this study, patients with suspected Mason I or II fractures were managed with limited face-to-face follow-up with high satisfaction rates. The reintervention rate was extremely low. This process has significant benefits to patients, who have fewer hospital visits, and to orthopaedic departments, which have more time to devote to complex cases.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Radial head; radial neck; fractures; virtual clinic; satisfaction; conservative; face-to-face review; cost savings

Radial head and neck fractures are the most common elbow bone injury, accounting for 3% to 4% of fractures overall.24 The Mason classification system,16 subsequently modified by Johnston,12 has become the mainstay of categorizing these fractures in the United Kingdom; the Hotchkiss classification is commonly used in the United States.8 This classification evolved because it was both prognostic and guided management. It was understood that most type I fractures could be treated conservatively and type III and IV fractures usually required surgical treatment.10,12,16 However, there is still widespread disagreement about the management of type II fractures.2,5,13,19,21,25

No ethical or review board approval was required for this study.

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Most patients with these injuries are referred by emergency departments (EDs) to the next available fracture clinic for an orthopaedic opinion. In some, the only evidence of a fracture may be the presence of an elbow fat pad sign, indicating an occult injury. The majority of fractures are conservatively managed, with an excellent prognosis, and therefore routine orthopaedic assessment is unnecessary and inefficient.

“Virtual” review systems and the use of modern technology to communicate with patients and to review cases is becoming increasingly widespread, and funding systems will need to evolve to recognize this. Virtual clinics have been successfully introduced in other specialties for the care of diabetes mellitus, renal problems, and irritable bowel syndrome.

A new protocol was introduced at our institution, with the agreement of all orthopaedic and ED consultants (Fig. 1). This promoted direct discharge by the ED of undisplaced fractures, including fractures with fat pad signs. Significantly displaced fractures and those associated with dislocations were referred for an urgent orthopaedic opinion. If there was doubt in the ED about the nature or significance of the injury, it was discussed at a multidisciplinary “virtual fracture clinic” (VFC). After this, a nurse would contact the patient with the outcome of the review and provide explanation and advice as required. The patient would be either discharged “virtually” or provided with an appointment for review at a specialist clinic. A telephone hotline was provided for patients who experienced problems or who failed to progress as expected.

The aim of this study was to examine the outcome of the new process in terms of patient flow through the system, satisfaction, reattendance, and reintervention.

Materials and methods

This was a retrospective review of all patients managed according to the new protocol between October 2011 and October 2012. The inclusion criteria were patients with an isolated, actual or suspected, radial head fracture who presented to the ED or its associated minor injuries unit during the time period. Patients were excluded if they had suffered a Mason III injury (n = 1), complex fracture dislocation (n = 3), bilateral injury (n = 1), or another injury (n = 2) or were referred with a nontraumatic cause (exacerbation of osteoarthritis; n = 3). Our institution is an urban teaching hospital, with a catchment area of 300,000, in a predominantly publicly funded health service (National Health Service, UK). It has a full range of secondary and tertiary orthopaedic services. There were no open, isolated, radial head fractures during the time period. There were 202 eligible injuries. None of the injured elbows were injected for diagnostic reasons.

All patients who attended the ED with an elbow injury were initially assessed by accident and emergency physicians. Anteroposterior and lateral images of the elbows were taken. If a polytraumatic, complex, or severely displaced injury was suspected, the patient was referred to the on-call orthopaedic team, who would then decide whether to admit the patient. For all other injuries, a leaflet with structured advice was issued and the patient was discharged without follow-up. The information leaflet included advice for early mobilization and a helpline contact number. ED physicians could refer any more complex patient or patient about whom they were worried to a VFC. All ED radiographs were reported within 24 hours by a radiologist. The reporting radiologist had access to the ED physician’s interpretation and highlighted any “discrepancies” to the ED for action. During the study period, there were 2 misdiagnoses (1%). These were diagnosed by the ED as the presence of fat pad signs. The radiology report was suggestive of an undisplaced supracondylar fracture, and the patient was recalled appropriately. There were 3 (1.5%) further false positives in which no abnormality was ultimately reported and 2 false negatives (1%). These were both referred for discussion at the VFC and were discharged with telephone advice. This was a multidisciplinary meeting at which the history and radiographs were reviewed and a decision made whether the patient should be discharged after a telephone review or be invited for an appointment in a specialist clinic (Fig. 1). The meeting was chaired by the on-call consultant (attending) orthopaedic surgeon. We used the Bluespier (Bluespier, Worcestershire, UK) electronic patient record system to manage referrals and outcomes from the VFC.

We evaluated the patient flow through the process by examining the rate of direct ED discharge, VFC review, and specialist clinic referral. We also examined the patient’s electronic patient record to determine if the patient had re-presented to our institution or had radiographs taken at any other institution in Scotland.

All radiologic images for referred patients were reviewed by a consultant orthopaedic elbow specialist (L.A.R.) and classified according to the Mason classification system. A satisfaction survey of these patients was carried out at least 6 months after the initial injury in 2 phases. In the first phase, a survey was sent by mail. Those who had not replied to the mail were contacted by telephone by an assessor who was independent of the clinical team. The overall response rate was 77% (n = 155 of 202).

Satisfaction was rated by a 4-level Likert scale with the options very satisfied, satisfied, dissatisfied, and very dissatisfied. Patients were asked if (1) they were satisfied with the outcome of their injury, (2) they were satisfied with the information provided, (3) they were satisfied with the helpline service provided, and (4) they had visited any other physician about this injury and for what reason.

If patients were dissatisfied, they were asked to complete some further questions and offered a clinic appointment with...
a consultant orthopaedic surgeon. The extended questions were the following: (1) Have you had any pain in your elbow? (2) When have you experienced pain? (3) Have you had any tingling, numbness, weakness, or stiffness? (4) Have you been unable to do anything as a result of your injury? and (5) Have you been able to return to normal activities?

The satisfaction rates for each question were then analyzed as simple proportions. When multiple proportions were compared, a $\chi^2$ test was used to assess statistical significance. When only 2 proportions were compared, an odds ratio and 95% confidence interval were calculated. The level of significance was set at $P < .05$.

Results

There were 20 patients (9.9%) who required early face-to-face review in an orthopaedic setting (Table I). Of those who responded to the survey, another 20 (13%) visited another physician, such as their general practitioner, during the follow-up period. The ED discharged 137 patients (68%) with explanation and advice. Another 45 patients (22%) were discharged after discussion at the VFC. There was no difference in the proportion of those discharged without review between suspected and definite fractures (Table I).

Table I Distribution and outcome of the type of injury sustained

<table>
<thead>
<tr>
<th>Suspected fracture (n = 98)</th>
<th>Direct discharge (n = 182)</th>
<th>Face-to-face review (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ED discharge (n = 137)</td>
<td>VFC discharge (n = 45)</td>
</tr>
<tr>
<td>Fat pad sign absent (n = 31)</td>
<td>22 (71%)</td>
<td>6 (19%)</td>
</tr>
<tr>
<td>Fat pad sign present (n = 67)</td>
<td>45 (67%)</td>
<td>15 (22%)</td>
</tr>
<tr>
<td>Definite fracture (n = 104)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial neck fractures (n = 24)</td>
<td>14 (58%)</td>
<td>8 (33%)</td>
</tr>
<tr>
<td>Mason type I (n = 38)</td>
<td>30 (79%)</td>
<td>6 (16%)</td>
</tr>
<tr>
<td>Mason type II (n = 42)</td>
<td>26 (62%)</td>
<td>10 (24%)</td>
</tr>
</tbody>
</table>

Results

There was no significant difference in the satisfaction rates in either the suspected fracture group ($P = .210$) or the definite fracture group ($P = .629$) (Table II). When Mason II fractures were compared with the remainder of the group (suspected fractures, Mason I, and neck fractures), there was no significant difference in satisfaction ($P = .142$).

Receipt of the information leaflet was recalled by 150 patients (97%). The overall satisfaction rate with the information provided by the leaflet was 95% (n = 142). The hotline was used by 15 patients (7%), of whom 14 (93%) were satisfied with the experience.

Of the 20 (13%) patients who had visited their general practitioner, 5 sought additional pain medication, 9 needed certification for absence from school or work, and 4 wanted advice on physiotherapy options. There were 2 patients who required subsequent elective surgery. The first had a fracture originally classified as a Mason type I but was later found to have a mobile fragment, developed impingement symptoms, and underwent excision. This patient had been invited back to a consultant-led clinic, and this problem was discovered at a scheduled follow-up appointment when the pain did not resolve as expected. The other patient had been assessed in the virtual clinic and discharged but was referred by his primary care physician, found to have a malunion of a Mason type II fracture, and underwent radial head replacement.

Of the 13 patients who were dissatisfied, 4 had no pain or other symptoms. The remaining 9 complained of ongoing pain in the elbow when lifting heavy weights or performing repetitive movements. Four complained of night pain, and 6 reported stiffness. One patient remains unable to lift heavy weights, and another 4 are unable to perform strenuous weight-bearing exercises such as press-ups.

Discussion

This study shows that acceptable patient satisfaction can be achieved by following our protocol. Only 10% of included patients required face-to-face review. The dissatisfaction rate was in keeping with the reported literature and similar to what would have been achieved with traditional universal fracture clinic review. There were no significant differences in review rates or overall satisfaction between suspected and definite fractures. There was no difference in satisfaction between Mason II fractures and the remainder of the group. There was no difference in satisfaction between suspected, Mason II, and radial neck fractures. High satisfaction rates were given for the information provided and the helpline service. Our practice has been to manage Mason II fractures conservatively and to offer intervention only when there is ongoing restriction in forearm rotation. Our standard practice in these cases would be to offer delayed radial head excision. Despite previous controversy in the management of this subgroup of patients, the use of virtual clinics has shown to be a viable alternative.
This study highlights that patients with Mason II fractures do not need long-term review. If given appropriate advice in the postinjury period, they can be managed expectantly and get in touch if the recovery trajectory is less than expected.

Although some units have introduced procedures to triage trauma referrals to appropriate specialist clinics and nurse-led reviews, the process is new in that it introduces the concept of direct discharge by both the ED and the orthopaedic department. All injuries with the criteria for direct discharge were reviewed in a virtual clinic. This multidisciplinary review process ensured quality control. The information leaflets provided satisfactory information and the helpline provided a point of contact for any problems or when recovery was below expectations.

It is beyond the scope of this study to assess resource savings with this approach. There were 182 new fracture clinic attendances saved, along with subsequent follow-up. Consultant time, the most expensive resource, was used more efficiently. Similar cost savings have been observed in other specialties that have introduced virtual review. There were also other indirect cost savings, such as reduced transportation requirements. Of the 20 patients who visited their general practitioner, 18 were successfully managed in the primary care setting, without needing to visit an orthopaedic surgeon. As such, there was also significantly less disruption and inconvenience to patients who did not need to reattend hospital in the early postinjury period.

The satisfaction results are in keeping with the literature, which report excellent early patient-reported and clinical outcomes with nonoperative treatment that remain at long-term review.

The main strength of this paper is that it is the first to describe the outcome of a process in which the majority of injuries did not receive face-to-face review. The literature widely acknowledges the excellent outcomes from these injuries, but traditional review has remained. There were several limitations to this study. Patient-reported outcome measures were not assessed as the clinical outcome of these injuries has already been extensively investigated in the literature. The study assesses only short-term satisfaction as we wished to maximize recall and response.

### Table II Results of satisfaction survey

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Very satisfied (n = 61)</th>
<th>Satisfied (n = 81)</th>
<th>Unsatisfied (n = 9)</th>
<th>Very unsatisfied (n = 4)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected fracture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat pad sign absent (n = 22)</td>
<td>8 (36%)</td>
<td>12 (55%)</td>
<td>1 (5%)</td>
<td>1 (5%)</td>
<td>.210</td>
</tr>
<tr>
<td>Fat pad sign present (n = 54)</td>
<td>30 (56%)</td>
<td>23 (43%)</td>
<td>1 (2%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Total (n = 76)</td>
<td>38 (50%)</td>
<td>35 (46%)</td>
<td>2 (3%)</td>
<td>1 (1%)</td>
<td></td>
</tr>
<tr>
<td>Definite fracture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mason I (n = 28)</td>
<td>9 (32%)</td>
<td>14 (50%)</td>
<td>3 (11%)</td>
<td>2 (7%)</td>
<td>.629</td>
</tr>
<tr>
<td>Mason II (n = 35)</td>
<td>8 (23%)</td>
<td>24 (69%)</td>
<td>2 (6%)</td>
<td>1 (3%)</td>
<td></td>
</tr>
<tr>
<td>Radial neck (n = 16)</td>
<td>6 (38%)</td>
<td>8 (50%)</td>
<td>2 (13%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Total (n = 79)</td>
<td>23 (29%)</td>
<td>46 (58%)</td>
<td>7 (9%)</td>
<td>3 (4%)</td>
<td></td>
</tr>
</tbody>
</table>

and the indications for early intervention, a recent cohort study reported excellent outcomes with a similar protocol. This study presents evidence that simple, stable fractures of the radial head with well-understood natural histories can be safely and effectively treated with minimal intervention. In particular, this study showed no difference in satisfaction between suspected, Mason I, and 3.4%. These discrepancies were examined and were managed appropriately. Only 2 patients required late surgical management, and both of these re-presented through routine pathways. It was very unlikely that these patients would have received surgical intervention at an earlier time point in the traditional fracture clinic system. Another barrier is the potential loss of income for practitioners as these fewer patients require face-to-face review. This protocol was introduced with the main aim of improving the quality of care and reducing unnecessary visits by patients rather than reducing costs. It was also introduced to enable more time to be devoted to complex cases. The cost-effectiveness and financial implications of this protocol are dependent on the health care environment in which it is implemented. There is, however, a widespread desire to ensure that health care remains safe and high quality while being delivered in a cost-effective fashion. The final barrier was the concern that this process would increase the time taken to manage patients in the ED. Local data have shown that this has not been the case. The injuries chosen to be managed by the ED are high-volume injuries, with excellent reported clinical outcomes.

The main strength of this paper is that it is the first to describe the outcome of a process in which the majority of injuries did not receive face-to-face review. The literature widely acknowledges the excellent outcomes from these injuries, but traditional review has remained. There were several limitations to this study. Patient-reported outcome measures were not assessed as the clinical outcome of these injuries has already been extensively investigated in the literature. The study assesses only short-term satisfaction as we wished to maximize recall and response.

### Conclusions

This study presents evidence that simple, stable fractures of the radial head with well-understood natural histories can be safely and effectively treated with minimal intervention. In particular, this study showed no difference in satisfaction between suspected, Mason I, and
New pathway management radial head fractures

Mason II fractures. This approach is beneficial to patients as well as reducing the burden of unnecessary review in orthopaedic departments. This protocol for the “self-care” of radial head fractures offers an attractive option for patients, EDs, and orthopaedic departments. Departments could adopt this protocol in its entirety, opt to use different components, or apply it to particular subgroups of injuries. These decisions will be based on local health care system policies and discussions with colleagues in orthopaedic departments and EDs.

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