

The Implementation of Consultant Led MRI Pathway for Acute Musculoskeletal Trauma

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Abstract

Aim

To describe the introduction of an Emergency Medicine led MRI pathway for acute joint injuries, and review patient diagnoses and outcomes.

Methods

MRIs referred from the ED for acute MSK trauma were reviewed retrospectively for a six-month period from July 2018 to January 2019 (scaphoids and spines excluded). Patient records were interrogated to determine time to MRI and ascertain the follow up and further management of injuries.

Results

Seventy-five MRIs were performed. Sixty-eight scans (90.7%) found clinically significant pathology including nine occult fractures of the shoulder or knee joint. Mean time to MRI was 165.5 hours/6.8 days (SD 162.4). Mean time to MRI knee (n37) was 91.2 hours/3.8 days (SD 92.2).

Conclusion

An Emergency Medicine led imaging initiative can facilitate timely and diagnostic imaging for patients with musculoskeletal trauma, identify significant injuries and instigate appropriate management for these injuries.

Introduction

Musculoskeletal (MSK) trauma accounts for a considerable proportion of attendances to Irish Emergency Departments (EDs). A 2005 study found that soft tissue injuries and fractures may account for approximately 20% of all presentations to EDs in Cork¹. Plain radiographs remain the first line radiological investigation for MSK trauma in the ED however a normal x-ray does not rule out the presence of significant injury, in particular to the soft tissues.

Newer imaging modalities such as Magnetic Resonance Imaging have demonstrated superiority in this setting^{2, 3}. While a normal x-ray is helpful in the management of MSK injuries patients may sustain significant ligament, tendon, or muscular injuries that require further diagnostics, and an alternative management plan other than the traditional rest, ice, compression, elevation (RICE) approach may be needed⁴. In the case of the patient who presents with a MSK trauma and has a subsequent normal x-ray, MRI has been shown to be a useful diagnostic tool. In the case of rotator cuff tears, anterior cruciate (ACL) ruptures and undisplaced fractures not visible on x-ray, a positive MRI scan can change management⁵⁻⁸. This is of course dependent on the clinical gestalt of the ED clinician and the reserving of MRI for patients who are most at risk of having significant pathology based on history and examination. At present there are also significant waiting lists for outpatient MRIs for patients with chronic MSK conditions and historically patients with acute injuries can face delays because of this. Cost analysis within the NHS revealed that early MRI specifically for knee injuries led to faster diagnoses and management of internal joint injuries when compared with standard treatment. This results in a reduction in missed workdays, less pain, less limitation on activity and also improved patient satisfaction scores¹¹.

In 2018, the Emergency and Radiology Departments at Sligo University Hospital agreed on a dedicated clinical pathway for adult patients with acute MSK trauma who would benefit from an urgent MRI. Suitable patients are referred by a Consultant for expedited advanced imaging following a focussed clinical history and examination. The Radiology Department facilitated two dedicated knee slots per week for ED patients. The knee is the joint most commonly injured within the body and accounts for the majority of presentations both in this ED and internationally⁴. Patients are either referred directly for MRI on the same day of attendance, or asked to re-present to a review clinic, usually within two weeks for a consultant review. This allows for a delayed examination, when swelling and pain has improved. This delayed assessment has been shown to have a demonstrable benefit when assessing the severity of a suspected ligamentous injury^{9, 10}. Following MRI, patients are then directed to the most appropriate management pathway based on their results: either referral for orthopaedic outpatients follow up, physiotherapy or discharge back to their GP.

This pathway was initially established to expedite imaging and treatment for the relevant patient cohort. At the time of data capture we found that the mean wait time for an MRI booked via the community in this hospital was 7300 hours, as compared to 91.2 hours for our knee patients. This study describes the benefits of this process over a six-month period and demonstrates the successes of this Emergency Medicine (EM) led initiative in terms of imaging utility, patient outcomes and cost savings.

Methods

This is a retrospective observational descriptive study. We included all patients who had had MRIs ordered using the National Integrated Medical Imaging System (NIMIS) from the ED over a six-month period from July 2018 to January 2019. MRIs of the scaphoid were excluded as these patients are placed on an existing separate pathway, and spinal MRIs were also excluded as these patients typically have more complex pathology and clinical course. Once patients were identified, their Emergency Department records were interrogated to determine outcome and management.

Information pertaining to patient demographics, referral source (direct from ED or review clinic), time to MRI, results of the MRI, and ultimate disposition of the patient was collected.

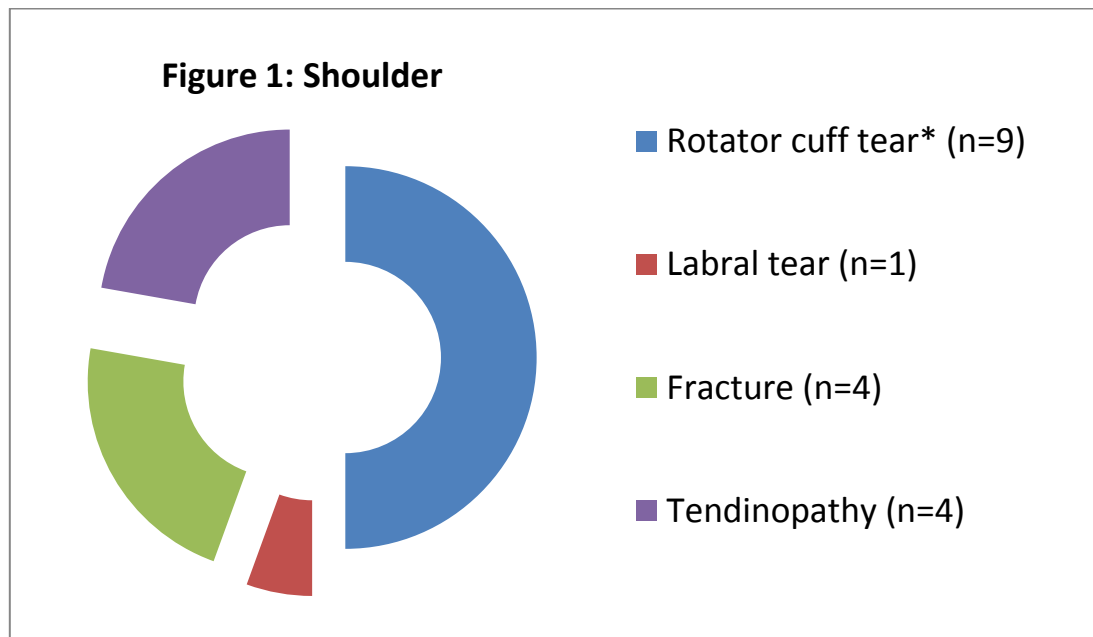
Results

Demographics

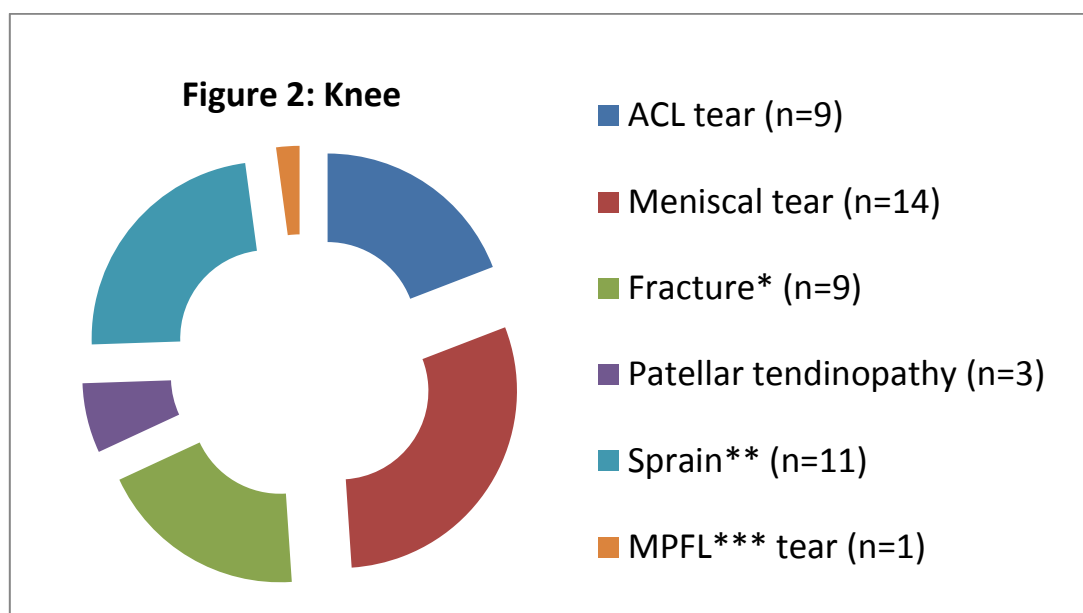
There were seventy-five patients suitable for inclusion that had MRIs ordered by EM clinicians during the study period. Of these, fifty (66.7%) were male. The mean age was 39 years (SD: 18.5, Range 15 - 81). Patients attending for review accounted for forty-eight (64%) of scans ordered, with twenty-seven (36%) ordered on first presentation to the ED. Of the MRIs ordered thirty-seven (49.3%) were of the knee, seventeen (22.7%) of the shoulder, seven (9.3%) of the wrist, six (8%) of the ankle, with foot, elbow, hip, pelvis, and thumb accounting for the remaining eight (10.6%).

Results

In sixty-eight (90.7%) scans clinically significant pathology was found. In MRIs of the knee thirty-one (83%) found a significant abnormality related to trauma. The range of injuries is described in figures 1 and 2. In both figures the number of injuries is greater than the number of scans performed due to the presence of multiple injuries in single patients. The mean time from ordering to MRI was 165.5 hours (SD 162.4, range 0.4 – 816). The mean time to MRI knee (n=37) was 91.2 hours (SD 92.2, range 0-456). Mean time to MRI of other joints (n=38) was 235.2 hours (SD 185.1, range 0-816).



**7 full thickness, 2 partial thickness*



*Fracture: Tibial plateau (n=5), femoral condyle (n=2), femoral epiphysis (n=1), patella (n=1)

**Sprain: MCL (n=9), ACL (n=1), PCL (n=1)

***Medial patellofemoral ligament

Disposition

Forty-two patients (56%) had an injury diagnosed on MRI which required follow-up in Orthopaedic clinic. Nineteen patients (25%) were referred to Physiotherapy. Referral to other institutions +/- physiotherapy accounted for four (5.3%). In the case of ten patients (13%) either no further follow-up was required or there was insufficient data to reach a conclusion.

Discussion

Our study demonstrates the benefits of prompt access to MRI for patients presenting to ED with acute limb injuries. The provision of protected time slots for acute injuries within our pathway allow for a mean time to scan of 6.8 days. The ED review clinic allows patients to undergo serial examination by experienced EM clinicians once their initial joint swelling has subsided. This has been shown to lead to a more accurate assessment particularly for ligamentous injuries^{9, 10, 13}. Dedicated extremity MRI for acute injuries has been shown to improve the prediction of the need for further intervention¹². There is also evidence that using MRI in acute MSK works best in conjunction with physical examination. The clinical accuracy of practitioners with experience in assessing MSK injuries is significantly greater than those without such experience^{9, 10, 14, 15}. This finding is supported locally by the overwhelmingly positive findings of the scans performed (90.7%), the majority of which were clinically significant. Clinical assessment alone has its limitations in making accurate diagnoses in these patients. Combining the clinical assessment by an experienced clinician and the use of MSK MRI in a timely manner allows for a more rapid accurate diagnosis and subsequent definitive care¹⁶.

An accurate diagnosis following early imaging allows the commencement of a targeted physiotherapy program prior to review by an Orthopaedic specialist for example^{17, 18}. Similarly the pathway allows for patients with acute pathology to be referred to orthopaedic fracture clinic where indicated, as opposed to being discharged to await outpatient imaging followed by referral to an elective clinic. A definite diagnosis allows for the appropriate rehabilitation programme and potentially improves symptoms faster than if waiting for definitive diagnosis and management.

The presence of nine fractures (including five tibial plateau fractures) is a further reminder of the limitation of plain radiographs. With regards to the tibial plateau fractures specifically, without the existence of this pathway these patients would likely either be discharged following their normal x-ray or referred to physiotherapy with ongoing pain. MRI has a clear role in the classification and treatment of such fractures and so if performed can affect management and outcomes¹⁹.

We did not specifically measure the cost savings in this study. Most of MRIs were ordered from the review clinic rather than on the initial presentation to the ED so an expectant approach can help limit the number of MRI scans carried out. A Dutch study from 2009 showed that the careful application of MRI for knee injuries does indeed lead to savings both in terms of medical costs but also to the patient and exchequer as a whole through a reduction in time off work/convalescence²⁰.

We have described the introduction of a pathway to fast track patients presenting to ED with acute musculoskeletal injuries to serial clinical examination by senior decision-makers and to MRI. This can facilitate timely and appropriate imaging and subsequent treatment for patients with musculoskeletal trauma. Patients with injuries requiring surgical management (e.g. ACL ruptures in the young athlete) can be referred for early pre-operative physiotherapy, and thus improve their ultimate recovery. An EM-led MSK MRI pathway has potential for quality improvement for both patients and the healthcare system.

Declaration of Conflicts of Interest:

The Authors have no conflict of interest to declare.

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