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The Ottawa knee rules

A useful clinical decision tool

Background

Acute knee injuries are a common presentation in the primary care setting. The Ottawa knee rules provide guidance on how to identify which cases of knee injury require radiographic investigation.

Objective

This article describes the Ottawa knee rules and outlines their sensitivity, reproducibility and application in the clinical setting.

Discussion

The Ottawa knee rules are a valuable tool for clinicians in the routine management of acute knee injuries. Studies show that they are highly sensitive at identifying patients with fractures of the knee and have a high degree of inter-observer agreement and reproducible results. Application of the Ottawa knee rules in appropriate clinical scenarios may reduce the number of unnecessary radiographs ordered, streamlining patient throughput and allowing for significant cost savings. Although designed for use in adults, some studies have suggested that the Ottawa knee rules may also be applicable to the paediatric population.

Keywords

knee joint; orthopaedics; diagnostic imaging

Acute knee injuries are very common and account for a significant number of presentations in general practice and hospital emergency department settings.^{1,2} As fractures are an important consideration in such injuries, many clinicians may be tempted to order routine radiographs for all patients who present with an acute knee injury. However, Stiell et al³ showed that while 74.1% of a large sample of patients presenting to Canadian hospital emergency departments with knee injuries were sent for knee radiographs, only 5.2% of these patients actually had a fracture. They identified that routine X-ray in patients with knee injuries may not be cost effective or in the best interests of the patient.

The Ottawa knee rules

The Ottawa knee rules (OKRs) were first derived and validated in Ottawa, Canada, with the aim of reducing the number of unnecessary radiographs ordered after

knee trauma without compromising patient care.⁴⁻⁷

The rules are outlined in *Table 1*. Patients who do not meet the fracture predictor of the OKRs are highly unlikely to have clinically significant fractures and can have knee radiographs safely deferred.

High sensitivity

The OKRs have been studied in the United Kingdom, Europe and the Middle East and have consistently demonstrated a high sensitivity, with values ranging from 84.6% to 100%.⁸⁻¹² Furthermore, it has been suggested that the few trials that showed the OKRs to have a sensitivity of less than 100% had errors in the implementation of the rules.¹³ In practice, the OKRs high sensitivity can be translated to a considerable reduction in the number of knee radiographs ordered following acute knee injuries. In a study by Jenny et al,¹² the number of knee radiographs ordered after knee trauma was reduced by 35% following the implementation of the OKRs. Similarly, other studies projected that the introduction of the OKRs at their respective sites would reduce the amount of knee radiographs performed by 41–50%.^{10,14} This reduction in number of radiographs performed in the setting of knee injuries has the potential to be associated with several advantages, including the streamlining of patient throughput, prevention of unnecessary radiation, cost savings and better allocation of medical resources. These may be particularly important considerations in resource-scarce rural areas.

Good inter-observer agreement

The OKRs have been shown to have good inter-observer agreement and hence reproducible results.^{4-6,11} In addition, a study in an emergency teaching centre in Brussels demonstrated that the degree of qualification of the initial examiner did not influence the value of the OKRs, which were shown to maintain a sensitivity of 100% when applied by medical students and surgical residents.¹¹

Table 1. The Ottawa knee rules⁴

Knee X-ray indications after acute knee injury:

- aged 55 years or over
- tenderness at the head of the fibula
- isolated tenderness of the patella
- inability to flex knee to 90 degrees
- inability to bear weight (defined as an inability to take four steps, ie. two steps on each leg, regardless of limping) immediately and at presentation

What about the paediatric population?

Although the OKRs were originally designed for adults, some studies recommend extending their application to the paediatric population.^{15,16} This is an important consideration as over 90% of children who present with knee injuries undergo radiographic investigation, exposing them to a large dose of radiation that may have been unnecessary.¹⁵ Preliminary studies by Khine¹⁵ and Bulloch¹⁶ have demonstrated sensitivities of 92% and 100% respectively. However, more research is required to confirm these findings and inform any recommendations regarding expanding the applicable age group of the OKRs to include the paediatric age group.

Implementation of the rules

While well known in Canada and the United States, clinicians in many other regions are relatively less aware of the OKRs and hence, are less likely to implement them in clinical practice.⁹ In addition, in some study settings the introduction of the OKRs did not result in a decrease in the number of knee X-rays ordered and this was attributed to the decision making processes of individual clinicians.¹⁷ Some clinicians have reported feeling that patients expected imaging after trauma as an integral part of their care and therefore it was more convenient to order radiographs routinely than to have to explain otherwise.³ Also, it has been suggested that some clinicians may chose to override the rules and order imaging out of fear of medicolegal repercussions.^{11,17}

The default approach of routinely ordering X-rays in the setting of knee trauma is problematic for two reasons. First, the majority of acute knee injuries are soft tissue injuries, such as meniscal tears or ligamentous damages, which may be evident on thorough clinical examination (though not always in the acute phase), but are not identifiable on plain radiographs. Second, a normal looking knee X-ray after acute trauma

does not exclude a fracture. Some knee fractures, such as tibial plateau fractures, Segond fractures (small avulsion fracture of the lateral tibial condyle commonly associated with ligamentous and meniscal injuries) and Salter-Harris type 1 fractures are easily missed on plain knee radiographs if the assessment of these radiographs is not complemented with clinical findings. Therefore, communicating to patients the reason for not doing an X-ray when this decision is clinically appropriate is an important aspect of good clinical care. Importantly, clinical follow up should be recommended if symptoms persist.

Key points

- Acute knee injuries present commonly in the general practice and hospital emergency department settings.
- The Ottawa knee rules are highly sensitive at identifying which patients with knee trauma should have an X-ray to exclude fracture.
- Appropriate application of the rules can reduce the number of radiographs performed in the setting of acute knee injuries, with the potential benefits of improved cost efficiency and decreased radiation exposure for the patient.

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