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## Imaging Decision Making: Acute Knee Injury

(Patients over 18 years of age<sup>1</sup>, injury less than 7 days<sup>2</sup>)

This protocol is for use in decision making for acute (within 7 days) knee injuries only. Knee is defined as the distal 8 cm of the femur, proximal 8 cm of the tibia, head and neck of fibula, and patella<sup>1</sup>. Radiography is suggested if one or more of the following is present:

- Age greater than 50<sup>2</sup>
- Mechanism of injury is blunt trauma from direct blow or force applied to knee including falls whether or not the knee was twisted<sup>2</sup>
- Inability to **bear full weight** on toe pads and heels for 4 consecutive steps either immediately after the injury OR during the examination<sup>3</sup>
- Tenderness at the head of the fibula<sup>1</sup>
- Patellar tenderness<sup>3</sup>
- Inability to flex to 90° (Inability to flex to 60° increases specificity)<sup>1</sup>
- Joint effusion or ecchymosis<sup>4</sup>

When one or more of the following exist, the decision rule should not be strictly adhered to and radiographs should be ordered based upon the clinicians discretion. This list is not all inclusive.

- Under 18 years of age<sup>1</sup>
- Altered level of consciousness due to head trauma, psychiatric, or acquired alteration secondary to drug or alcohol intoxication<sup>1, 4, 5</sup>
- Overlying skin injury<sup>1, 2</sup>
- History of knee surgery or fracture<sup>2, 4</sup>
- Multiple painful injuries<sup>1, 4</sup>
- Paraplegia<sup>1</sup>
- Diminished limb sensation (e.g. diabetic patients<sup>1</sup>)
- Previous evaluation for the same injury<sup>1, 2, 4</sup>

If radiographs are not obtained, patients are advised to seek further care if they fail to satisfy all the following criteria after 14 days from the date of the injury.<sup>1</sup>

- Pain is improving
- Ability to walk is improved
- No longer requires assistance to walk
- Has returned to usual occupational activities

WSCC standard knee radiographic series

- AP, lateral

Additional views for detection of subtle abnormality or suspected occult fracture

- Intercondylar notch view (a.k.a. tunnel view)
- Tangential view of the patella (a.k.a. sunrise view)

Additional diagnostic imaging recommendations

- If serious soft tissue injuries, (e.g. ligament, tendon, or meniscal tears) are suspected, MRI is recommended. This recommendation is made as these structures are poorly visualized on plain film radiographs. Plain film radiography should be performed prior to advanced imaging however, as an initial resource for the detection of fracture.

## Discussion

With current utilization in knee injury cases, only approximately 6% of knee radiographs are positive for fracture, with patellar fracture being the most common knee fracture. Several imaging protocols for acute knee trauma have been advanced in recent literature in an attempt to decrease radiography thereby increasing cost effectiveness, while not missing any fractures.<sup>1,2,4,5</sup> There is, however, dissent as to whether any of these individual rules are sufficient for detection of 100% of fractures. Table 1 shows the statistical figures for the various rules. It can be seen that none of the rules was 100% sensitive in all trials. Due to this, a combination of portions of the various rules deemed best by literature review has been made. As this is a modification of existing protocols, it has not been held up to peer review. These modified rules have not undergone prospective or retrospective testing, and are a conglomeration of the most reliable portions of the published rules. Modifications to increase sensitivity include the use of the more stringent Pittsburgh walking rule<sup>2</sup>, and removing the term "isolated" when referring to patellar tenderness from the Ottawa rules.<sup>1,3</sup>

There is also a number of exclusions which must be kept in mind with regards to these rules. Altered mentation or altered sensorium can prevent a patient from being aware of the extent of injury. Patients younger than 18 years must be evaluated more carefully because immature bone and physal plates may predispose these patients to fractures from blunt trauma, and history is not always reliable.<sup>2</sup> The increased morbidity and liability associated with a missed or delayed diagnosis in a minor is another concern.<sup>2</sup> Patients greater than 50 years have a much higher rate of fracture than the younger population, accounting for 38% of the knee fractures, though they only accounted for 14% of the knee injury patients in one study,<sup>1</sup> and 57% of fractures for 28% of the injured patients in another.<sup>5</sup> This discrepancy is likely associated with increased incidence of osteoporosis in this age group.

Finally, a statement made by Ian Stiell, M.D., the originator of the Ottawa Knee Rules, should be kept in mind. "... [the rules]... are not meant to override clinical judgment."<sup>6</sup>

Review of knee decision rule literature								
Rule Being Tested	Author	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Positive LR	Negative LR	% decrease in radiography
Ottawa	Stiell <sup>1</sup>	100%	54%	n/a	n/a	2.17	0.00	28%
	Stiell <sup>7</sup>	100%	49%	11%	100%	1.96	0.00	28%
	Richman <sup>3</sup>	85%	49%	12%	98%	1.67	0.31	34%
	Stiell <sup>8</sup>	100%	48%	11%	100%	2.08	0.00	26%
	Seaburg <sup>9</sup>	97%	27%	n/a	n/a	1.33	0.11	23%
	Tigges <sup>10</sup>	98%	19%	13%	98%	1.21	0.11	17%
	Wigder <sup>11</sup>	n/a	n/a	14%	n/a	n/a	n/a	23%
Pittsburgh	Seaburg <sup>2</sup>	100%	79%	n/a	n/a	4.76	0.00	78%
	Weber <sup>5</sup>	100%	24%	n/a	n/a	1.32	0.00	n/a
	Seaburg <sup>9</sup>	99%	60%	n/a	n/a	2.48	0.03	52%
Bauer	Bauer <sup>4</sup>	100%	n/a	n/a	100%	n/a	0.00	39%
	Richman <sup>3</sup>	85%	49%	12%	98%	1.67	0.31	33%

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