

Diagnostic Imaging Pathways - Ankle Injury

Population Covered By The Guidance

This pathway provides guidance on imaging adult patients with suspected traumatic ankle injuries. It incorporates the Ottawa Ankle Rules.

Date reviewed: June 2016

Date of next review: June 2019

Published: June 2017

Quick User Guide

Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

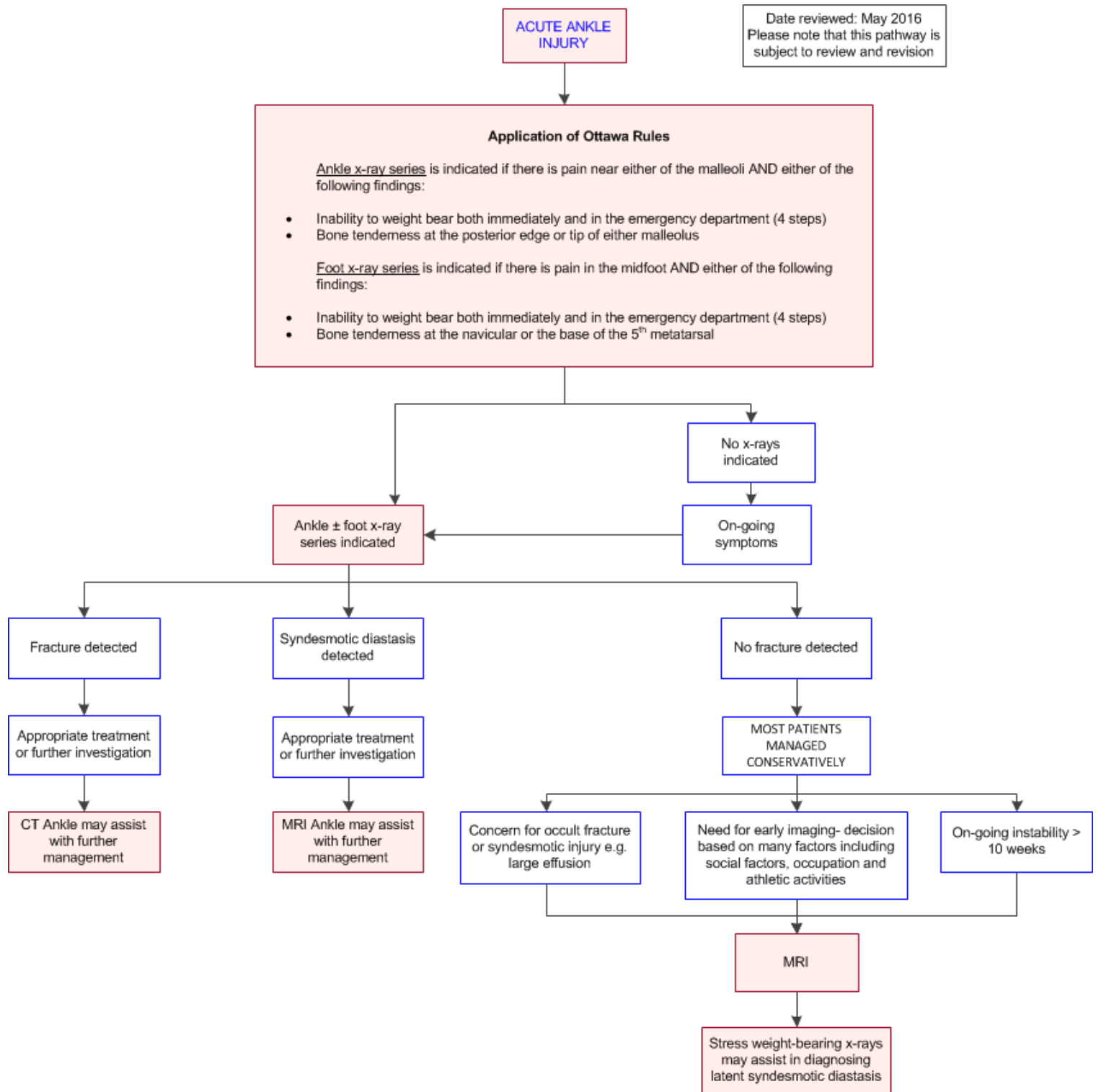


Image Gallery

Note: These images open in a new page

1a

Tri-malleolar Fracture

Image 1a (Plain Radiograph): Lateral view demonstrating a posterior tibial



fracture.

1b



Image 1b (Plain Radiograph): AP view demonstrating fractures through both medial and lateral malleoli.

2



Lateral Malleolus Fracture of Right Ankle

Image 2 (Plain Radiograph): Oblique fracture of the lateral malleolus of the right ankle. There is lateral displacement within the ankle mortise with widening of the medial joint space.

3



Fractured Fifth metatarsal

Image 3 (Plain Radiograph): Fracture of the base of the 5th metatarsal.

4



Talar Dome Fracture

Image 4 (Magnetic Resonance Imaging): Sagittal proton density image showing a chronic undisplaced osteochondral talar dome fracture.

Teaching Points

- Most patients presenting following acute ankle injury can be managed conservatively and do not require imaging
- The Ottawa Ankle Rules and Ottawa Foot Rules should be used to select patients who require ankle and/or foot radiography and can safely exclude those who do not require imaging
- MRI of the ankle may be useful in selective patients and may assist in further management
- CT of the ankle is not indicated as the initial investigation but may assist with further management
- Stress radiography may be useful in suspected latent syndesmotic diastasis

Acute Ankle Injury

- Ankle injury is a common reason for presentation to the emergency department and in the general practice setting
- In those presenting with acute ankle injury, the incidence of ankle fracture is low (2-20% amongst

- those who undergo evaluation with radiography) [1,2](#)
- Soft tissue injuries are the most common diagnosis following ankle injury, with up to 85% of ankle sprains involving the lateral ligament complex ('lateral ankle sprain') [3](#). This can be diagnosed clinically and in most, imaging is not required [2](#)
- The Ottawa Ankle Rules (OAR) safely excludes patients who do not have a fracture following acute ankle injury and assists in selecting patients who require imaging

Ottawa Ankle Rules (OAR)

- The Ottawa Ankle and Foot Rules are clinical decision rules derived for predicting which patients have a fracture following acute ankle/foot injury in order to assist in selecting those who require radiography [4](#)
- These rules were refined and validated prospectively on 453 patients [5](#)
- The OAR have been prospectively applied in several other studies [6-11](#) and in all but one [6](#) have resulted in a significant reduction in the use of ankle and foot radiographs (19-34%) without missing any clinically significant fractures
- In one systematic review and meta-analysis summarising the evidence on the accuracy of the OAR for excluding fractures of the ankle and mid-foot, the pooled sensitivity was high (> 96%) when the OAR were applied within 48 hours following injury. [12](#) Less than 2% of patients who were negative for fracture according to the OAR actually had a fracture [12](#)
- In one series, implementation of the OAR resulted in a decrease in the use of ankle radiography by 28% and foot radiography by 14% without affecting the incidence of fracture detection [13](#)
- The OAR are validated in adults and children > 5 years. They should not be used in patients with decreased sensation or inability to communicate [1](#)
- The specificity of the OAR ranged from 26-48% in one study. [12](#) Modified OAR have been suggested to increase its specificity but have not been validated [1,14](#)

Plain Radiography of the Ankle and Foot

- An ankle x-ray series usually consists of anteroposterior (AP), lateral and mortise views. The fifth metatarsal distal to the tuberosity should be seen in at least one projection [1](#)
- The presence of an ankle effusion is best appreciated on the lateral view and is an important finding as a large effusion may represent an occult fracture [15](#)
- In one series, 33% of patients with an ankle effusion but no detectable fracture on radiography had an occult fracture confirmed on computed tomography. [15](#) The positive predictive value for occult fracture is generally greater for larger effusions (0.5 for 8mm, 0.86 for 15mm) [15](#) and a cut off of > 15mm has been suggested to prompt further cross-sectional imaging with MRI [1,2,16](#)
- A foot x-ray series usually consists of AP, oblique and lateral view

Magnetic Resonance Imaging (MRI) of the Ankle

- MRI can detect rupture of lateral ligaments with a sensitivity of 75-100%. [2,17](#) However, it is not routinely performed in this setting as findings do not correlate with clinical outcome [18](#) and most ligamentous injuries heal with sufficient strength to maintain joint stability with conservative management [1,2](#)
- For injuries of the tibiofibular syndesmosis, MRI has a sensitivity of 100% and specificity of 70-100% [19](#)



- Limitations of MRI include [2](#)
 - High cost
 - Longer examination time
 - Less availability
- For these reasons and the high incidence of sprained ankle, MRI has been recommended for [1, 2, 20](#)
 - Detection of occult fractures
 - Injuries of the tibiofibular syndesmosis
 - Chronic instability of the ankle
 - Suspected osteochondral lesions
 - When there is a need for an early imaging-based decision such as with high-performance athletes

Computed Tomography (CT) of the Ankle

- CT is not indicated for initial imaging in acute ankle injury. [1, 14](#) It may assist with further management following diagnosis with x-ray [1, 21](#)
- Although an uncommon injury, fractures of the talus are negative in up to 40% of plain radiographs [1](#)
- Lateral process fractures of the talus are most common in snowboarders and should be suspected when there is a history of inversion with dorsiflexion, together with tenderness over the lateral aspect of the talus [22](#)
- Although there is limited evidence regarding the diagnostic accuracy of CT in ankle injury, it has been recommended for assessing the degree of displacement in the preoperative panning for fractures of the talus [1](#)

Stress Weight-bearing Radiography

- Syndesmotic injuries (high ankle sprain) can be challenging to diagnose on static radiographs, as the fibula remains reduced. Some syndesmotic injuries, particularly Grade II, may be occultly unstable and if left untreated, can result in chronic instability, pain, degenerative joint disease and predispose to further injury [23](#)
- In addition to a thorough clinical examination (including special tests such as the external rotation test), stress weight bearing radiographs (where tolerated by the patient) may assist in detecting latent syndesmotic injury [24](#)
- Classically, syndesmotic injuries may be present if radiographs show increased tibiofibular clear space, decreased tibiofibular overlap and/or increased medial clear space [25](#)

References

Date of literature search: June 2016

The search methodology is available on request. [Email](#)

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

1. Mosher TJ, Kransdorf MJ, Adler R, Appel M, Beaman FD, Bernard SA, et al. **ACR Appropriateness Criteria acute trauma to the ankle.** J Am Coll Radiol. 2015;12(3):221-7. (Guidelines). [View the reference](#)
2. Polzer H, Kanz KG, Prall WC, Haasters F, Ockert B, Mutschler W, et al. **Diagnosis and treatment of acute ankle injuries: development of an evidence-based algorithm.** Orthop Rev (Pavia). 2012;4(1):e5. (Guidelines). [View the reference](#)
3. Cheng Y, Cai Y, Wang Y. **Value of ultrasonography for detecting chronic injury of the lateral ligaments of the ankle joint compared with ultrasonography findings.** Br J Radiol. 2014;87(1033):20130406. (Level III evidence). [View the reference](#)
4. Stiell IG, Greenberg GH, McKnight RD, Nair RC, McDowell I, Worthington JR. **A study to develop clinical decision rules for the use of radiography in acute ankle injuries.** Ann Emerg Med. 1992;21(4):384-90. (Level II evidence). [View the reference](#)
5. Stiell IG, Greenberg GH, McKnight RD, Nair RC, McDowell I, Reardon M, et al. **Decision rules for the use of radiography in acute ankle injuries. Refinement and prospective validation.** Jama. 1993;269(9):1127-32. (Level I evidence). [View the reference](#)
6. Kelly AM, Richards D, Kerr L, Grant J, O'Donovan P, Basire K, et al. **Failed validation of a clinical decision rule for the use of radiography in acute ankle injury.** N Z Med J. 1994;107(982):294-5. (Level II evidence). [View the reference](#)
7. Lucchesi GM, Jackson RE, Peacock WF, Cerasani C, Swor RA. **Sensitivity of the Ottawa rules.** Ann Emerg Med. 1995;26(1):1-5. (Level II evidence). [View the reference](#)
8. Pigman EC, Klug RK, Sanford S, Jolly BT. **Evaluation of the Ottawa clinical decision rules for the use of radiography in acute ankle and midfoot injuries in the emergency department: an independent site assessment.** Ann Emerg Med. 1994;24(1):41-5. (Level II evidence). [View the reference](#)
9. Stiell I, Wells G, Laupacis A, Brison R, Verbeek R, Vandemheen K, et al. **Multicentre trial to introduce the Ottawa ankle rules for use of radiography in acute ankle injuries. Multicentre Ankle Rule Study Group.** Bmj. 1995;311(7005):594-7. (Level II evidence). [View the reference](#)
10. Papacostas E, Malliaropoulos N, Papadopoulos A, Liouliakis C. **Validation of Ottawa ankle rules protocol in Greek athletes: study in the emergency departments of a district general hospital and a sports injuries clinic.** Br J Sports Med. 2001;35(6):445-7. (Level II evidence). [View the reference](#)
11. Leddy JJ, Smolinski RJ, Lawrence J, Snyder JL, Priore RL. **Prospective evaluation of the Ottawa Ankle Rules in a university sports medicine center. With a modification to increase specificity for identifying malleolar fractures.** Am J Sports Med. 1998;26(2):158-65. (Level II evidence). [View the reference](#)
12. Bachmann LM, Kolb E, Koller MT, Steurer J, ter Riet G. **Accuracy of Ottawa ankle rules to exclude fractures of the ankle and mid-foot: systematic review.** BMJ. 2003;326(7386):417. (Level II evidence). [View the reference](#)
13. Stiell IG, McKnight RD, Greenberg GH, McDowell I, Nair RC, Wells GA, et al. **Implementation of the Ottawa ankle rules.** JAMA. 1994;271(11):827-32. (Level I evidence). [View the reference](#)
14. Jonckheer P, Willems T, De Ridder R, Paulus D, Holdt Henningsen K, San Miguel L, et al. **Evaluating fracture risk in acute ankle sprains: Any news since the Ottawa Ankle Rules? A systematic review.** Eur J Gen Pract. 2016;22(1):31-41. (Level II evidence). [View the reference](#)
15. Clark TW, Janzen DL, Ho K, Grunfeld A, Connell DG. **Detection of radiographically occult ankle fractures following acute trauma: positive predictive value of an ankle effusion.** AJR Am J Roentgenol. 1995;164(5):1185-9. (Level III evidence). [View the reference](#)
16. Clark TW, Janzen DL, Logan PM, Ho K, Connell DG. **Improving the detection of radiographically occult ankle fractures: positive predictive value of an ankle joint effusion.** Clin Radiol. 1996;51(9):632-6. (Level III evidence). [View the reference](#)
17. Gaebler C, Kukla C, Breitenseher MJ, Nellas ZJ, Mittlboeck M, Trattinig S, et al. **Diagnosis of lateral ankle ligament injuries. Comparison between talar tilt, MRI and operative findings in**



- 112 athletes.** Acta Orthop Scand. 1997;68(3):286-90. (Level III evidence). [View the reference](#)
- 18.** Zanetti M, De Simoni C, Wetz HH, Zollinger H, Hodler J. **Magnetic resonance imaging of injuries to the ankle joint: can it predict clinical outcome?** Skeletal Radiol. 1997;26(2):82-8. (Level III/IV evidence). [View the reference](#)
- 19.** Oae K, Takao M, Naito K, Uchio Y, Kono T, Ishida J, et al. **Injury of the tibiofibular syndesmosis: value of MR imaging for diagnosis.** Radiology. 2003;227(1):155-61. (Level III evidence) [View the reference](#)
- 20.** Cheung Y, Rosenberg ZS. **MR imaging of ligamentous abnormalities of the ankle and foot.** Magn Reson Imaging Clin N Am. 2001;9(3):507-31, x. (Review article). [View the reference](#)
- 21.** van den Bekerom MP. **Diagnosing syndesmotic instability in ankle fractures.** World J Orthop. 2011;2(7):51-6. (Review article). [View the reference](#)
- 22.** Chan GM, Yoshida D. **Fracture of the lateral process of the talus associated with snowboarding.** Ann Emerg Med. 2003;41(6):854-8. (Level IV evidence). [View the reference](#)
- 23.** Ryan LP, Hills MC, Chang J, Wilson CD. **The lambda sign: a new radiographic indicator of latent syndesmosis instability.** Foot Ankle Int. 2014;35(9):903-8. (Level III evidence). [View the reference](#)
- 24.** Lin CF, Gross ML, Weinhold P. **Ankle syndesmosis injuries: anatomy, biomechanics, mechanism of injury, and clinical guidelines for diagnosis and intervention.** J Orthop Sports Phys Ther. 2006;36(6):372-84. (Review article). [View the reference](#)
- 25.** Hunt KJ. **Syndesmosis injuries.** Curr Rev Musculoskelet Med. 2013;6(4):304-12. (Review article). [View the reference](#)

Information for Consumers

Information from this website	Information from the Royal Australian and New Zealand College of Radiologists' website
<p>Consent to Procedure or Treatment</p> <p>Radiation Risks of X-rays and Scans</p> <p>Ankle Injury</p> <p>Computed Tomography (CT)</p> <p>Magnetic Resonance Imaging (MRI)</p> <p>Plain Radiography (X-ray)</p>	<p>Computed Tomography (CT)</p> <p>Magnetic Resonance Imaging (MRI)</p> <p>Plain Radiography/X-rays</p> <p>Radiation Risk of Medical Imaging During Pregnancy</p> <p>Radiation Risk of Medical Imaging for Adults and Children</p>

Copyright

© Copyright 2015, Department of Health Western Australia. All Rights Reserved. This web site and its

content has been prepared by The Department of Health, Western Australia. The information contained on this web site is protected by copyright.

Legal Notice

Please remember that this leaflet is intended as general information only. It is not definitive and The Department of Health, Western Australia can not accept any legal liability arising from its use. The information is kept as up to date and accurate as possible, but please be warned that it is always subject to change

File Formats

Some documents for download on this website are in a Portable Document Format (PDF). To read these files you might need to download Adobe Acrobat Reader.



[Legal Matters](#)