



Title: <b>Imaging Guidelines in the Secondary Care Environment</b>		Effective date: <b>July 2016</b>
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## Introduction

These guidelines for Radiology, Ultrasound, Nuclear Medicine, CT and MRI have been endorsed by the Radiology Services Committee, Clinical Council and Executive Management Team. They are intended to both rationalise and also ensure appropriate utilisation of imaging resources in secondary care in the Hawkes Bay Health System.

Radiology will prioritise referrals according to these guidelines. Variation from these guidelines may well require a SMO to SMO discussion. The guidelines focus on the conditions that are either (or both) common and acute. Requests for indications not covered by the guidelines may need discussion.

These guidelines are intended for use in the secondary care environment. For guidance in access to medical imaging in primary care please refer to:

### [National Criteria for Access to Community Radiology 2015](#)

As there are no national guidelines or pathways for secondary care we have had to develop our own imaging guidelines. We have based these guidelines around the guidelines produced by Waikato DHB, [Western Australian Imaging Guidelines](#), and the Choosing Wisely initiative.

***“a useful investigation is one in which the result – positive or negative – may alter management and improve the outcome for the patient”*** (NCRAC). Always ask whether the investigation meets these criteria. A significant number of radiological investigations do not fulfil these aims and may add unnecessarily to patient irradiation. Particular consideration is required before ordering tests with ionising radiation, especially in younger people.

Please note that inappropriate requests for both MRI and CT scanning in ED can delay patient flow, both for the patient awaiting an unnecessary scan, and for patients who actually need scans.

**Imaging should never be requested as an alternative to performing an assessment of a patient.**

Imaging will not be performed on a patient's or relatives' request if there is no good clinical indication. Having guidelines can help empower doctors to decline such requests. These guidelines also mean that the organization will take the risk if rationing limits access.

## Choosing Wisely

The American Boards in Internal Medicine have started an initiative to rationalise management. The ABIM note: *“waste and overuse are widespread in US medicine, affecting both the quality of care (up to 30,000 deaths annually from overuse) and costs to the health care system.”*



*An initiative of the ABIM Foundation*

Similar initiatives are now being undertaken in Australasia as 'Choosing Wisely Australia'.

The Royal Australia and New Zealand College of Radiologists have published a list of the Top 5 things clinicians and consumers should question.

We have included the relevant 'Choosing Wisely' recommendations in these guidelines.

The general recommendations are listed here and the more specific ones are included in the relevant section in red font.

### **The 'Choosing Wisely' recommendations include:**

Do not order chest radiography for screening purposes for patients being admitted to the hospital. Avoid preoperative chest x-rays for ambulatory patients with unremarkable history and physical exam

### **See the following links:**

[America's Epidemic of Unnecessary Care – The New Yorker](#)

[Choosing Wisely American Boards in Internal Medicine](#)

[Choosing Wisely Recommendations Australia RANZCR 2015](#)

[Choosing Wisely in the UK BMJ 2015](#)

[Choosing Wisely Recommendations Australia ACEM 2015](#)

[US ACEM Top-Five List JAMA 2014](#)

## Radiology Requests

The HBDHB radiology department has policies on requesting requirements, responsibilities and limitations. There is a policy for radiology request forms from medical practitioners and nurse practitioners and a separate policy for radiology request forms from other health professionals such as registered nurses. It is the responsibility of the referrer and radiology personnel to be familiar with the pertinent radiology requesting policies.

All requests for a nuclear medicine scan, CT or MRI that are made on behalf of an SMO, must have the SMO's name in the clinical details section to ensure that the report is directed to the right SMO. Radiology will take a zero tolerance approach to this. If the form is written on behalf of an SMO and there is No SMO name = No scan.

- Emergency or after hours scans must always be discussed with the on call SMO with responsibility for the care of the patient.
- After hours MRI requests (service only available until 7pm) must also be discussed with a Radiologist.
- You can't just FAX the request for an urgent CT or MRI scan and expect it to be actioned (in or out of hours).

Request forms must have adequate clinical details, the main objective of the examination, and include:

- Clinical indications, any relevant past history and results of prior imaging studies
- Any allergies especially to X-ray contrast
- Possible infection risks e.g. HIV/Hep B +ve
- Coagulation factors prior to any invasive procedures, and
- A recent eGFR and creatinine if the examination may include IV contrast

Any invasive examination requiring IV contrast requires the patient to fill out a safety and information form prior to the procedure. In most cases these will be sent to the ward prior to the examination. Complete forms in good time. Do not forget to include a recent eGFR and insert an appropriate IV line. Not doing so may lead to cancellation or delay in doing the test. Remember that the eGFR should only be calculated if the creatinine is stable and in AKI will underestimate renal function.

## Timing

The time frames indicated in these guidelines are a reasonable compromise given our resources. Variation will usually require a SMO to SMO discussion.

Less urgent imaging should be done as an outpatient.

Radiology has agreed to give a day and time for non-urgent scans to allow a patient to be discharged if they are only awaiting a scan and there is no other reason for them to be in hospital.

Patients should never be admitted just to try and fast-track investigations and 'jump the queue'.

Priority 0 - Acute ED/inpatient same day as request

Priority 1 - Urgent IP 1-3 days

Priority 2 - Urgent OP within 10 working days

Priority 3 - Routine within 6 weeks

Priority 4 - Routine for future date > 6 weeks

## Repeat Imaging

Imaging should not be repeated without good clinical reasons.

- Always check if your patient has had imaging in the community
- Consider whether imaging really needs to be repeated and if the results will change management.
- For some conditions (for example epilepsy) we have included indications for repeat imaging.

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## **Abdominal Pain**

### **General Principles**

An appropriate clinical assessment should always precede imaging.

Patients with “surgical abdomens” do not always require imaging and imaging should not need to be done to “prove” a patient with abdominal pain has a surgical problem before they are seen.

### **Plain Film Radiology**

Plain film radiology (PFR) has a limited role and should only be used for specific indications.

In an unselected population with acute abdominal pain PFR rarely alters clinical management.

Utilising PFR for 'non-specific abdominal pain' is unlikely to yield a positive finding. Significantly, unrelated or incidental pathology can be identified and alter clinical management erroneously.

Evidence and consensus indications for PFR in the investigation of acute abdominal pain include:

- suspected bowel obstruction or ileus
- suspected bowel perforation
- ingested foreign body, and
- **severe** abdominal pain or tenderness of unknown origin requiring opiate analgesia

The [National Community Radiology Access Criteria](#) have the following indications for PFR:

- diagnosis of constipation where patient history is unobtainable
- follow-up of radio-opaque renal tract stones with a kidney, ureter, bladder (KUB) X-ray

The NCRAC note referral for community X-ray not typically indicated:

- acute abdomen: discuss with acute surgical services or emergency services
- vague central abdominal pain
- suspected colorectal neoplasm
- suspected constipation (other than in specific patient groups as above)

### **Ultrasound**

In young patients (<40) ultrasound is usually preferred to CT to minimise radiation exposure.

In women with lower abdominal pain pelvic ultrasound should always be considered first. In RUQ pain and suspected cholecystitis ultrasound should usually be requested first.

US hours of service 8am-5pm, Monday-Friday

## **CT**

### **The 'Choosing Wisely' recommendations include:**

CT scans are not necessary in the routine evaluation of children with abdominal pain.

Don't do CT for the evaluation of suspected appendicitis in children until after ultrasound has been considered as an option.

For a patient with functional abdominal pain syndrome (as per ROME III criteria) CT scans should not be repeated unless there is a major change in clinical findings or symptoms.

## **MRI**

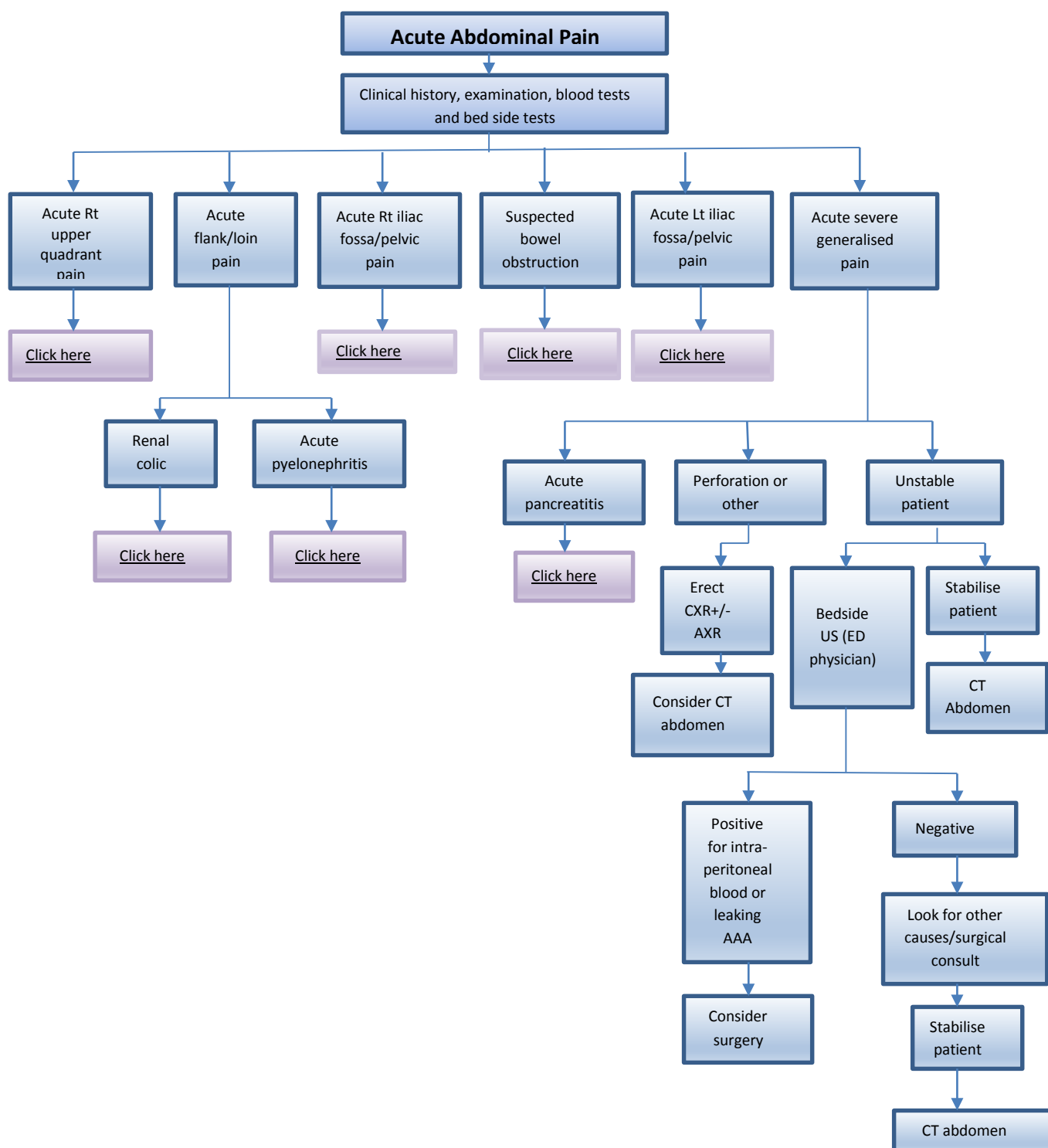
MRI is rarely needed except for specific indications and should only be done after specialist review and usually a discussion in the MDT (for example staging pelvic tumours before surgery).

Clinical urgency: Depends on the acuity. After 5.00pm the MRI service is only available for cord compression cases. These must first be discussed with a radiologist.



## Waikato DHB Guidelines

- **Cholecystitis (Suspected)**
- **Left Iliac Fossa Pain**
- **Right Iliac Fossa Pain**
- **Pyelonephritis (Suspected)**
- **Renal Colic (Suspected)**
- **Pancreatitis (Suspected)**



As this shows there are further pathways based on the site of pain (for example: RIF, LIF, RUQ, Loin) and/or the likely cause (Cholecystitis, Renal Colic, Pyelonephritis, Pancreatitis).

## Cholecystitis (Suspected)

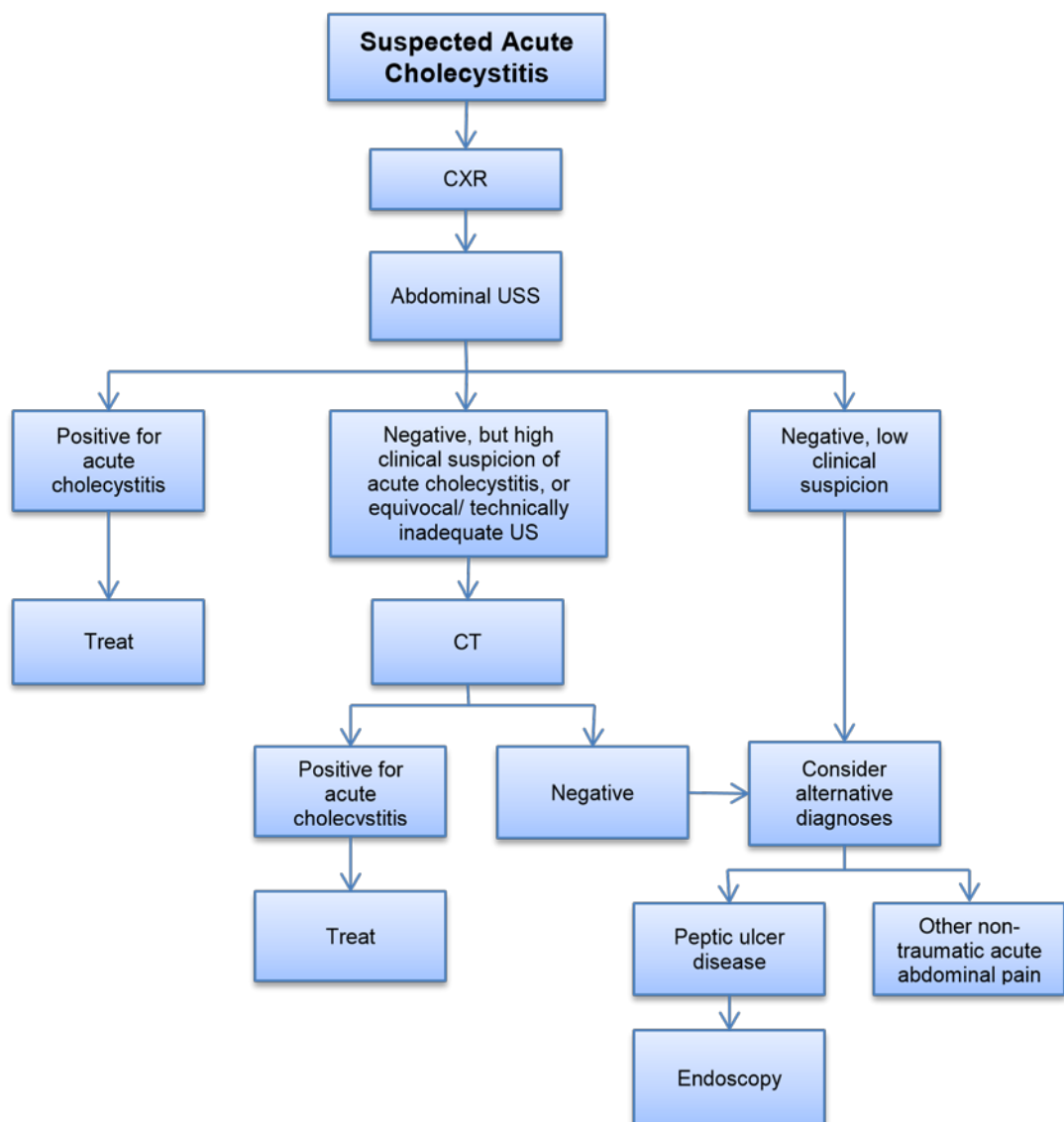
Plain abdominal radiography has no place in suspected acute cholecystitis but a CXR may help exclude a pulmonary condition as the cause of the symptoms.

Ultrasound is very specific in the diagnosis of acute cholecystitis, particularly if the signs of gall bladder wall thickening or oedema, peri-cholecystic fluid, gallstones and a positive ultrasonic Murphy's sign are all present but it has limited sensitivity.

If ultrasound is negative alternative diagnoses should be considered and if these are more likely appropriate further investigation (e.g. endoscopy) may be appropriate.

The Australian guidelines recommend that if there is a continuing high clinical suspicion of acute cholecystitis but a negative (or technically unsatisfactory) ultrasound a Tc-HIDA nuclear medicine scan is performed but we have more limited access to radio-isotope scanning.

A CT may help when the clinical picture is non-specific as it can detect other intra-abdominal inflammatory processes and when complications of acute cholecystitis are suspected.



## Left Iliac Fossa Pain

Causes of acute left iliac fossa pain to consider include:

- acute sigmoid diverticulitis
- tubo-ovarian pathology and ectopic pregnancy in females

- ischaemic colitis
- pseudomembranous colitis
- inflammatory bowel disease
- locally perforated sigmoid carcinoma
- renal colic
- leaking abdominal aortic aneurysm

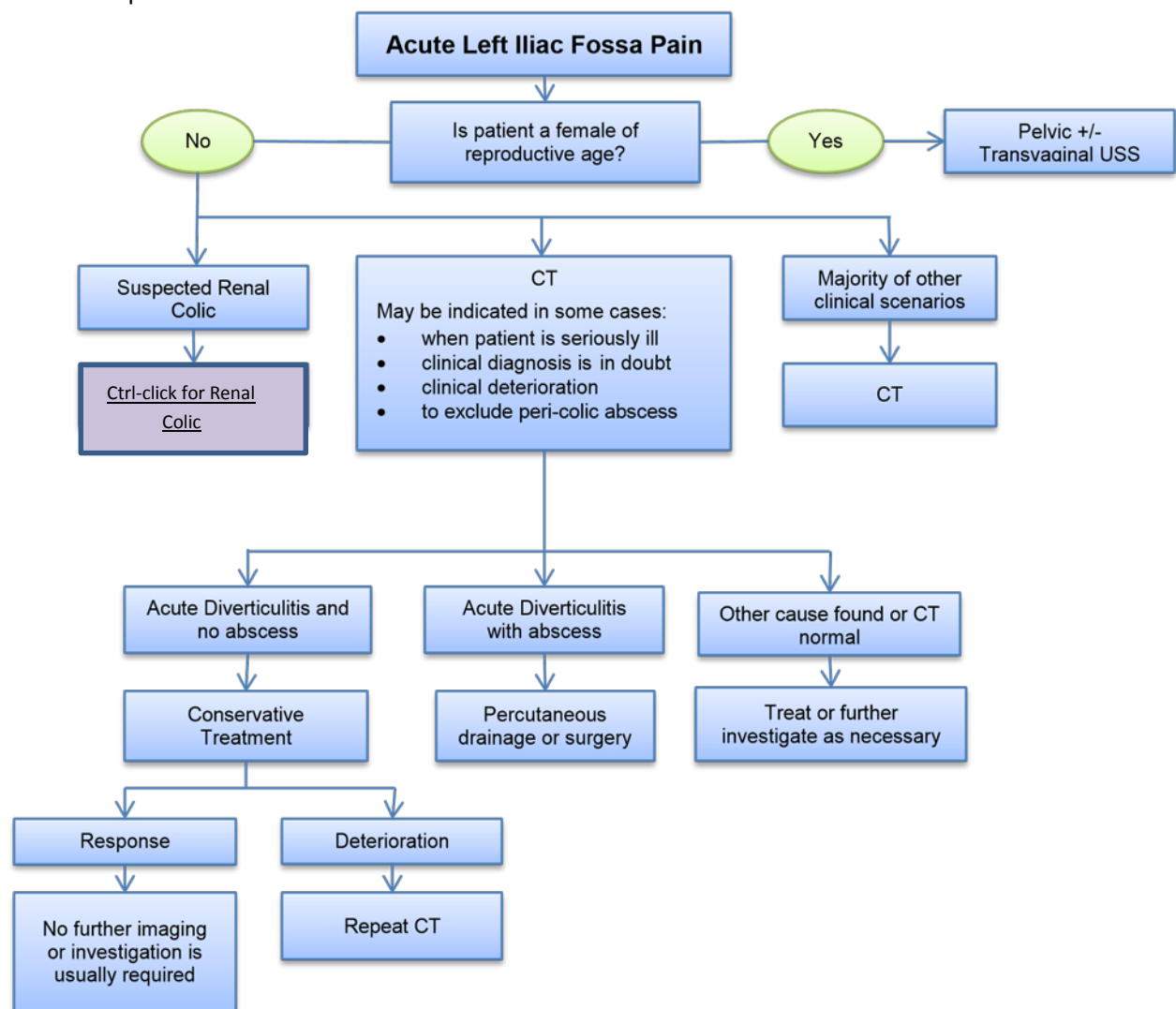
An erect CXR is useful in excluding pneumo-peritoneum and in the assessment of coincidental cardiorespiratory pathology. An abdominal X-ray rarely helps.

In young female patients, US should be performed initially to detect gynaecological causes.

In suspected acute colonic diverticulitis, if investigation is needed, CT is the usual first line test.

Indications for CT include:

- when patient is seriously ill
- when clinical diagnosis is in doubt
- clinical deterioration
- exclusion of pericolic abscess



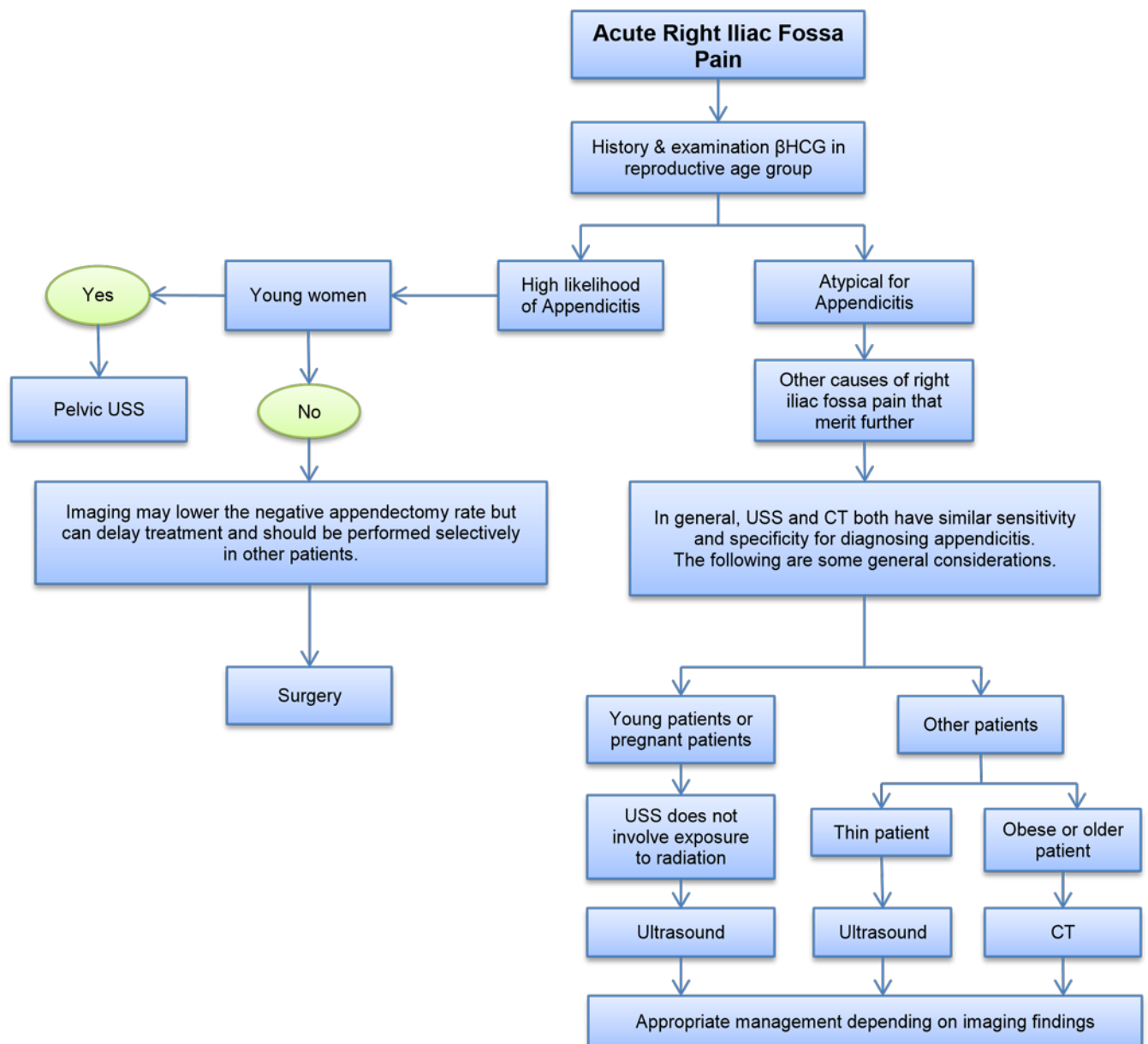
## Right Iliac Fossa Pain

In suspected acute appendicitis, imaging can significantly reduce the negative appendectomy rate but must not delay treatment.

Both ultrasound and CT are accurate for the diagnosis of appendicitis.

Ultrasound is generally preferable as the first investigation in young patients because:

- there is no ionizing radiation
- it can detect gynaecological causes of acute pain in young female patients



## Renal Colic (Suspected)

In older patients it is important to consider and exclude an abdominal aortic aneurysm.

This is best done in with a bedside USS but some patients may require a contrast CT.

A non-contrast enhanced CT scan is the most accurate way of detecting calculi in the renal tract.

An ultra-low dose CT scan gives an acceptably low radiation exposure and is of acceptable accuracy for detecting calculi and/or most alternative causes of pain.

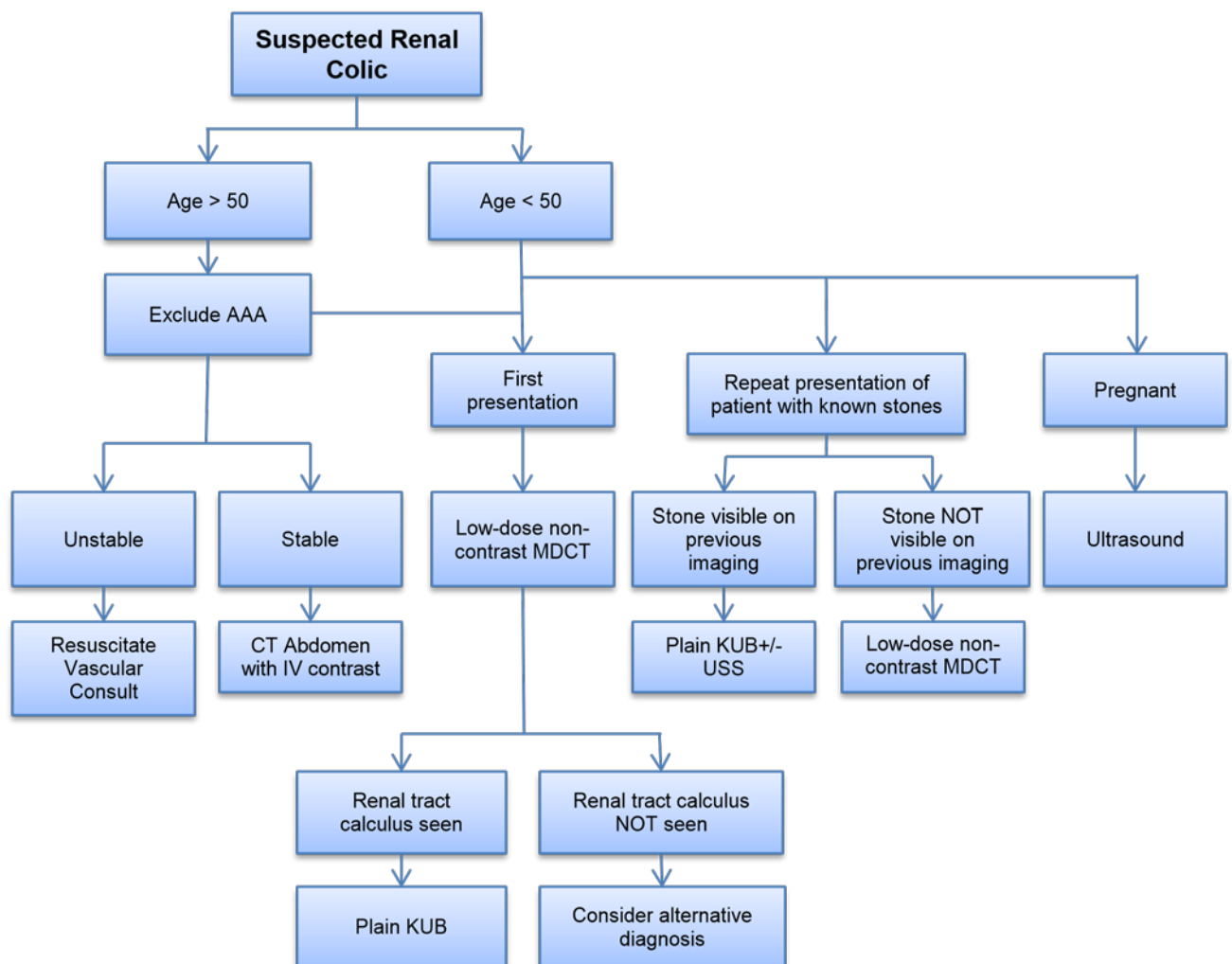
In young patients with typical symptoms of renal colic, plain x-ray and ultrasound is an acceptable initial combination and in pregnant patients, ultrasound is the investigation of choice.

Ultrasound has high specificity (90%) but low sensitivity (10-50%) for the diagnosis of ureteric stones and >90% sensitivity and specificity for the detection of urinary tract obstruction.

Plain film in combination with US has a sensitivity of 77-79% and specificity of 90-92.7% for stones.

**The 'Choosing Wisely' recommendations include:**

Avoid requesting CT KUB in otherwise healthy ED patients, age <50 years, with a history of kidney stones, presenting with symptoms and signs consistent with uncomplicated renal colic



## **Pancreatitis (Suspected)**

Routine CT scan is not indicated. The role of imaging in acute pancreatitis is to:

- exclude an underlying cause (e.g. gallstones)
- assess severity
- detect complications
- guide treatment of complications (e.g. fluid collection drainage)

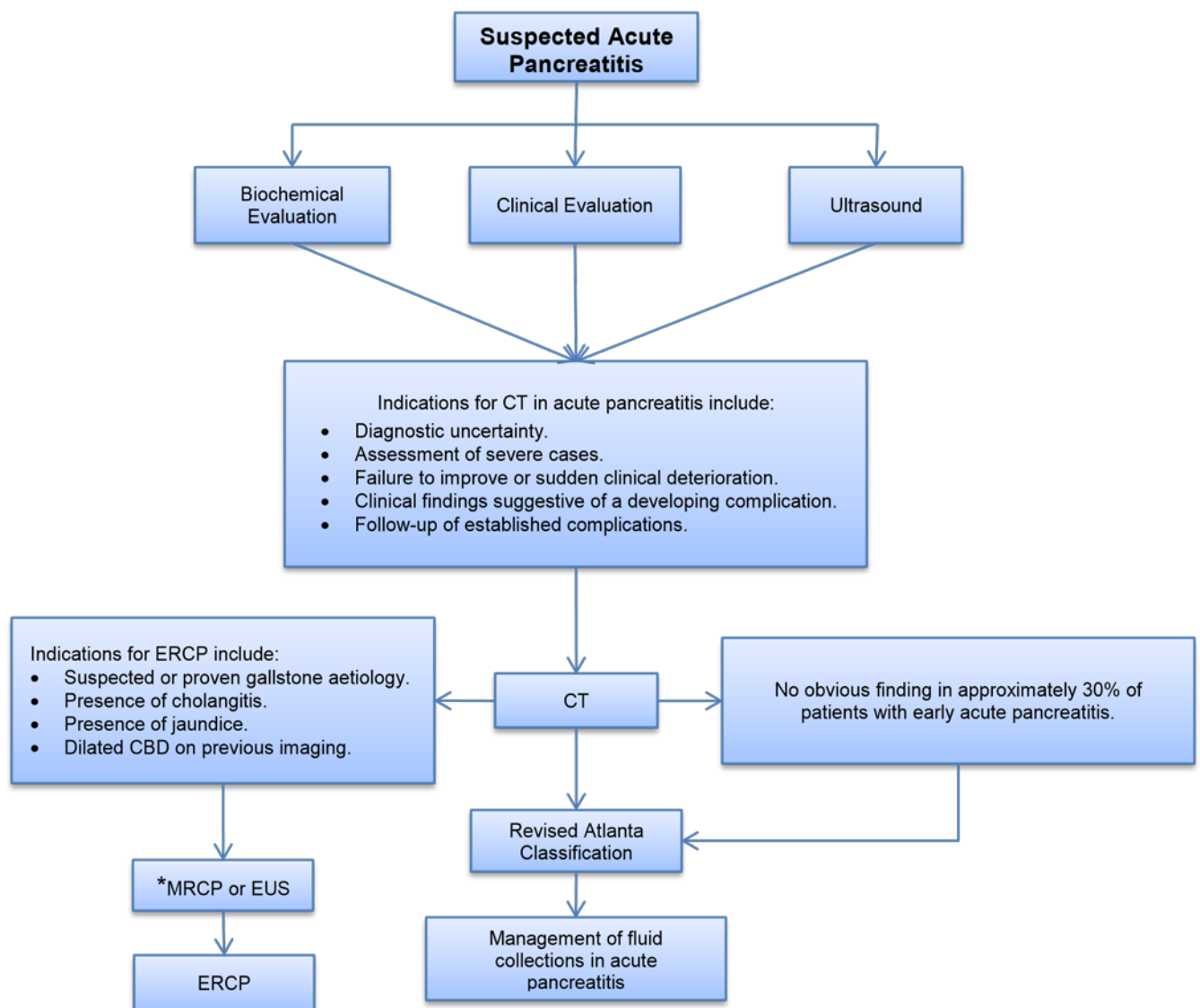
CT indications include:

- where diagnosis is in doubt
- clinically severe cases to assess degree of pancreatic necrosis
- failure to improve or sudden deterioration
- imaging complications of pancreatitis

Ultrasound may help determine the aetiology by assessing for gallstones and dilated ducts.

ERCP indications are shown in the pathway.

\*MRCP and/or endoscopic US may help in determining the aetiology in difficult cases but may not be appropriate if an interventional ERCP is indicated anyway.



## **Pyelonephritis (Suspected)**

In uncomplicated acute pyelonephritis imaging is not usually indicated.

There are several indications for imaging in suspected acute pyelonephritis:

- when the diagnosis is uncertain/equivocal
- if obstruction of the collecting system is suspected
- patients with suspected or known underlying anatomical predisposition
- recurrent acute pyelonephritis
- in 'high risk' patients who are more susceptible to occult infection or complications: this includes individuals with diabetes mellitus, elderly patients, patients who are immunosuppressed or on immunosuppressant therapy, renal transplant patients
- in patients who fail to respond to culture sensitive intravenous antibiotics within 72hrs

Ultrasound is usually the appropriate first line investigation in such cases.

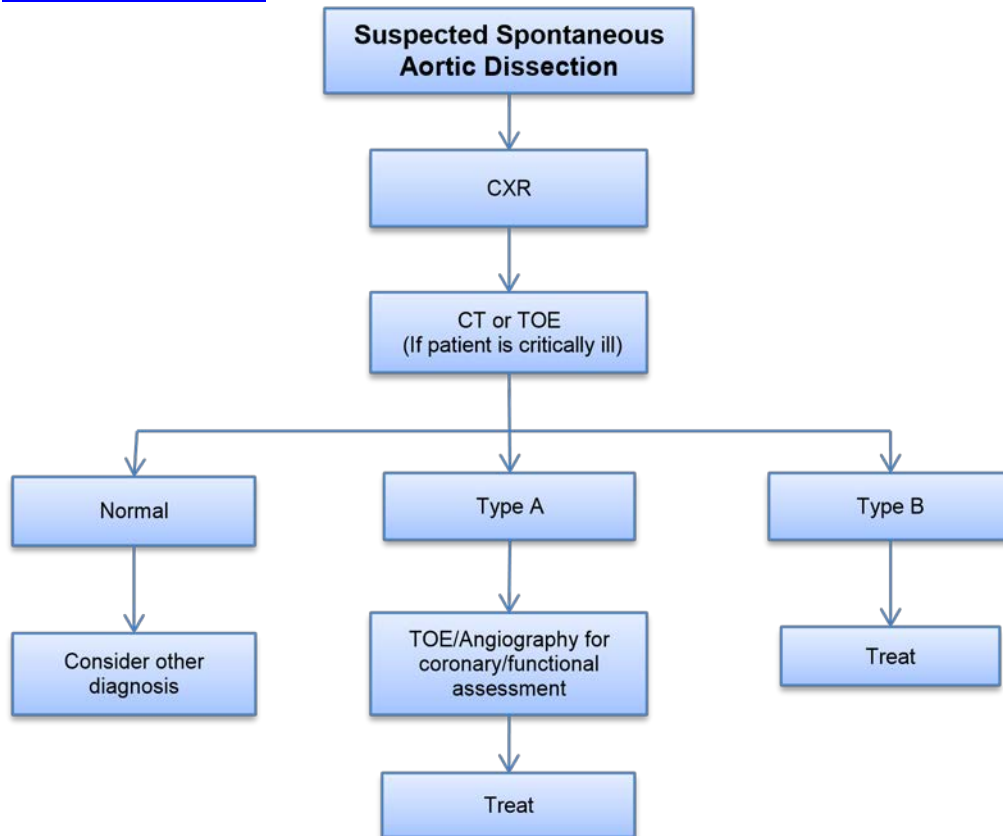
CT is more sensitive than ultrasound in diagnosing pyelonephritis or its complications and/or excluding other causes and may be used selectively in patients with no evidence of obstruction on ultrasound, if they are not improving (especially for 'high risk' patients).

## **Abdominal Masses and Organomegaly**

The option of ultrasound should be considered (as it is a non-contrast investigation) but in patients with suspected malignancy abdominal CT is usually preferred over ultrasound unless the patient has renal impairment, a contraindication to contrast or suspected biliary obstruction.

Clinical urgency: Dependent on the acuity. Diagnostic imaging takes precedence over staging.

## Aortic Dissection



A CXR is also helpful in excluding other causes of chest pain but a normal CXR does not exclude the diagnosis of aortic dissection.

Contrast enhanced spiral CT scan is the initial investigation of choice for the evaluation of suspected spontaneous aortic dissection.

Echocardiography is very rarely used as the first line imaging modality.

## Abdominal Aortic Aneurysm (AAA) Rupture or Leak

As indicated in the abdominal pain algorithm, a bedside ultrasound scan performed by an Emergency Physician is the best initial investigation to screen for an abdominal aneurysm.

CT may be indicated if the USS is negative and there remains diagnostic uncertainty.

Ultrasound is the first line modality for follow up of abdominal aortic aneurysms. CT angiography is used in patients with aneurysms >5 cm in diameter to guide surgery or endoluminal repair.



## Arthritis Joint Disease and Osteoporosis

The new National Community Radiology Access Criteria have very reasonable recommendations for imaging in suspected joint disease. They focus on red flags and when imaging is not typically indicated and emphasize the importance of considering whether the result will change management.

The following 10 key recommendations for imaging in rheumatoid arthritis are taken from the Ann Rheum Dis 2013;0:1–11. They were developed using the limited research-based evidence available (level of evidence shown) and expert opinion.

MRI requests in rheumatoid arthritis must be endorsed by a consultant rheumatologist.

**Table 1** Recommendations, SOR and level of evidence

Recommendation*	SOR, mean VAS 0–10 (95% CI)	Level of evidence
1 When there is diagnostic doubt, CR, ultrasound or MRI can be used to improve the certainty of a diagnosis of RA above clinical criteria alone†	9.1 (8.6 to 9.6)	III
2 The presence of inflammation seen with ultrasound or MRI can be used to predict the progression to clinical RA from undifferentiated inflammatory arthritis	7.9 (6.7 to 9.0)	III
3 Ultrasound and MRI are superior to clinical examination in the detection of joint inflammation; these techniques should be considered for more accurate assessment of inflammation	8.7 (7.8 to 9.7)	III
4 CR of the hands and feet should be used as the initial imaging technique to detect damage. However, ultrasound and/or MRI should be considered if conventional radiographs do not show damage and may be used to detect damage at an earlier time point (especially in early RA)	9.0 (8.4 to 9.6)	IV
5 MRI bone oedema is a strong independent predictor of subsequent radiographic progression in early RA and should be considered for use as a prognostic indicator. Joint inflammation (synovitis) detected by MRI or ultrasound as well as joint damage detected by conventional radiographs, MRI or ultrasound can also be considered for the prediction of further joint damage	8.4 (7.7 to 9.2)	III
6 Inflammation seen on imaging may be more predictive of a therapeutic response than clinical features of disease activity; imaging may be used to predict response to treatment	7.8 (6.7 to 8.8)	III-IV
7 Given the improved detection of inflammation by MRI and ultrasound than by clinical examination, they may be useful in monitoring disease activity	8.3 (7.4 to 9.1)	III
8 The periodic evaluation of joint damage, usually by radiographs of the hands and feet, should be considered. MRI (and possibly ultrasound) is more responsive to change in joint damage and can be used to monitor disease progression	7.8 (6.8 to 8.9)	III
9 Monitoring of functional instability of the cervical spine by lateral radiograph obtained in flexion and neutral should be performed in patients with clinical suspicion of cervical involvement. When the radiograph is positive or specific neurological symptoms and signs are present, MRI should be performed	9.4 (8.9 to 9.8)	III
10 MRI and ultrasound can detect inflammation that predicts subsequent joint damage, even when clinical remission is present and can be used to assess persistent inflammation	8.8 (8.0 to 9.6)	III

\*Recommendations are based on data from imaging studies that have mainly focused on the hands (particularly wrists, metacarpophalangeal and proximal interphalangeal joints). There are few data with specific guidance on which joints to image.

†In patients with at least one joint with definite clinical synovitis, which is not better explained by another disease.

Note that Hawkes Bay Hospital does not have a DEXA scanner. Limited funding is available for private scans. Requests are co-ordinated by the medical managers. Requests must be endorsed by a SMO.

### The 'Choosing Wisely' recommendations include:

Don't perform MRI of the peripheral joints to routinely monitor inflammatory arthritis.

Don't routinely perform surveillance joint radiographs to monitor juvenile idiopathic arthritis (JIA) disease activity.

Avoid ordering a knee MRI for a patient with anterior knee pain without mechanical symptoms or effusion unless the patient has not improved following completion of an appropriate functional rehabilitation program.

Don't use DEXA screening for osteoporosis in women younger than 65 or men younger than 70 with no risk factors. Don't routinely repeat DEXA scans more often than once every two years.

## Back Pain

The prevalence of previously undiagnosed serious pathology in patients presenting with acute low back pain in the primary care setting is very rare.

Routine or immediate imaging for back pain without indications of serious underlying conditions does not usually affect management or improve outcomes and is associated with radiation exposure. Imaging is usually only indicated if there are red flags or neurological findings.

The NCRAC have the following indications for plain X-ray in this setting:

- spine pain >8 weeks
- spine pain with red flags
- spine pain and osteoporosis or prolonged use of corticosteroids
- focal neurological deficit
- significant spinal deformity

'Red flags' that prompt imaging in primary care include:

- recent significant trauma (mild trauma if age = 50)
- unexplained weight loss
- fever
- age <22 or >55 years
- history of malignancy or immune compromise
- intravenous drug use
- osteoporosis or glucocorticoid use
- suspicion of ankylosing spondylitis
- compensation or work injury issues

If there are no 'red flags', imaging is indicated only after a period of conservative therapy is trialled first. Initial investigation is usually with plain films.

Further imaging may be indicated if plain X-rays are abnormal or the cause of the pain remains uncertain or for specific indications like suspected spinal infection.

If there are neurological findings MRI is the best modality. Acute cases should be discussed with the on call radiology SMO.

A bone scan may be an option if bone metastases are strongly suspected and if there are no neurological findings. Always consider whether the findings will change management. A repeat scan in patients with known metastatic prostate cancer is rarely helpful.

Clinical urgency: MRI should be done ASAP in an acute presentation with progressing neurology

### **The 'Choosing Wisely' recommendations for investigation of back pain include:**

Don't obtain imaging (plain radiographs, MRI or CT, or other advanced imaging) of the spine in patients with non-specific acute low back pain who not have red flags (severe or progressive neurologic deficits or a suspected serious underlying condition (such as vertebral infection, cauda equina syndrome, or cancer with bony metastasis)).

Don't do a MRI of the spine or brain for patients with only peripheral neuropathy (without signs or symptoms suggesting a brain or spine disorder).

## **Bowel Obstruction**

The Australian imaging guidelines have pathways for [Bowel Obstruction](#).

Plain X-rays should be done first and further imaging based on the clinical picture and X-ray findings. Further imaging may not be needed in small bowel obstruction with suspected adhesions but CT may be indicated for large bowel obstruction not due to constipation with faecal loading.

Clinical urgency: Usually as soon as possible depending on the acuity. For CT referrals after 5 pm, the urgency will need to be discussed with the on call ED /Surgical SMO. If a patient does not have signs of an acute abdomen, they should be admitted and a CT scan usually be deferred until the following morning.

## **Suspected Brain Masses (Diagnosis - see also Malignancy)**

CT with contrast will usually establish the presence of a mass but MRI/A is often needed before decisions regarding treatment. Further imaging may not be appropriate if the patient is not for any intervention and most cases require SMO decisions regarding options for further investigation and management.

It can be difficult with a solitary lesion to differentiate between a 1° and 2°. Metastatic disease needs to be ruled out if considering neurosurgery. Look for a possible 1° and 2° elsewhere.

Consider CT chest/abdomen/pelvis before doing a MRI if 2° are likely, but only if it is appropriate to establish a 1° site and/or get a tissue diagnosis and it will affect treatment.

Clinical Urgency: Most brain masses are identified in imaging done for other reasons such as suspected stroke, TIA or headache. An urgent CT may be indicated if there is a reduced level of consciousness. Further imaging with CT chest/abdomen or MRI to guide treatment should usually be within 48 hours.

## **Breast Imaging**

The NCRAC recommend mammography (± ultrasound) is the appropriate investigation modality for women over 40 years. Mammography service is not available at the HBDHB hospital site but is outsourced to TRG.

Referral to local breast service for advice/assessment and multidisciplinary work-up, is preferable (this supersedes these recommendations).

## **Cardiac Disease and Chest Pain**

In New Zealand exercise stress ECG testing remains the first line investigation in most patients with suspected low to medium risk ACS, to aid with further risk stratification and decide who needs further tests, including angiography, myocardial perfusion imaging and CT angiography

### **CT Coronary Angiography (CTCA)**

CTCA in Hawke's Bay must be requested by a cardiologist and is offered only for these criteria:

- evaluation of ischaemic sounding symptoms in an outpatient setting, if another modality such as exercise stress testing has been equivocal or indeterminate
- evaluation of anomalous coronary anatomy
- evaluation of coronary grafts
- evaluation of anatomy in selected chronic occlusive CAD cases for planned interventions or in planning for a small number of other complex intervention cases
- evaluation for an ischaemic cause of cardiomyopathy (EF<40%, no regional wall motion abnormality) when suspicion of ischaemia is not high, in place of invasive angiography.

CTCA still requires IV contrast. Contraindications to CTCA at HBDHB include:

- atrial fibrillation
- renal impairment eGFR <30
- contrast allergy (relative)
- severe calcification

Referrals need to include the patient's resting heart rate, suitability for outpatient metoprolol loading (50 mg BD for the day prior to scan and on the morning of the scan) and any contraindication to beta blocker therapy. Radiation can be reduced in patients with steady heart rates <60.

Clinical Urgency: CTCA are usually performed as outpatient investigations.

**Myocardial perfusion scintigraphy** is an alternative to exercise testing in patients who

- cannot exercise or
- have LBBB or
- have an equivocal exercise test.

**Radioisotope scanning** (MUGA) is also an alternative modality for functional imaging in oncology patients having chemotherapy. Because of limited capacity all requests must be discussed with Radiology SMO.

**Stress echocardiography** in hypertrophic cardiomyopathy, assessing functional reserve pre cardiac surgery). Requests are to be discussed with Cardiology.

**Cardiac MRI** is not available at HBDHB.

**The 'Choosing Wisely' recommendations include:**

Don't perform cardiac imaging for patients who are at low risk.

Don't perform cardiac imaging as a pre-operative assessment in patients scheduled to undergo low- or intermediate-risk non-cardiac surgery.

Don't perform radionuclide imaging as part of routine follow-up in asymptomatic patients.

Don't perform stress cardiac imaging or advanced non-invasive imaging in the initial evaluation of patients without cardiac symptoms unless high-risk markers are present.

Use methods to reduce radiation exposure in cardiac imaging, whenever possible, including not performing such tests when limited benefits are likely.

Don't use coronary artery calcium scoring for patients with known CAD, for preoperative evaluation for any surgery, irrespective of patient risk, for screening purposes on low risk asymptomatic individuals.

Don't routinely order coronary computed tomography angiography for screening asymptomatic individuals or in high risk patients presenting with acute chest pain.

## Colon Cancer – Suspected

CT colonography has replaced barium enema as the radiological imaging modality for the colon but colonoscopy still remains the investigation of choice for most patients with suspected colon cancer. All CT colonography referrals are currently reviewed by the Gastroenterology team and allocated for either CT colonography or optical colonoscopy.

We use the [National Referral Criteria for Direct Access Outpatient Colonoscopy](#), developed in 2012, to triage referrals for colonoscopy and have adapted these for CT colonography.

These criteria are designed to cover the majority of indications for referral for colonoscopy by GPs and non-gastrointestinal specialists. We also use them to triage internal referrals to ensure equity of access.

The criteria include references to the option of CT colonography as an alternative to colonoscopy:

- ***“CT colonography is an acceptable alternative investigation to colonoscopy for many indications in the ‘six week category’ where direct mucosal visualisation is not required”***
- ***“CT colonography may also be the most appropriate investigation for patients with significant co-morbidities but who meet the criteria for investigation”***

Unfortunately, at Hawkes Bay, we currently have limited capacity to do CT colonography. We are not able to accept all referrals and have to be selective. This may change in the future and we may offer CT colonography in lower risk cases but at the moment we are only able to offer a very limited service. This means we will **not** offer CT colonography as an “*alternative investigation*” without a good reason.

At Hawke’s Bay DHB we will:

- offer CT colonography to patients who have had a failed colonoscopy
- consider CT colonography for patients who meet the National Referral Criteria for Direct Access Outpatient Colonoscopy but have contraindications to colonoscopy.

CT colonography is not without significant morbidity from the bowel preparation and the procedure. Many frail patients do not tolerate CT colonography very well. Perforation is a potentially fatal risk. Referral implies a patient is well enough to tolerate both the test and treatment if a cancer is found.

The National Referral Criteria for Direct Access Outpatient Colonoscopy also state a referrer should:

- inform the patient about the procedure
- ensure they are willing to undergo the procedure
- consider the ability of the patient to tolerate both the bowel preparation and procedure
- consider whether the patient being referred will benefit if they are frail, have multiple co-morbidities or advanced malignancy (generally referral implies they are well enough to tolerate further treatment)

Referrers should always consider (taken from the National Criteria) whether the patient will benefit:

- ***“if they are frail, have multiple co morbidities or advanced malignancy”***

In a frail patient with multiple co-morbidities consider other management options.

For example, if a patient with iron deficiency anaemia due to presumed GI blood loss is not fit for colonoscopy or surgery, consider stopping the any antiplatelet therapy and treating with iron rather than further investigation.



The colonoscopy criteria also include the referrals that won't be accepted shown in the following table and CT colonography will not be offered for any of these indications either.

Not accepted
Acute diarrhoea < six weeks duration - likely infectious aetiology and self-limited
Rectal bleeding aged less than 50 years (normal haemoglobin <sup>[JM1]</sup> <sup>[E2]</sup> ) - consider FSA or flexible sigmoidoscopy if no anal cause
Irritable bowel syndrome (may require specialist assessment)
Constipation as a single symptom
Uncomplicated computed tomography (CT) proven diverticulitis <b>without</b> suspicious radiological features
Abdominal pain alone without any 'six week category' features
Decreased ferritin aged < 50 years with normal haemoglobin
Abdominal mass - refer for appropriate imaging
Metastatic adenocarcinoma unknown primary - six percent is due to CRC and in the absence of clinical, radiological, or tumour marker evidence of CRC, colonoscopy is not indicated.

If a referral is declined the options include:

- offering alternative imaging if more appropriate, for example CT abdomen
- redirecting the referral for consideration of colonoscopy if the colonoscopy criteria are met
- declining the referral if the colonoscopy criteria are not met

## Collapse, Loss of Consciousness and Syncope

CT is not usually indicated if a patient has fully recovered consciousness or in suspected syncope with no focal neurological signs.

Clinical Urgency: Urgent imaging may be indicated if there is a reduced level of consciousness of uncertain cause and the patient has not recovered.

**The 'Choosing Wisely' recommendations include:**

Avoid CT of the head in asymptomatic adult patients with syncope, insignificant trauma and a normal neurological evaluation.

## Delirium

CT is not usually indicated in most patients with delirium.

Waikato DHB Guidelines suggest to consider CT if:

- focal neurology
- new seizures
- head injury or fall
- on anticoagulants
- evidence raised ICP
- 

MRI should only be performed if the CT has shown a lesion that requires further investigation and is rarely indicated if the CT is normal, unless there is a specific concern like suspected encephalitis.

Clinical Urgency: Urgent CT may be indicated if there is a reduced level of consciousness.

## Dementia

The [Dementia Imaging Pathway](#) in the Australian imaging guidelines supports either CT or MRI as the imaging modalities in dementia. We recommend CT is used for most cases.

MRI is normally restricted to patients who have had a CT that raised uncertainties and where further imaging is required to clarify the diagnosis.

The NCRAC include these indications for CT referral:

Undiagnosed cognitive impairment with one or more high-risk feature:

- age < 60 years
- rapid (i.e., one or two months) unexplained decline in cognition or function
- recent and significant head trauma
- unexplained neurological symptoms (e.g. new onset of severe headache or seizures)
- history of cancer (especially in sites and types that metastasize to the brain)
- use of anticoagulants or history of bleeding disorder
- history of urinary incontinence and gait disorder early in the course of dementia
- any new localizing sign (e.g. hemiparesis or a Babinski reflex)
- unusual or atypical cognitive symptoms or presentation (e.g. progressive aphasia)
- gait disturbance

Clinical Urgency: Urgent CT is rarely indicated in suspected dementia unless there are red flags.

**The ‘Choosing Wisely’ recommendations include:**

Don't use PET imaging in the evaluation of patients with dementia unless the patient has been assessed by a specialist in this field.

## Dizziness and Vertigo

The Australian imaging guidelines have a [Vertigo Imaging Pathway](#).

It is usually possible to clinically differentiate between peripheral and central causes of dizziness and vertigo. Patients with a likely peripheral cause do not need imaging.

Isolated dizziness without any other neurological features is very rarely due to a central cause and imaging is only indicated if there are neurological findings or in an older patient if the cause is uncertain and they have vascular risk factors.

Ideally MRI is performed to image the posterior circulation but, because of limited availability, CT is usually done and, in most cases, is adequate. MRI may still be required in selected patients.

Clinical urgency:

Stroke is suspected and there are neurological findings or if a candidate for thrombolysis - **Immediate CT** whatever the time

If on anticoagulants and progressing – **CT** available 24/7

Other strokes or suspected strokes - **CT** available 24/7

MRI will not be performed out of hours for dizziness and vertigo.

## ENT

**The 'Choosing Wisely' recommendations include:**

Don't order CT of the head for sudden hearing loss.

Don't order imaging studies in patients with non-pulsatile bilateral tinnitus, symmetric hearing loss and an otherwise normal history and physical examination.

Don't order sinus computed tomography (CT) for uncomplicated acute rhinosinusitis or symptoms limited to a primary diagnosis of allergic rhinitis alone.

## Epilepsy (and Seizures)

**First Seizure:** In patients without red flags (see below) there is no urgency to image and it may be more appropriate to get an outpatient MRI rather than an urgent CT. However, in older patients with a new onset of seizures a pragmatic approach is to do a CT (but not urgent overnight) before discharge from ED or the ward.

MRI may not be needed if CT shows a structural lesion not requiring further imaging or in older patients after a single seizure if the CT and neurological examination are normal as it is unlikely to change management. Seek SMO advice.

**Recurrent Seizure:** Repeat imaging in a patient with known epilepsy is not indicated unless there are features suggesting a new cause of seizures or a complication is suspected, for example significant new neurological signs, fever, or a prolonged reduction in the level of consciousness. Seek SMO advice.

Clinical urgency: We recommend an urgent CT scan 24/7 if:

- persistent altered mental status (with or without intoxication)
- a structural brain lesion is suspected with new onset partial seizures or focal deficit
- fever suggestive of CNS infection (LP then also needs to be performed)
- recent significant head trauma or anticoagulation
- history of malignancy and suspicion of brain metastases
- 

**The 'Choosing Wisely' recommendations include:**

Neuroimaging (CT, MRI) is not necessary in a child with simple febrile seizure.

## Fractures (see Trauma)

If plain radiology fails to demonstrate a clinically suspected fracture options include repeating imaging with plain films after an interval, bone scanning, CT and MRI. The best modality will depend on the site of the suspected fracture and the options for treatment. It is not always necessary to demonstrate a fracture when management will not change for example rib or stable pelvic fractures. Seek appropriate specialist advice before requesting further imaging.

**The 'Choosing Wisely' recommendations include:**

Don't request imaging for acute ankle trauma unless indicated by the Ottawa Ankle Rules (localised bone tenderness or inability to weight-bear as defined in the Rules).



## Gastrointestinal Conditions (Other)

MRI enterography has replaced Barium imaging in the assessment of selected patients with Crohn's Disease.

## Gynaecological Conditions (see also Malignancy)

The main first line imaging modality is ultrasound (US).

If US is abnormal, or histology shows a malignancy, further imaging may be required.

To stage malignancy, CT of the chest, abdomen and pelvis is usually the first line investigation.

To stage a known endometrial cancer for myometrium invasion or cervical cancer for parametrial invasion, MRI is usually requested as well.

MRI may also be used in selected cases in the investigation of suspected malignancy of the cervix, endometrium, ovaries, and uterine abnormalities such as fibroids if a sarcoma is suspected. A MRI may also be requested for the following non-malignant indications:

- investigation of known or suspected Mullerian tract abnormalities
- investigation of abnormal placentation ?placenta percreta, ?trophoblastic disease
- investigation of suspected fistula of genito-urinary +/- GI tract
- upon recommendation from Radiology (usually for the above) or another speciality.

MRI is only indicated in the investigation of endometriosis (for staging/bowel/bladder involvement), if patients are previously known to have endometriosis, or have large endometriomas on USS +/- renal

MRI is not a screening test for endometriosis and should not be performed if USS is normal.

Clinical urgency: Usually within 1-2 weeks desirable, to allow treatment decisions to be made.

**The 'Choosing Wisely' recommendations include:**

Avoid routine imaging for cancer surveillance in women with gynaecologic cancer, specifically ovarian, endometrial, cervical, vulvar and vaginal cancer.

Don't recommend follow-up imaging for clinically inconsequential adnexal cysts.

## Headache

Most patients with a headache do not need imaging. Imaging is indicated if there are any "red flags" (see below). There are also pathways for [Headache](#) and [Thunderclap Headache](#) in the Australian guidelines.

A [JAMA 2006;296:1274](#) review of imaging in headache suggests a migraine headache is 92% likely if at least four of the following are present - **P**OUNDing [**P**ulsatile quality; duration of 4-72 h**O**urs; **U**nilateral location; **N**ausea or vomiting; **D**isabling intensity] This mnemonic is useful to help make a diagnosis of migraine and identify those patients who did not need imaging.

The **NCRAC** include these indications for CT in headache:

- New onset >50 years
- Change in pattern of headaches with increase in frequency or severity
- Aggravated by exertion or Valsalva
- Associated with nausea and vomiting
- Systemic illness with cerebral complications or involvement especially malignancy.

CT without contrast is adequate for most of the patients with "red flags" who need imaging.

Contrast CT may be needed if there is a history of malignancy and/or a possible mass lesion.

MRI is not indicated after CT unless there is a clear clinical indication or an abnormality needing further imaging to guide management. Always consider if this is necessary.

MRI/MRA/MRV or CTA/CTV may be needed in a minority of patients, where dissection or venous thrombosis are realistic possibilities; note that a -ve D-dimer makes thrombosis unlikely. Further imaging may also be indicated in thunderclap headache despite a negative CT and LP where there is a still very strong pre-test probability or clinical suspicion of haemorrhage.

#### Clinical Urgency:

? Subarachnoid or subdural with neurology – CT available 24/7

Other probable cause of headache - CT 8am to 5pm / 7 days a week

#### **The 'Choosing Wisely' recommendations include:**

Don't do imaging for uncomplicated headache.

Don't perform neuroimaging studies in patients with stable headaches that meet criteria for migraine.

## Head Injury

The 'Canadian Head CT Rules' imaging recommendations are summarised below:

**GCS<8 Severe Head Injury** - All patients suffering any kind of trauma leading to GCS <8 require a CT head and a CT cervical spine

**GCS 8-12 Moderate head injury** - All such patients require a CT head

**GCS 13-15 Minor head injury** - Use the 'Canadian CT Head Rules' (only validated in adults) to decide on CT.

Minor Head Injury' is defined as initial GCS 13-15 in ED with any of the following:

- witnessed loss of consciousness, or
- definite amnesia, or
- witnessed disorientation

#### **Canadian CT Head Rules for Minor Head Injury**

All patients with a head injury with any of these features (witnessed loss of consciousness, or definite amnesia, or witnessed disorientation) requires a head CT if they have **any one** of the following:

##### **High risk (for neurological intervention):**

- GCS <15 at 2 hours post injury
- suspected open or depressed skull fracture
- any sign of basal skull fracture
- vomiting ≥ two episodes
- age ≥ 65yrs

##### **Medium risk (for brain injury on CT)**

Amnesia before impact > 30 mins

- Dangerous mechanism
  - pedestrian struck by motor vehicle
  - occupant ejected from motor vehicle
  - fall from height >3 feet (1 metre) or 5 stairs

In addition, consider a CT in any patient who has had a head injury if they are on anticoagulants or on a combination of antiplatelets **even without** any of witnessed loss of consciousness, or definite amnesia, or witnessed disorientation.

Note: a CT will not exclude delayed bleeding so consider continuing neuro-observations in these patients even if the initial CT is normal.

#### **The 'Choosing Wisely' recommendations include:**

Don't request CT head scans in head injuries, unless indicated by a validated clinical decision rule.

Avoid ordering a brain CT or brain MRI to evaluate an acute concussion unless there are progressive neurological symptoms, focal neurological findings on exam, or there is concern for a skull fracture. Don't routinely obtain CT scanning of children with mild head injuries.

## Incidentalomas

If imaging has shown an unexpected asymptomatic finding, for example a pituitary, adrenal or liver lesion or lung nodule, either:

- Radiology will suggest appropriate follow up based on agreed guidelines, or
- The findings and case should be discussed at the appropriate Radiology MDT conference before further imaging is requested.

Clinical urgency: Follow-up imaging in asymptomatic cases can be performed as an outpatient.

## Intracranial Haemorrhage

The [Stroke Imaging Pathway](#) in the Australian imaging guidelines recommends CT angiography or MRA is performed if clinically indicated to assess the cerebral vasculature. This is an SMO decision.

It can be difficult to interpret CTA or MRA images soon after a bleed, so if early intervention is not indicated, a delayed CT with contrast may be adequate to exclude an underlying mass lesion. Seek specialist advice from a local Physician with expertise in stroke medicine before seeking specialist advice from a tertiary centre Neurosurgery or a Neuroradiologist.

It is not usually necessary to further image frail elderly patients with a likely hypertensive bleed or bleeding from an amyloid angiopathy, and/or if intervention is not indicated.

Clinical urgency:

If reduced level of consciousness – **Immediate** CT whatever the time

If on anticoagulants and progressing - CT available 24/7

Other suspected cases - CT 8am to 5pm / 7 days a week

## Jaundice and Liver Disease

Ultrasound should usually be the first line investigation for differentiating between medical and surgical causes of jaundice or in the investigation of the cause of abnormal liver function.

In patients with suspected malignancy abdominal CT is usually preferred over ultrasound unless the patient has renal impairment or a contraindication to contrast or suspected biliary obstruction. MRCP may be indicated if ultrasound and CT do not identify a cause of an obstructed system.

MRI may be needed in screening for hepatoma if too obese for US imaging.

The new NCRAC have the following indications for referral for abdominal ultrasound in suspected liver disease and other abdominal conditions:

- abdominal mass or other palpable abdominal abnormality
- painless jaundice without obvious cause
- suspected gallstones: persistent/recurrent right upper quadrant pain
- suspected pancreatic disease (limited resolution in obesity and CT may be more appropriate)
- abnormal LFTS; both GGT and ALT >1.5 times ULN for >3 months with no other cause
- abnormal LFTS suggestive of biliary tract obstruction or malignancy (persistently raised ALP/GGT+/- bilirubin)

The Criteria note that referral for ultrasound is not typically indicated in:

- infective hepatitis
- acute abdomen or suspected bowel obstruction
- dyspepsia
- suspected colorectal neoplasm
- clinically evident hernia in adults
- screening for AAA

Clinical urgency: Dependent on acuity. Imaging will not usually be performed after 2200

**The 'Choosing Wisely' recommendations include:**

Don't perform CT or MRI routinely to monitor benign focal lesions in the liver unless there is a major change in clinical findings or symptoms

## **Malignancy Suspected**

CT will be prioritised as urgent if the clinical information indicates a high probability of cancer.

Chest and Abdominal CT (and pelvic for female patients) should be requested at the same time to avoid repeating CT scans.

It is always important to consider whether further imaging is appropriate, especially if a patient is frail or has multiple co-morbidities and may not be a candidate for any therapy.

Clinical urgency:

Very dependent on acuity. Imaging will not usually be performed out of hours. Less urgent scans can be done as an outpatient. Radiology will give a day and time for non-urgent scans to allow a patient to be discharged if they are only awaiting a scan.

**The 'Choosing Wisely' recommendations include:**

Don't use whole-body scans for early tumour detection in asymptomatic patients.

## **Malignancy Staging Investigations**

While in the diagnostic work-up of patients with suspected malignancy, CT chest and abdomen (plus pelvis for female patients) is usually used, once a diagnosis has been confirmed.

As with suspected malignancy, it is important to consider whether further imaging is appropriate, especially if a patient has multiple co-morbidities and may not be a candidate for any therapy.

The Cancer Network have also developed specific guidelines for the work-up of a number of cancers including: [Non-Small Cell Lung Cancer](#) and melanoma.

Diagnostic staging investigations may include CT chest/abdomen/pelvis, NM Bone scan, PET CT aligned with PET-CT national indications list.

PET scanning has been of limited availability, but now that its role is better established, it is funded for a number of indications. National guidelines for PET scanning have been developed and these are shown below. PET scanning for other indications needs to be negotiated.

**The 'Choosing Wisely' recommendations include:**

Don't perform CT surveillance for evaluation of indeterminate pulmonary nodules at more frequent intervals or for a longer period of time than recommended by established guidelines.

Don't perform PET, CT, and radionuclide bone scans in the staging of early prostate or breast cancer at low risk for metastasis.

Don't perform surveillance imaging (PET, CT, and radionuclide bone scans) for asymptomatic individuals who have been treated for breast cancer with curative intent.

Limit surveillance CT scans in asymptomatic patients following curative-intent treatment for aggressive lymphoma.

Don't perform baseline or routine surveillance CT scans in patients with asymptomatic, early-stage chronic lymphocytic leukaemia (CLL).

Avoid routine imaging for cancer surveillance in women with gynaecologic cancer, specifically ovarian, endometrial, cervical, vulvar and vaginal cancer.

Avoid using PET or PET-CT scanning as part of routine follow-up care to monitor for a cancer recurrence in asymptomatic patients who have finished initial treatment to eliminate the cancer unless there is high-level evidence that such imaging will change the outcome.



PET-CT National Indications List		
Colorectal	CR1	Pre-operative evaluation of patients with colorectal carcinoma (CRC) who are candidates for resection of metastases
	CR2	Evaluation of patients with colorectal carcinoma and residual structural abnormality on conventional imaging following definitive treatment
	CR3	Rising tumour markers with negative or equivocal findings on conventional imaging following definitive treatment for colorectal carcinoma and further curative therapy is feasible should localised treatable recurrence be identified on PET-CT
Anal	AN1	Staging of locally advanced ( $\geq$ T2 +/- node positive) anal squamous cell carcinoma
	AN2	Evaluation of distant disease in patients with residual or recurrent anal squamous cell carcinoma who are surgical candidates
Lung	LU1	Staging of patients with non-small cell lung cancer (NSCLC) prior to surgery or radiotherapy with curative intent
	LU2	Staging of patients with limited disease small cell lung cancer on CT who are candidates for radical therapy (surgery or chemo-radiotherapy)
	LU3	Isolated pulmonary nodules not amenable to fine needle aspiration (FNA) or which have failed pathological characterisation
Lymphoma	LY1	Staging of early stage Non Hodgkin's lymphoma to guide indication for radiation and appropriate treatment fields
	LY2	Staging of Hodgkin's Disease
	LY3	Restaging of residual mass in Hodgkin's and Non Hodgkin's lymphoma following definitive treatment
	LY4	Re-staging of Hodgkin's lymphoma after 2-4 cycles of chemotherapy to inform management options for paediatric patients
	LY5	Assessment of response to salvage chemotherapy in patients who are candidates for stem cell transplantation
Head& Neck	HN1	Restaging of residual neck masses in patients with head and neck cancers following definitive treatment
	HN2	Staging of locally advanced/node positive head and neck squamous cell carcinoma (SCC)
	HN3	Metastatic squamous cell carcinoma (SCC) in cervical lymph nodes from an unknown primary with equivocal findings on conventional imaging, where the patient may be a candidate for radical therapy
Oesophagus	OE1	Staging of locally advanced oesophageal and gastro-oesophageal junction cancer and radical treatment is being considered
Skin	SK1	Assessment of distant nodal or metastatic disease in patients with melanoma and radical dissection or radiotherapy is contemplated
	SK2	Staging prior to radical therapy for patients with biopsy proven Merkel cell carcinoma
Cervical	GY1	Staging of locally advanced ( $>$ FIGO Stage 1A) cervical (includes vaginal and vulval) cancer where curative therapy is being considered
	GY2	Staging of histologically proven, loco-regionally recurrent, cervical, vaginal or uterine cancer, where pelvic exenteration is being considered
Ovarian	GY3	Restaging of recurrent ovarian and fallopian tube carcinoma where cytoreductive/curative surgery is being considered
Epilepsy	EP1	Detection of focal hypometabolism in refractory partial epilepsy
Sarcoma	SA1	Staging of patients with localised, intermediate or high grade sarcoma, where radical therapy is being considered
	SA2	Re-staging of residual masses in patients with Ewings sarcoma or rhabdomyosarcoma to help plan local treatment
GIST	GT1	Re-staging of recurrent gastrointestinal stromal tumour (GIST) before potentially curative resection
Neuroendocrine Tumour	NE1	$^{68}\text{Ga}$ -DOTATATE or FDG PET scan for staging and restaging of neuroendocrine tumour where curative surgery is considered and MR liver is negative or equivocal
Thyroid	TH1	Assessment of patients with suspected, recurrent thyroid carcinoma based on elevated thyroglobulin where conventional imaging is negative or equivocal
Glioma	GL1	FET PET scan to guide biopsy or target delineation for radiotherapy planning in patients with heterogeneous tumours on MR scan
	GL2	FET PET scan for differentiation of radionecrosis from recurrent glioma in patients treated with radiotherapy
Hepatobiliary	HB1	Pre-op liver transplant staging in patients with hepatocellular carcinoma (HCC) approaching the limits of current size-number criteria for transplantation, including previous resection for HCC, and/or equivocal macrovascular invasion on imaging
	HB2	Evaluation of patients with gallbladder or bile duct cancer which appears localised on conventional imaging and radical surgery is being considered
Graft Infection	GR1	Evaluation of suspected vascular graft infection where conventional imaging is equivocal
Testicular Cancer	TE1	Evaluation of residual disease in testicular cancer post treatment

**The Waikato DHB Oncology Unit have developed guidelines for the following  
(Listed alphabetically):**

**Brain Tumours (Suspected Metastases)**

CT is usually the first investigation requested.

If a suspected brain metastasis (or multiple metastases) is (are) detected on CT, MRI may still be indicated for further characterisation and to better assess the full extent of disease.

MRI brain is the most sensitive and specific investigation and is clinically indicated:

- In situations where it is important to assess whether metastases are potentially resectable or suitable for stereotactic radiosurgery. This includes an assessment of the number of metastases.
- In situations where being as confident as possible about the absence of intracranial metastases is important prior to embarking on any other proposed therapy (e.g. a major extra-cranial surgical procedure, chemotherapy)

Clinical urgency: Imaging within 1-2 weeks desirable, to allow important treatment decisions to be made. Greater urgency may exist for neurosurgical indications (e.g. hydrocephalus).

**Brain Tumours (Suspected Primary)**

CT is usually the first investigation requested.

If a suspected primary brain tumour is detected on CT, MRI (which is more sensitive and specific) should be undertaken for further characterisation and to better assess the full extent of disease.

MRI is clinically indicated:

- To assess resectability
- To assess post-resection residual tumour
- To aid radiation therapy planning (with fusion MRI and planning CT, for target volume definition)

Clinical urgency: Imaging within 1-2 weeks is desirable, to allow important treatment decisions to be made. Greater urgency may exist for neurosurgical indications (e.g. hydrocephalus).

**Liver and Adrenal Lesions**

Liver and adrenal lesions may be identified on ultrasound or CT. Depending on the nature of the abnormality it may be appropriate to further image using a combination of ultrasound or CT.

MRI is clinically indicated in the investigation of abnormalities demonstrated on other imaging where significant uncertainty about the specific nature of abnormality (e.g. possible metastasis) and where resolving the uncertainty will alter the management plan.

Clinical urgency: Imaging within 1-2 weeks desirable, to allow treatment decisions to be made.

**Monitoring of Response to Treatment**

Repeated imaging should only occur if it is needed to determine future treatment decisions.

CT is the most commonly indicated modality, but plain X-rays (e.g. CXR) may be adequate.

MRI is clinically indicated in the monitoring of response to therapy in situations where it is significantly superior to other imaging options. Some examples (not an exhaustive list) are:

- Patients not suitable for IV contrast
- Liver tumours (primary and secondary)
- Pelvic lymphadenopathy
- Some bone metastases
- Tumours of the orbit
- Brain tumours (primary and secondary)

Clinical urgency: Dependent on how urgently information is required for decisions to be made about ongoing treatment – e.g. to fit with date of next scheduled chemotherapy cycle

## **Myeloma and Plasmacytoma**

Plain X-rays continue to play a major role in the management of myeloma.

It remains unclear whether the extra sensitivity of MRI 'skeletal survey' for myelomatous lesions in routine cases (over traditional plain radiography) translates to worthwhile clinical benefit.

MRI is clinically indicated in the investigation of apparent solitary Plasmacytoma.

There are a wide range of situations where MRI may be the investigation of choice in a patient with myeloma, and these will require consideration on a case-by-case basis.

Note that Tc-99bone scanning is very rarely helpful in the diagnosis of multiple myeloma.

Clinical urgency: Imaging within 1-2 weeks desirable, to allow treatment decisions to be made.

## **Suspected Spinal Cord or Cauda Equina Compression**

MRI whole spine is the favoured investigation.

Imaging objectives:

- To determine presence, extent and vertebral level of compression (incl. possible multiple sites)
- To identify sites of incipient compression
- To identify presence of soft-tissue tumour(s) contributing to presenting symptoms
- To assist in treatment decision making, including the potential role of surgery

Clinical urgency: In most instances this imaging should be performed on the day the request is submitted.

## **Staging of Pelvic Tumours**

For most primary malignancies of the pelvis (rectum, prostate, cervix) the major determinant of the subsequent treatment plan is the clinical stage. This is usually determined prior to definitive therapy, but is sometimes also indicated following definitive treatment (e.g. surgery) but prior to adjuvant treatment (e.g. radiation therapy). Pelvic MRI is usually preferred over CT.

Clinical urgency: Usually within 1-2 weeks desirable, to allow treatment decisions to be made.

## **Meningitis (Suspected)**

The [Suspected Meningitis](#) imaging pathway in the Australian imaging guidelines supports our approach that CT before LP is only indicated if the patient has:

- an impaired conscious level
- neurological signs
- features of raised intracranial pressure
- seizures
- in very ill patients
- sinus or ear infections

Do not delay giving antibiotics to wait for a CT and/or LP to be performed. If bacterial meningitis is suspected and a LP cannot be performed immediately start antibiotics.

Clinical Urgency: If CT is indicated pre LP, CT available 24/ 7



## **Multiple Sclerosis (suspected) and Unexplained Neurological Symptoms**

MRI requests will not be accepted for patients with neurological symptoms but no signs unless the patient has been reviewed by a relevant SMO.

Clinical Urgency: Unless there are progressive signs imaging will be deferred until office hours.

## **Ophthalmology**

CT or CTA is indicated for the following ophthalmic conditions or patients:

- suspicion of orbital fractures or traumatic optic neuropathy (CT scan brain and orbits)
- suspected orbital tumour especially if better delineation of bony anatomy is required (CT),
- to exclude a carotid-cavernous fistula (CTA),
- assessing a patient with a pupil involving third nerve palsy (urgent CTA),
- patients with 4th or sixth cranial nerve palsy, who have vasculopathic risk factors, if there is a lack of improvement or recovery of the condition (CTA), and
- acute painful anisocoria (Horner's syndrome) (urgent CTA brain/neck to exclude dissection).

Clinical Urgency: As shown. Urgent CTA is indicated for third nerve palsy and suspected dissection.

## **Psychosis (First Episode)**

The [Psychosis Imaging Pathway](#) in the Australian Imaging guidelines supports either CT or MRI as the imaging modalities in a first episode of psychosis. We recommend CT first.

In Hawke's Bay MRI is normally restricted to those patients who have had a CT that has raised uncertainties and where further imaging is required to clarify the diagnosis.

Clinical Urgency: Unless a reduced level of consciousness imaging will not be done after 1700 hours.

## **Pulmonary Embolism and Deep Vein Thrombosis**

**The 'Choosing Wisely' recommendations include:**

Don't request any diagnostic testing for suspected PE unless indicated by Wells Score followed by PE Rule-out Criteria (in patients not pregnant). Low risk patients in whom diagnostic testing is indicated should have PE excluded by a negative D dimer, not imaging.

Don't request duplex compression US for suspected lower limb DVT in ambulatory outpatients unless the Wells Score > 2, OR if less than 2, the D-dimer assay is positive.

Don't reimaging DVT in the absence of a clinical change.

Clinical Urgency: CTPA will not usually be performed after hours as Teleradiology Service does not have sufficient quality images for diagnostic purposes. In most patients with suspected PE, treatment with LMWH can be started on the basis of the clinical suspicion and CTPA imaging deferred until the following day.

DVT Ultrasound can usually be deferred to the next working day. If a high clinical suspicion start treatment while awaiting the scan.

## Pulmonary Nodules - Indeterminate

These are a common incidental finding on a CT investigation.

Follow up plan for these must be discussed with Respiratory Physician team.

**Fleishner Guideline** may be of use (link below)

<http://www.radiologyassistant.nl/en/p516161ad36ba1/fleischner-guidelines-for-pulmonary-nodules.html>

- Assess cancer risk to help guide timing of follow up CT imaging
- Most cases will be dealt with by Respiratory Physicians to determine follow up plan
- Mostly are benign

## Renal Artery Stenosis

Consider investigation only if:

- progressive CKD of uncertain aetiology in a high risk patient
- flash pulmonary oedema
- acute on chronic renal failure in a high risk patient after ACEI/ARB therapy is started
- a patient with features indicating possible fibromuscular hyperplasia (young women with bruits)
- resistant hypertension (poor BP control on 3+ agents in max doses, including a diuretic)
- accelerated hypertension
- 

Duplex scanning is now our first line investigation. CTA is usually the next investigation. This needs to be discussed with the radiologist and renal service. MRA may still be required in selected cases. Requests for duplex scans are triaged by the Renal Service. Any request not meeting the above criteria will be returned to the requestor.

**The 'Choosing Wisely' recommendations include:**

**Don't screen for renal artery stenosis in patients without resistant hypertension and with normal renal function, even if known atherosclerosis is present.**

Clinical Urgency: Scans will be performed as outpatients. CT available 8am-5pm

## Renal Disease

The new National Community Radiology Access Criteria have the following indications for referral for abdominal ultrasound in renal or kidney disease:

- eGFR is consistently reduced for age after repeat testing with the patient well hydrated
  - <70 years eGFR is reduced to <45mls/min
  - >70 years eGFR is reduced to <30mls/min
- Painless macroscopic haematuria or persistent microscopic haematuria on two or more uncontaminated (epithelial cell count <15 x 10<sup>6</sup>/L) mid-stream urinalyses (MSU) (not dipstix)
- Polycystic kidneys screening when >20 years age and a positive family history.
- Recurrent urinary tract infections (UTI). Only women with one or more of these risk factors for an identifiable underlying cause require imaging investigation:
  - repeated (>2) pyelonephritis (fever, chills, vomiting, costo-vertebral angle tenderness)
  - persistence of infection on urinalysis after completion of a prolonged 3 week course of appropriate antibiotics (i.e. laboratory confirmed sensitivity)
  - gross haematuria or persistent microscopic haematuria (>15x10<sup>6</sup>) on two separate specimens) after resolution of infection
  - recurrence of infection after 3 months of completed antibiotic prophylaxis

- urea-splitting organisms e.g. proteus, klebsiella, pseudomonas ○ history of abdomino-pelvic malignancy or immunocompromised
- history of urinary tract surgery or calculi
- obstructive symptoms with straining and weak stream
- Recurrent or persistent UTI in males.
- Suspected renal colic in pregnancy. For all other patients consider referral for CT KUB.
- Suspected urinary retention with palpable/suspected enlarged bladder.

**The ‘Choosing Wisely’ recommendations include:**

Avoid requesting CT KUB in otherwise healthy ED patients, age <50 years, with a history of kidney stones, presenting with symptoms and signs consistent with uncomplicated renal colic.

The NCRAC note referral for US is not typically indicated for:

- recurrent uncomplicated UTIs in adult females as underlying abnormalities are uncommon
- investigation of hypertension
- elevated PSA
- lower urinary tract symptoms
- investigation of isolated proteinuria (discuss with local relevant specialist)
- serial ultrasounds for polycystic kidneys unless there are clinical symptoms In patients admitted to hospital the following have been suggested by the Renal service:

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**Acute Kidney Injury (AKI)**

Imaging is required in most cases.

Clinical Urgency: Urgency depends on the clinical context.

**Chronic Kidney Disease (CKD)**

Imaging is not required in all cases.

Patients with stable mild to moderate CKD (eGFR >30 ml/min) usually do not require imaging.

Consider imaging in patients with:

- Associated haematuria and/or proteinuria (urine protein: creatinine ratio >100 mg/mmol)
- Symptoms indicating possible structural problems of the urinary tract e.g. obstructive uropathy
- **Progressive** CKD (eGFR loss of > 5 ml/min/year or more than 15 ml/min over 5 years)
- Family history of polycystic kidney disease and are more than 20 years old

The recommended initial imaging is ultrasound of the urinary tract.

Clinical Urgency: Urgent imaging is not required unless AKI.

## Stroke

The [Stroke Imaging Pathway](#) in the Australian guidelines recommends CT as the initial imaging investigation of choice in acute stroke.

In patients with a clinical stroke an early CT (within 24-48 hours) may not demonstrate the ischaemic area but rules out a bleed and most stroke mimics, so further imaging is not usually required.

Contrast CT may be needed to exclude stroke mimics in patients with possible mass lesions.

CTA may be indicated in selected patients to rule out carotid or vertebral artery dissection.

CTA may have a role in the further investigation of other very selected cases (see [Vascular Imaging](#)) and CTA requests will only be accepted if recommended by an SMO.

In young patients (<50) with no risk factors with a normal CT, MRI/MRA/MRV may be indicated to confirm the diagnosis and/or exclude a dissection or uncommon cause of stroke if recommended by an appropriate SMO.

MRI may also be required if there is significant diagnostic uncertainty or atypical clinical or radiological features and the MRI findings would change the management of the patient.

Always seek SMO advice before requesting (or suggesting) further imaging. MRI will not be performed on a patient's or their relatives' requests if there is no good clinical indication.

Clinical urgency:

If a candidate for thrombolysis - **Immediate** CT whatever the time (refer Code Stroke pathway)

If on anticoagulants and progressing - 24 hour CT / 7 days a week

Other strokes or suspected strokes\*: - CT 8am to 5pm / 7 days a week

\* There may also be other times when urgent CT may be indicated: seek SMO advice.

## Thyroid Disease

The [National Community Radiology Access Criteria](#) for thyroid ultrasound are:

- palpable nodules
- euthyroid goitre

Referral for ultrasound is not typically indicated:

- thyrotoxicosis (with or without goitre)<sup>13</sup>
- goitre with hypothyroidism

**The 'Choosing Wisely' recommendations include:**

Don't routinely order a thyroid ultrasound in patients with abnormal thyroid function tests if there is no palpable abnormality of the thyroid gland.

Don't use nuclear medicine thyroid scans to evaluate thyroid nodules in patients with normal thyroid gland function

## TIA

The [TIA Imaging Pathway](#) in the Australian guidelines recommends CT as the initial imaging investigation of choice in TIA.

MRI after a normal CT is restricted to patients with significant diagnostic uncertainty.

Clinical urgency:

1<sup>st</sup> TIA: CT 8am to 5pm / 7 days a week. After 5pm book a 0830 scan

Recurrent TIAs within one week: CT available 24/7.

## **Trauma**

### **Plain Film radiography**

#### **Chest X-ray:**

CXR is critical to determine respiratory compromise requiring intervention and to exclude sites of life threatening haemorrhage. The image should be available for review within 7 minutes of the patient's arrival. Any symptomatic tension pneumothorax may be treated prior to CXR if the diagnosis is clear and the patient is compromised.

#### **Pelvic X-ray:**

This is often recommended in major blunt trauma patients, unless going straight for CT. A pelvic fracture that is not clinically obvious can be the site of unexplained blood loss. A dislocated hip is an orthopaedic emergency can be missed in a patient with multiple injuries, especially if unconscious. Call orthopaedic registrar immediately.

#### **Lateral Cervical Spine X-ray:**

The C-spine cannot always be radiologically cleared with a lateral X-Ray alone. This rarely alters treatment. CT of the cervical spine should be performed in preference to a lateral cervical spine in a major trauma patient.

Do not delay urgent surgical interventions to get C-spine X-rays - just consider the spine as being fractured and manage in a hard collar. Change to a well fitted Philadelphia or Aspen collar immediately. Shocked and unstable patients are put at increased risk if interventions are delayed by inappropriate imaging.

Cervical spine clearance should be done within 3 hours of admission to prevent problems with airway control, avoidable pain and soft tissue injury.

## **CT**

### **Whole body CT**

In major trauma there is a large body of evidence to support the selective use of whole body CT (CT head, neck, chest, abdomen and pelvis). This is in preference to segmented scans of isolated body regions, which may lead to further, completion, imaging later, with resultant missed or delayed recognition of injuries. This is especially important in the obtunded patient.

CT is highly sensitive and specific for injury, both to solid organs, vessels and bones. As these scans are associated with a large dose of radiation, their use should be limited to those patients that require them.

Indications may include:

- Motor Vehicle crash:
  - o fatality at scene
  - o ejected from vehicle
  - o prolonged extraction
- Assault
  - o Gun Shot Wound/penetrating injury to more than one anatomical site
  - o Injury to more than one region
- Head Injury: making proper clinical assessment impossible

Physiological parameters have been shown to be unreliable as predictors of serious injury, especially in the young.

### **Abdominal/Pelvic CT:**

Abdominal/Pelvic CT for trauma is highly sensitive and specific for significant injury and is the definitive test of choice in stable blunt trauma patients.

The accuracy of abdominal CT in assessing penetrating injury is unreliable, especially with isolated bowel injury. These patients may require laparoscopy or laparotomy.

Clinical assessment of the abdomen is unable to exclude many occult, life-threatening injuries within the abdominal cavity. CT should be used to exclude these with knowledge of the risks of radiation. Abdominal/Pelvic CT accurately diagnoses pelvic fractures, retroperitoneal injuries, solid organ injuries, lumbar spine fractures, sacral fractures and most hollow viscus injuries. Contrast blush in a solid organ may indicate the need for angio-embolisation in stable patients. Hollow viscus injury can have devastating effects if it is missed and CT has a false negative rate (missed injury rate) of 10-13%.

The CT signs consistent with hollow viscus injury are:

- free air or oral contrast extravasation (hard signs); or
- free fluid, bowel thickening, mesenteric stranding and haematoma (soft signs).

Hard signs warrant laparotomy; soft signs warrant either laparotomy or careful serial examinations.

The negative predictive value of contrast-enhanced abdominal CT is 99.5%. That means if the scan is negative, there is almost no chance of significant injury. Certainty in diagnosis allows other interventions to occur and enables confident decision-making in patients with multiple injuries and multiple competing priorities.

Oral contrast is not used routinely and maybe harmful in patients who are at risk of aspiration. If contrast is to be used; follow the CT Trauma Protocol.

### **Chest CT:**

CT of the chest gives detailed information on the chest and its contents and can reveal injuries that are not well defined by plain radiology. Most thoracic injuries do not require chest CT, with some notable exceptions.

Chest CT will reveal occult pneumothoraces, haemothoraces, pulmonary contusions, thoracic spinal injuries and mediastinal injuries, all of which should be excluded or accurately diagnosed prior to prolonged anaesthesia, transport or positive pressure ventilation.

The presence of an occult pneumothorax or basal pulmonary contusion may often be seen in the uppermost cuts of an abdominal CT. Indications for Chest CT include:

- Wide mediastinum in a stable patient
- Suspicion of pulmonary contusion
- Suspicion of pneumothorax that is occult to CXR but must be diagnosed prior to transport or positive pressure ventilation
- Suspected thoracic spinal fractures

### **Brain CT for Neurotrauma Patients:**

CT scanning is the diagnostic test of choice for blunt traumatic brain injury.

All patients with moderate to severe TBI (sustained GCS<14 at any stage) require CT brain.

The indications for brain CT scan in patients with mild TBI (GCS>13) are:

- Loss of consciousness >5 minutes
- Persistent neurological signs
- Persistent decrease in level of consciousness
- Unable to clinically assess (anaesthesia, drugs, young children)
- Elderly patient taking anticoagulants

### **CT of the Cervical Spine:**

In general CT scanning of the cervical spine gives information that is accurate enough to describe all significant injuries and therefore allow definitive clinical decision-making. Scanning of the brain and cervical spine at the same time is rapid and efficient. Returns to the CT scanner for cervical imaging are wasteful of resources and put patients at risk.

## Interventional Radiology

This modality is gaining an increasingly important role in trauma management, particularly in early diagnosis and treatment of exsanguination in organ systems where surgical access and haemostasis is challenging and less effective. Angio-embolisation can also be used in conjunction with stenting procedures in proximal vascular injuries.

Angio-embolisation is both diagnostic and therapeutic, and gives excellent results when applied judiciously. It is the standard of care for major pelvic exsanguination and is increasingly used for diagnosis and vascular control in many body regions, including:

- Pelvis/retroperitoneum
- Liver/spleen /kidneys
- Chest wall

The technique is usually applied in the context of multiple conflicting priorities and therefore requires expert judgement and careful risk profiling of individual patients around sound clinical principles. The decision-making processes are incorporated into the exsanguinating patient algorithms.

## MRI

MRI has a limited role in trauma imaging owing to the inherent dangers of undiagnosed metallic foreign bodies, cost and availability. The use of MRI is mainly restricted to non-emergent spinal cord, brain and joint injuries on request of appropriate specialists.

Clinical Urgency: as noted above

### The 'Choosing Wisely' recommendations include:

Avoid the routine use of "whole-body" diagnostic CT scanning minor or single system trauma. Don't routinely request imaging of the cervical spine in trauma patients, unless indicated by a validated clinical decision rule (E.g. NEXUS/Canadian C-Spine rule).

Don't request imaging for acute ankle trauma unless indicated by the Ottawa Ankle Rules (localised bone tenderness or inability to weight-bear as defined in the Rules)

## Vascular Imaging in Stroke and TIA

Carotid Doppler ultrasound is the preferred modality we use for assessing for carotid stenosis after TIA or stroke to determine the suitability for surgery. CTA (or MRA) may occasionally be indicated to clarify the degree of stenosis. Discuss cases with Vascular Surgery.

CT angiography (CTA) may provide important information on large artery atheroma in the aetiology of the stroke or TIA. CTA can be used in very selected cases, if findings would alter management

- to differentiate between high risk large artery atheroma and low risk lacunar cases
- to assess the severity of stenosis of calcified intracranial vessels. The request for CTA should always be endorsed by a SMO.

### The 'Choosing Wisely' recommendations include:

Don't screen for carotid artery stenosis in asymptomatic adult patients.

Don't perform imaging of the carotid arteries for simple syncope without other neurologic symptoms.

Don't initiate routine evaluation of carotid artery disease prior to cardiac surgery in the absence of symptoms or other high-risk criteria.

Clinical Urgency: CTA in suspected dissection should be done at the time of the CT which will be done according to the guidelines above. MRA, if indicated, will not usually be done overnight.

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