Queensland Health

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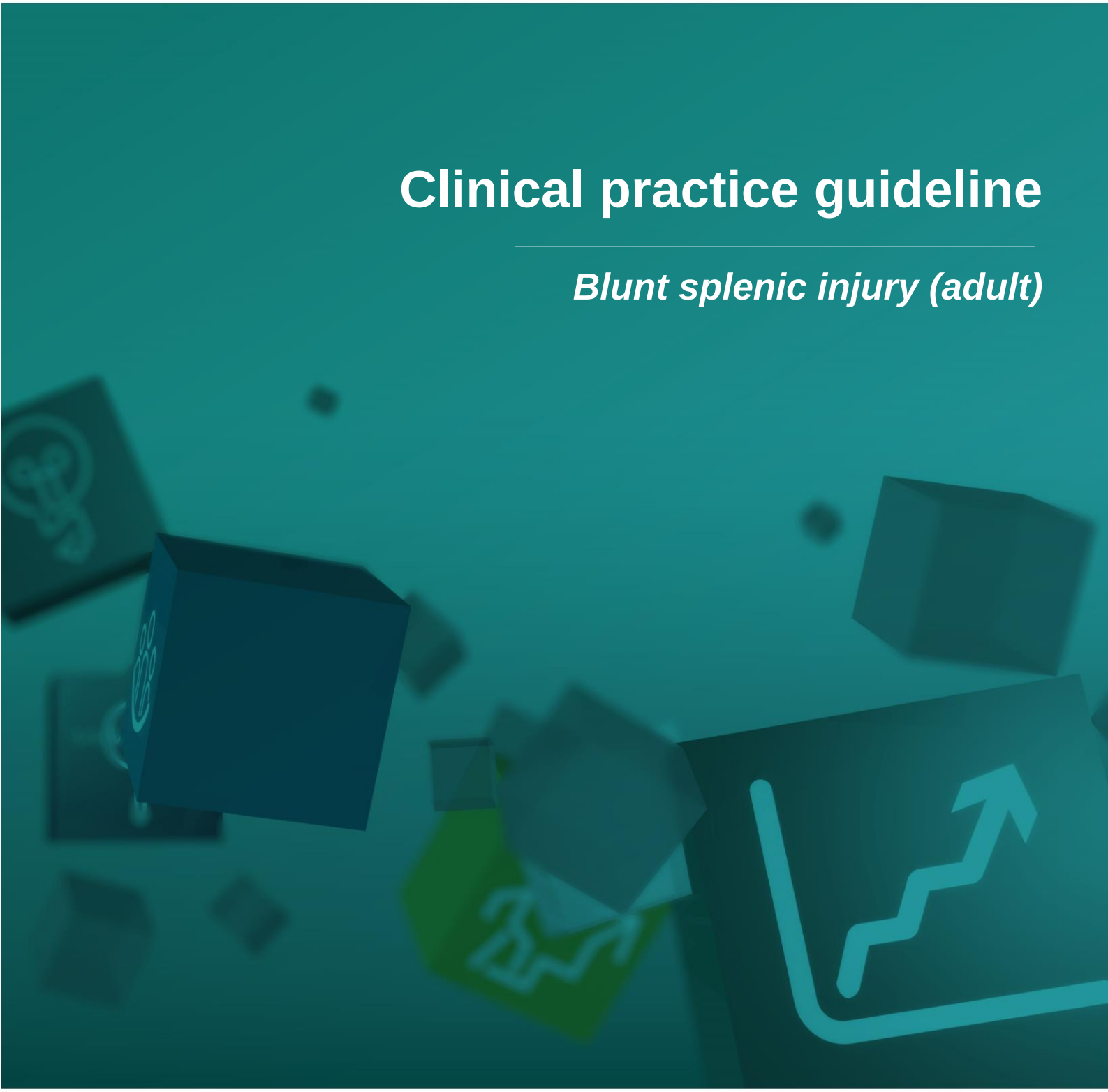
Clinical practice guideline

Blunt splenic injury (adult)



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Queensland Government

Blunt splenic injury (adult)

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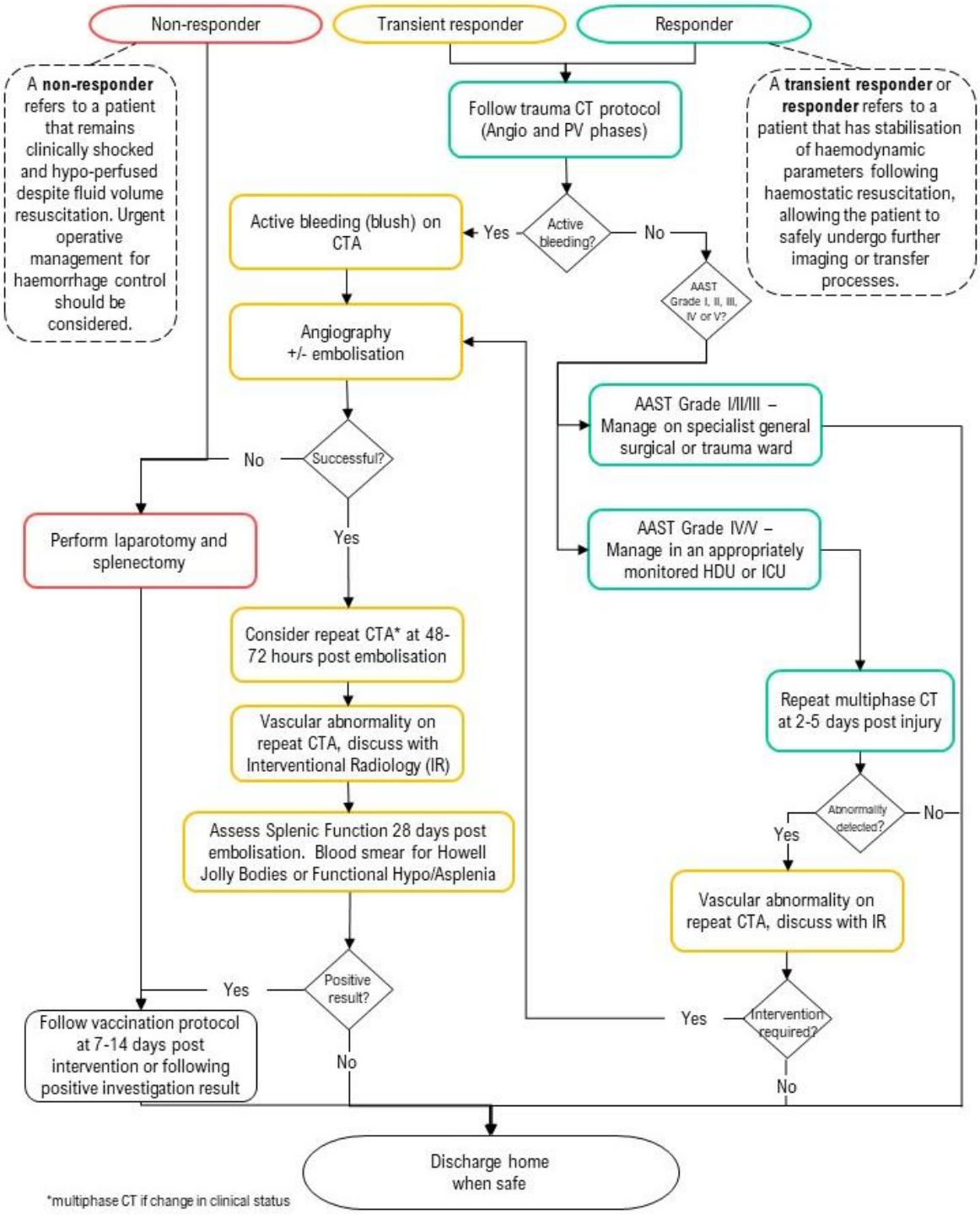
An electronic version of this document is available on the intranet, at
https://qheps.health.qld.gov.au/caru/networks/trauma

Disclaimer:
This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect.
The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances, may be appropriate.
This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making, including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

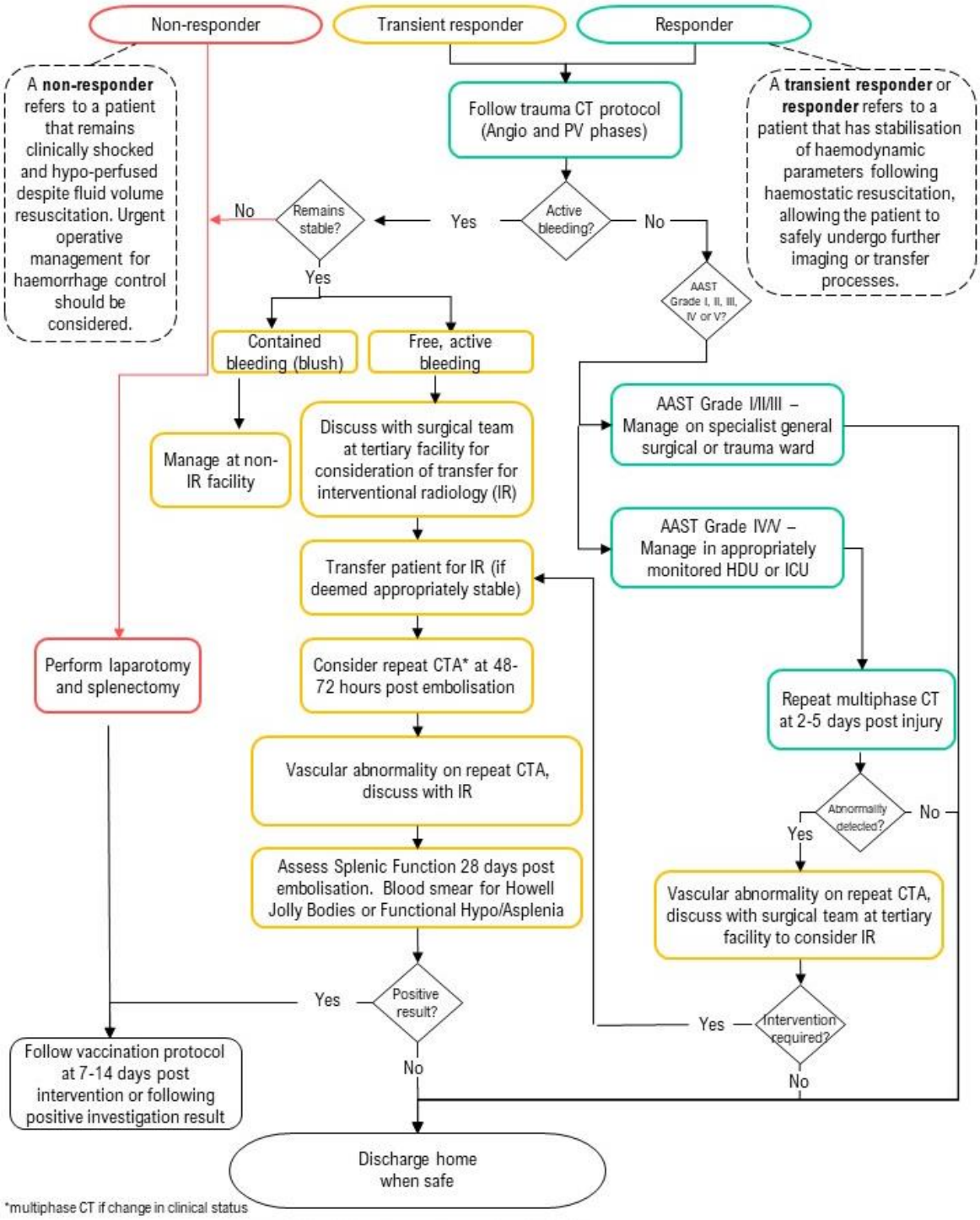
Flowchart 1: Blunt Splenic Injury (sites with Interventional Radiology)

This care pathway is designed to assist clinicians in the care of adult patients presenting to hospital with splenic injuries. This pathway assumes access to interventional radiology.



Flowchart 2: Blunt Splenic Injury (sites with no Interventional Radiology)

This care pathway is designed to assist clinicians in the care of adult patients presenting to hospital with splenic injuries. This pathway assumes there is no local access to interventional radiology.



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Summary

The spleen is one of the most commonly injured solid organs in blunt force abdominal trauma[1] and often occurs from a direct force or impact to the left upper quadrant. As the spleen is the most vascular organ in the body, any undetected arterial splenic injury can lead to significant haemodynamic instability and death,[2] so prompt diagnosis and management is essential. The spleen also plays a large role in the immune system; therefore, splenic injury management has been trending towards selective operative and non-operative management to preserve these important immunologic functions. This clinical practice guideline outlines the assessment and management of patients presenting to hospital with blunt splenic injury. It applies to ***adult*** splenic injury and should never replace sound clinical decision making. The Paediatric solid organ injury management guideline[3] contains further information for splenic injuries in the paediatric population. In older adults with trauma, particularly low energy trauma, this document may be used in conjunction with the Older Adult Trauma Clinical Framework.[4] This blunt splenic injury guideline is intended for use by Queensland Health clinicians and is to be considered with local subspeciality resourcing, including the availability of interventional radiology (IR) and surgical capability.

1. Background

The management of splenic injury has evolved over the past two decades with increasing evidence that selective non-operative management along with IR techniques and control with embolisation can be safe alternatives to splenectomy.[5, 6] In the hemodynamically unstable patient, splenectomy is a rapid and effective means for haemorrhage control. Computed tomography (CT) imaging is used to identify the grade of injury and any source of active haemorrhage, to direct the use of non-operative techniques. Embolisation is a non-operative alternative to managing acute bleeding with appropriate case selection. The use of embolisation for splenic preservation with major trauma has created an environment in which assessment of splenic function is required, to determine future overwhelming post-splenectomy infection (OPSI) risk. Flowcharts 1 and 2 support decision-making in facilities both with and without IR available.

1.1 Anatomical structures

The spleen is located postero-laterally in the left thoraco-abdominal region (upper quadrant) and is the largest organ in the lymphatic system. It is closely located to the left hemidiaphragm, left lower ribs, stomach, left kidney and the left colic flexure. The splenic hilum, adjacent to the tail of the pancreas, receives blood supply from the splenic artery and short gastric vessels derived from the coeliac trunk, with little collateral flow. The splenic vein unites with the superior mesenteric vein to become the portal vein.

1.2 Mechanism of injury

Splenic injury most commonly occurs after blunt trauma due to motor vehicle accidents, falls, physical assaults, or sport-related activities; with penetrating splenic injury being less common. Deep inspiration and splenomegaly displace the spleen inferiorly and increase the likelihood of injury. Older adults are at an increased risk of adverse outcomes from low velocity mechanisms of injury,

due to frailty, multimorbidity and cognitive impairment, and therefore require a multidisciplinary and holistic approach to care.

1.3 Associated injuries

With both blunt and penetrating (depending on energy and trajectory) mechanisms of injury, co-located injuries to the diaphragm, ribs, pancreas, left kidney and large bowel should be considered and addressed.

2 Assessment

2.1 Clinical examination

A trauma **primary survey** should be performed to identify life threatening injuries requiring immediate intervention. In the setting of major splenic injury, this is focused on the circulation assessment, including response to fluid volume replacement. A haemodynamically unstable patient despite resuscitation, with peritonism on examination and/or a positive extended focused assessment with sonography in trauma (EFAST) scan requires an emergent laparotomy.[7]

A **secondary survey** should be completed following the primary survey, after the patient has been stabilised. It includes a thorough review of the patient history and a full head-to-toe clinical examination to determine if any further assessment, imaging or pathology testing is required. Splenic injury should be suspected in patients with direct trauma to the left upper quadrant, left flank or left chest. Abdominal examination should focus on abdominal tenderness or peritonism, although these are not specific to splenic injury. Associated findings may include abdominal wall contusion (seatbelt sign), lower left chest wall tenderness and/or clinical rib fractures. A negative history or examination does not exclude splenic injury. Suitability for CT imaging and the role of IR should be considered at this stage.

The **tertiary survey** should be completed within 24 hours of presentation, or as soon as practicably appropriate, to check for any undetected or evolving injuries. This includes a complete physical re-examination of the patient and re-evaluation of laboratory and radiological results. If the patient is intubated when the tertiary survey is undertaken, a repeat examination is required following extubation.

2.2 Diagnostic Imaging

Patients with suspected intra-abdominal injury and/or haemorrhage should undergo a CT abdomen with both arterial and portal venous phases, as this will assist to define the grade of injury and presence of contrast extravasation (blush). Vascular injuries are evident on both phases whereas parenchymal injuries are best evaluated on the portal venous phase, as splenic parenchyma typically demonstrates heterogenous and variable arterial phase enhancement (zebra spleen appearance). Patients with multiple injuries, including those with concurrent lower chest findings, should also have a thoracic CT with contrast in arterial phase. It is recommended arterial phase scans should be performed as a single bolus in preference to dual bolus protocols.[8] Injuries that

may be demonstrated on CT scan include haematoma (peri-splenic, intraparenchymal, subcapsular), laceration, vascular injury, active bleeding (detected by contrast extravasation), haemoperitoneum, splenic infarction (due to thrombus formation following injury/arterial dissection) and associated chest/abdominal injuries.

Bedside imaging with EFAST is used in the haemodynamically unstable patient, to identify free fluid within the peritoneum, to aid clinical disposition decisions.[9] Haemodynamically unstable patients with a positive EFAST scan should have an urgent surgical consultation. The role of EFAST in the stable patient is controversial and this should not be used as the only diagnostic investigation in suspected splenic injury.

2.3 Grading of injury

The American Association for the Surgery of Trauma (AAST) organ injury scale utilises a scoring system of I to V dependent on anatomical disruption, as illustrated in Table 1 below.[10]

Table 1: Splenic injury grading scale (2018 revision)

Grade*	AIS Severity	Imaging Criteria (CT Findings)	Operative Criteria	Pathologic Criteria
I	2	Subcapsular haematoma <10% surface area	Subcapsular haematoma <10% surface area	Subcapsular haematoma <10% surface area
		Parenchymal laceration <1 cm depth	Parenchymal laceration <1 cm depth	Parenchymal laceration <1 cm depth
		Capsular tear	Capsular tear	Capsular tear
II	2	Subcapsular haematoma 10-50% surface area; intraparenchymal haematoma <5 cm	Subcapsular haematoma 10-50% surface area; intraparenchymal haematoma <5 cm	Subcapsular haematoma 10-50% surface area; intraparenchymal haematoma <5 cm
		Parenchymal laceration 1-3 cm	Parenchymal laceration 1-3 cm	Parenchymal laceration 1-3 cm
III	3	Subcapsular haematoma >50% surface area; ruptured subcapsular or intraparenchymal haematoma ≥5 cm	Subcapsular haematoma >50% surface area or expanding; ruptured subcapsular or intraparenchymal haematoma ≥5 cm	Subcapsular haematoma >50% surface area; ruptured subcapsular or intraparenchymal haematoma ≥5 cm
		Parenchymal laceration >3 cm depth	Parenchymal laceration >3 cm depth	Parenchymal laceration >3 cm depth
IV	4	Any injury in the presence of a splenic vascular injury or active bleeding confined within splenic capsule	Parenchymal laceration involving segmental or hilar vessels producing >25% devascularisation	Parenchymal laceration involving segmental or hilar vessels producing >25% devascularisation
		Parenchymal laceration involving segmental or hilar vessels producing >25% devascularisation		
V	5	Any injury in the presence of a splenic vascular injury with active bleeding extended beyond the spleen into the peritoneum	Hilar vascular injury with devascularised spleen	Hilar vascular injury with devascularised spleen
		Shattered spleen	Shattered spleen	Shattered spleen

Vascular injury is defined as a pseudoaneurysm, contrast extravasation or arteriovenous fistula, and may appear as a focal collection of vascular contrast that decreases in attenuation with delayed imaging. Active bleeding from a vascular injury presents as focal or diffuse vascular contrast, that increases in size or attenuation in the delayed phase. Vascular thrombosis can lead to organ infarction. The grade is based on the highest-grade assessment made on imaging, at operation, or on pathologic specimen. More than one grade of splenic injury may be present and should be classified by the higher grade of injury. If multiple low-grade injuries are present within the splenic parenchyma, the grading is upgraded to III. Any vascular injury is considered high-grade injury.

3 Acute management

The initial management of splenic injury is primarily based on both the haemodynamic status of the patient, and the response to intervention and resuscitation. Early investigations such as point-of-care imaging studies, laboratory results and/or formal imaging results, will aid the decision making on management, when utilised in conjunction with clinical parameters, other traumatic injuries and medical co-morbidities. Management may change depending on available resources, for example if a facility does not have access to IR services.

Patients with a splenic injury may be classified into stable, non-responder, transient responder and responder categories, as outlined in Table 2 below.

Table 2: Splenic injury categorisation

Category	Presentation
Stable	Vital signs are within normal range, despite the splenic injury.
Responder	Vital signs and perfusion improve following the initial fluid bolus, and the patient remains haemodynamically stable.
Transient responder	Vital signs and perfusion improve following the initial fluid bolus, however then trend negatively when the bolus is slowed or ceased.
Non-responder	Vital signs are unchanged, despite fluid volume resuscitation. The patient remains clinically shocked and hypoperfused.

Stable, responder and transient responder patients have stabilisation of haemodynamic parameters, allowing the patient to safely undergo further imaging or transfer processes. Patients that respond to fluid resuscitation with blunt splenic injury should have a CT scan and subsequently can be considered for embolisation where available.[5, 11, 12] Patients with diffuse peritonitis or who have haemodynamic instability despite adequate fluid resuscitation, with free fluid in the abdomen following blunt or penetrating abdominal trauma should be considered for urgent operative management for haemorrhage control. [13, 14]

Evidence suggests the following are ***not*** contraindications to non-operative management (NOM) in a haemodynamically stable patient:[15-24]

- The grade of splenic injury on CT scan
- The degree of haemoperitoneum on CT scan
- Neurological status

- Age >55
- Presence of associated injuries

Formal angiography with a view to embolisation should be considered for:[25-36]

- Injury AAST grade III or higher
- Contrast extravasation (contained or free)
- Moderate haemoperitoneum
- Evidence of ongoing bleeding

When embolisation is performed, a CT angiogram should be performed at approximately 48 hours post intervention to evaluate for further vascular abnormalities and/or ischaemia of the splenic parenchyma.[24, 37]

3.1 Non-operative management (NOM)

3.1.1 Overview of NOM

NOM can include observation alone, and/or angiography followed by embolisation, and is appropriate to consider for the transient-responder and responder subgroups. This is currently the preferred treatment pathway for those with a low AAST grade. The rationale is to avoid surgical and anaesthetic risks, and retain as much functional splenic tissue as possible, decreasing the long-term risk of infectious complications.

There is a higher failure rate of NOM with increasing AAST grade of injury, though all grades can bleed unpredictably. Operative management is suggested in non-responder patients and those with generalised peritonitis or other intra-abdominal injury necessitating surgical exploration.

Disadvantages of non-operative management include an increased risk of a missed injury (particularly hollow viscus injury), delayed bleeding, transfusion-related illness and the risks associated with embolisation techniques.

3.1.2 Patient suitability for NOM

In the stable patient without peritonitis, that responds to fluid resuscitation or did not require initial resuscitation, there is no indication for a routine laparotomy for an isolated splenic injury[38, 39] This cohort of patients may be more suitable for NOM. It is recognised that successful NOM depends on appropriate patient selection and the availability of adequate resources, to closely observe and rapidly treat a patient who may deteriorate. The best predictors are injury grade (based on CT) and the abdominal abbreviated injury score (AIS).[40] Due to splenic capsule thinning with age, patients aged over 55 may have an increased risk of complications or failure of NOM, although evidence has not demonstrated any associated increase in mortality due to this.[16] There is no universal guideline for patient selection criteria and diagnostic and grading procedures for non-operative management; further evidence will be beneficial in defining these groups more clearly.

Current evidence suggests there are several ***relative contraindications*** to NOM, including:

- Portal hypertension, which may prevent clot formation due to increased venous pressures.
- Patients with liver cirrhosis have higher rates of complications than non-cirrhotic patients, as indicated in data from the National Trauma Data Bank.[41]
- Higher grade injuries, i.e. those with active contrast extravasation or significant haemoperitoneum, who may be more appropriate for initial surgical management.
- Traumatic brain injury and altered neurological state that may preclude the ability to perform reliable serial abdominal examinations and assessment of pain.
- Pre-existing anaemia or the refusal of blood transfusions, which may complicate the ability to manage a patient non-operatively.

A low-grade injury in a clinically stable patient who has been managed with observation alone, does not require follow-up imaging, unless there is a deterioration. Duration of observation should be individualised and consider the grade of injury along with any associated injuries and co-morbidities.

Higher grade injuries require longer observation. Evidence has demonstrated over 60% of failed non-operative management occurs within the first 24 hours, however 8% of non-operative management failed nine days or later after injury.[21]

3.1.3 Appropriate care settings

The appropriate location for NOM of a patient is dependent on the AAST grade of injury, as follows:

a. High grade injuries (AAST Grade IV-V) should be managed in an appropriate clinical environment (High Dependency Unit [HDU] or an Intensive Care Unit [ICU]) with repeat CT angiography at day three to five post injury. This may occur during step down to the ward environment.

   Note that NOM of high-grade splenic injuries should only be considered in an environment that provides capabilities for close physiological monitoring, serial clinical evaluations, access to CT imaging, rapid access to an operating theatre or hybrid suite and has appropriately trained staff.[42-46] The benefit of embolisation must be weighed up against the risk of deterioration in transit, when considering an interhospital transfer.

b. Intermediate grade splenic injuries (AAST Grade III) should be managed on a specialised surgical or trauma ward with consideration for a repeat CT angiogram, based on clinical requirement.

c. Low grade splenic injuries (AAST Grade I-II) can be managed on a specialised surgical or trauma ward when clinically appropriate and may be discharged to the community with discussion of future bleeding risks. Routine repeat imaging is not necessary and should be directed by other clinical indications.[47]

Transfer to a trauma centre or tertiary facility should be considered and discussed with the local referral team. It is recommended the patient have daily haemoglobin, haematocrit and platelet levels, with serial clinical reviews for the first 24 hours. In patients that have mobility restrictions associated with NOM, extra consideration needs to be given for the prevention of venous thromboembolism. Bed rest has previously been advised but there is recent evidence that early mobilisation is safe once splenic bleeding is controlled and clinical stability is confirmed.[48]

3.1.4 Failure of NOM

In patients that deteriorate and require further management after NOM, treatment may consist of either secondary embolisation or operative intervention. Failure of NOM is determined by the development of haemodynamic instability or ongoing requirement for blood products.
There is a risk of delayed bleeding in AAST grade III to V injuries (relating to the formation of pseudoaneurysms, evidenced by vascular abnormalities on the CT angiogram).[26, 49, 50]
The decision between embolisation or surgery is often governed by resource availability and the patient's ability to tolerate the expected duration of an interhospital transfer.

3.2 Interventional Radiology

Splenic embolisation requires specialised imaging facilities and a vascular IR team. Embolisation is most valuable when employed selectively in patients with haemodynamic stability, that have CT findings such as active contrast extravasation, pseudoaneurysm or a significant haemoperitoneum. Optimal management for grade IV and V injuries varies according to patient parameters and available resources.

In cases managed conservatively, close imaging surveillance and regular clinical assessment may identify early complications (e.g. delayed bleeding and pseudoaneurysm formation) that can be treated with embolisation. Stable patients with grade IV or V injuries may benefit from prophylactic embolisation.[51, 52]

Embolisation techniques may include proximal embolisation to decrease the perfusion pressure to the whole spleen, or distal embolisation which targets the local area of bleeding, to interrupt blood flow in major or branch arteries, resulting in a partial reduction of perfusion. There is no clear superior technique. Technique choice is dependent on IR operator expertise and patient factors. Embolisation may lead to a degree of ischaemia which can be complicated by abscess formation. A second (proximal) embolisation may be performed in patients who continue to bleed after initial distal embolisation.

When embolisation is not successful, a patient often requires surgical management of haemorrhage. Failure may be indicated by instability of haemodynamic parameters, ongoing blood transfusion requirement, onset or aggravation of peritoneal irritation, or worsening splenic injury on follow-up imaging. Higher grade injuries have increased bleeding risk and post embolisation complications.

3.3 Surgical Management

Surgical management occurs in approximately 20-40% of patients with a splenic injury[41] and is indicated in a non-responder patient with a blunt or penetrating injury. Operative intervention aims to define the source of intra-abdominal bleeding and achieve haemorrhage control. Surgical exploration is also advised in patients who are not candidates for NOM, have signs of other significant intra-abdominal injury and those who fail NOM.

In a facility without access to an IR service, surgical exploration may be considered for lower grade injuries. It should be considered in patients who cannot safely be transferred to a tertiary trauma

centre, cannot be adequately observed due to resource limitations (ICU/HDU), and are unlikely to tolerate a significant episode of hypotension. Patient suitability for transfer to a trauma centre should be assessed on an individual basis and in conjunction with the local surgical team, the accepting tertiary trauma/surgical team, and the interventional radiologist. Other factors such as the patient's haemodynamic stability, radiological evidence of injury, suitability for embolisation and mode and distance of transfer all need to be considered.

Preparation for surgery includes securing sufficient intravenous access, routine trauma blood testing (full blood count, chem20, lipase, coagulation screen), thromboelastography (TEG) or rotational thromboelastometry (ROTEM), and blood typing and cross match of blood products.

At a minimum, prophylactic antibiotics are required (e.g. Cephazolin), or broader spectrum (e.g. Piperacillin/Tazobactam [Pip Taz]) in the case of a concurrent bowel injury. Post operative care is largely dictated by associated injuries. Specific considerations in splenectomy include serial assessment focussed on the detection of ongoing bleeding, thrombocytosis, and complications. Serial abdominal examinations, and laboratory measurements will occur as dictated by clinical need in the acute phase (24 hours post injury).

3.4 Venous thromboembolism (VTE) prophylaxis

Evidence suggests in the absence of contraindications (such as intracranial haemorrhage, haemorrhagic diathesis, or concurrent anticoagulation therapy), VTE prophylaxis can be safely commenced >24hours after admission, regardless of injury grade.[47, 53] Chemical VTE prophylaxis can be commenced after 24 hours in isolated blunt splenic injuries, without increasing the failure rate of non-operative management [54]. The use of aspirin in the setting of thrombocytosis (platelets >1000) remains controversial.[55, 56] Mechanical thromboprophylaxis should be commenced on admission[57] for all cases, unless contraindicated.

3.5 Analgesia

Adequate analgesia is paramount to avoiding complications related to immobility and poor respiratory function. Analgesia requirements will vary with individual patient needs, the injury profile and previous analgesia use. A stepwise approach including the use of simple analgesia (e.g. Paracetamol, Ibuprofen), oral opiate analgesia (e.g. Targin, Oxycodone), intravenous (Patient Controlled Analgesia [PCA], continuous infusions) and regional anaesthesia techniques. Early involvement with acute pain services to provide optimal multimodal analgesia is strongly advised.

3.6 Mobilisation

Patients may be mobilised early (after 24 hours post-injury) provided bleeding control and clinical stability is achieved. For very high grade injuries, consultation with the treating medical team should occur prior to any mobilisation. Routinely, patients are immobilised four hours post-embolisation or as per local protocols.

3.7 Interhospital transfers

Ideally, all splenic injuries should be managed in a facility with surgical capability, which is guided by the severity of the injury and the stability of the patient. The capability of the facility to respond to patient deterioration should also be considered. Interhospital transfers of patients with splenic injuries (including vascular abnormalities) to a major trauma centre should be considered in the context of:

- The referring hospital capability for monitoring, serial clinical evaluations, surgical expertise, operating theatre access, and blood product resources.
- The patient's coexisting injuries and management requirements.
- The period of time that the patient has remained physiologically stable.
- The expected retrieval and transfer time, and availability of retrieval assets.
- The severity and nature of the injuries
- Contributing patient medical comorbidities.
- The risk of ongoing bleeding during transfer, and the ability to manage this in transit.

The necessity of interhospital transfer of a patient with splenic injury should be weighed up with the risks and benefits of a transfer and should always be made in consultation with the accepting surgical team and patient (or designated decision maker). As transfer considerations may be complex, decision-making in these situations should be made at a Consultant level, or nearest appropriate senior clinician. Referrals for aeromedical interhospital transfers should be made through Retrieval Services Queensland (RSQ), and road transfers through Queensland Ambulance Service (QAS).[58] Such referrals should be made early, once the likely need for transfer is established, to facilitate expeditious transport to the most appropriate treating facility.

4 Complications

4.1 Short term complications

Post embolisation complications

- Pseudoaneurysm formation, leading to bleeding or rupture
- Peritonitis
- Infection, splenic abscess (preferentially managed with percutaneous drainage), or sepsis
- Splenic atrophy
- Iatrogenic arterial damage or dissection
- Allergy, anaphylaxis, or acute renal failure related to contrast administration
- Migration of embolic material
- Pain or haematoma at vascular access puncture site
- Post-embolisation syndrome, including discomfort, fever, local pain, leukocytosis persisting for three to five days
- Thrombocytosis
- Pancreatitis/pancreatic necrosis

Post surgical complications

- Pancreatic fistula
- Post-operative bleeding
- Pulmonary complications
- Surgical site or intra-abdominal infection
- Sepsis
- Reactive thrombocytosis (increases the risk of VTE)
- Gastric perforation
- Vascular thrombosis – commonly in the portal, mesenteric and splenic veins.
- Iatrogenic splenosis

4.2 Long term complications

- Delayed splenic rupture – this rare but potentially disastrous complication, cannot be reliably predicted. More than 90% occur within 10 days of initial trauma and are managed non-operatively. Most of the remainder occur within two weeks.[21, 59]
- Bleeding requiring readmission
- Overwhelming post-splenectomy infection – occurs in approximately 0.5% of all splenectomies in trauma.
- Splenic abscess
- Peritoneal adhesions causing intestinal obstruction
- Pancreatitis
- Post-splenectomy infection
- Death

5 Assessment of splenic function

Splenic function should be examined in all patients that undergo a non-selective splenic embolisation, by performing a Howell Jolly body (HJB) assessment 28 days after intervention (using full blood count analysis with a HJB smear). The presence of HJB indicates the patient may have functional 'asplenia' when assessed for OPSI risk and requires additional vaccinations. If no HJBs or asplenic changes are present, the spleen is considered functional, and the patient does not require additional vaccinations and/or antibiotics.

All patients that have had a splenectomy should receive the approved vaccination regime within 7-14 days post operation if medically safe to do so. Medical recommendations and the vaccination schedule from Spleen Australia[60] are contained in Appendix 1.

Long term management

5.1 Hypo or asplenic patients

- Follow the national splenic vaccination schedule (Appendix 1)
- Advise patients to register with Spleen Australia
- Discuss OPSI risk with patient:
  - Minor viral infections are not normally a concern, but fever or significant symptoms warrant a clinical review
  - All animal bites should be reviewed as soon as possible
  - Dental procedures do not need antibiotic prophylaxis
  - Maintain vaccinations as per schedule (Spleen Australia and National Immunisation Program)[60, 61]
- Inform friends and family of increased risk of OPSI and sepsis.[60] Consult Spleen Australia for education kits and consider wearing a medi-alert bracelet
- Ensure an emergency supply of antibiotics at home
- Daily oral antibiotics, based on specific patient risks.

Bacterial vaccines for asplenic patients are free of charge for hospitals administering them, under the National Immunisation Program (NIP) schedule.[61] It is important to ensure the pharmacy is aware of the indication and local processes are followed to ensure any administered NIP-funded vaccines are recorded in the Australian Immunisation Register.

5.2 Return to activity

Return to work and sport is tailored to the individual based on the initial injury grade and concurrent injury profile. This may range from two to six months.[62]

For a ***low grade*** splenic injury, return to work and sport can occur with a graduated program.[62] Consensus from literature recommends a restricted return to activity from two weeks post injury, with return to full activity from six weeks (low grade injury with NOM or IR intervention). Avoidance of contact or high-risk sports for three to six months is recommended, depending on injury grade.

For ***high grade*** splenic injury, return to work and sport is tailored to the individual based on the initial injury grade and concurrent injury profile. This may range from three to six months.[62] Consensus from literature recommends a graded return to activity from two weeks, but not return to full activity before three months (depending on individual injury profile).

Following ***splenectomy***, a return to full function may occur from three weeks, depending on other individual injury characteristics.

5.3 Outpatient follow up

If the HJB smear is not performed prior to discharge, the patient may return for outpatient testing and review of results and commence vaccinations if required. Routine follow up assessment should be arranged as indicated - based on injury profile, co-morbidities, and specific risk factors.

Appendix 1 - Spleen Australia - Medical Recommendations[60]

Spleen Australia – Medical Recommendations

Vaccines for adults (>18 years) with asplenia/hyposplenism who have not previously been vaccinated ** January 2023** v42

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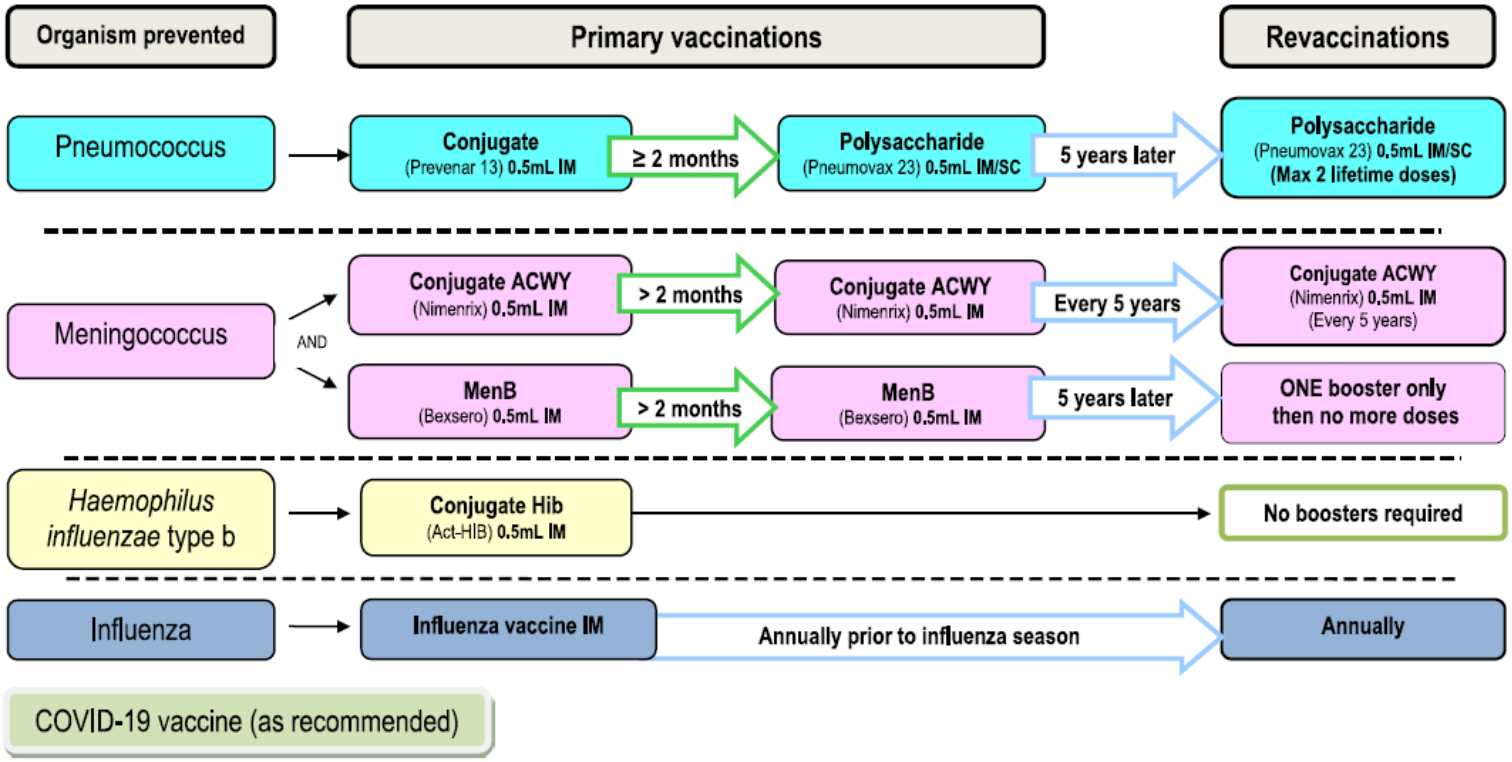
Disclaimer: These guidelines have been produced to guide clinical decision making for medical, nursing and allied health staff. They are not strict protocols, and **they do not replace the judgement of a senior clinician**. Clinical common sense should be applied at all times. These clinical guidelines should never be relied on, as a substitute for proper assessment with respect to the particular circumstances of each case and the needs of each patient. Clinicians should also consider the local skill level available and their local area policies before following any guideline.

Give 1st dose 7 – 14 days or longer prior to elective splenectomy or at least 7 days after emergency splenectomy



This table is for patients who have had one or more previous "spleen vaccines"

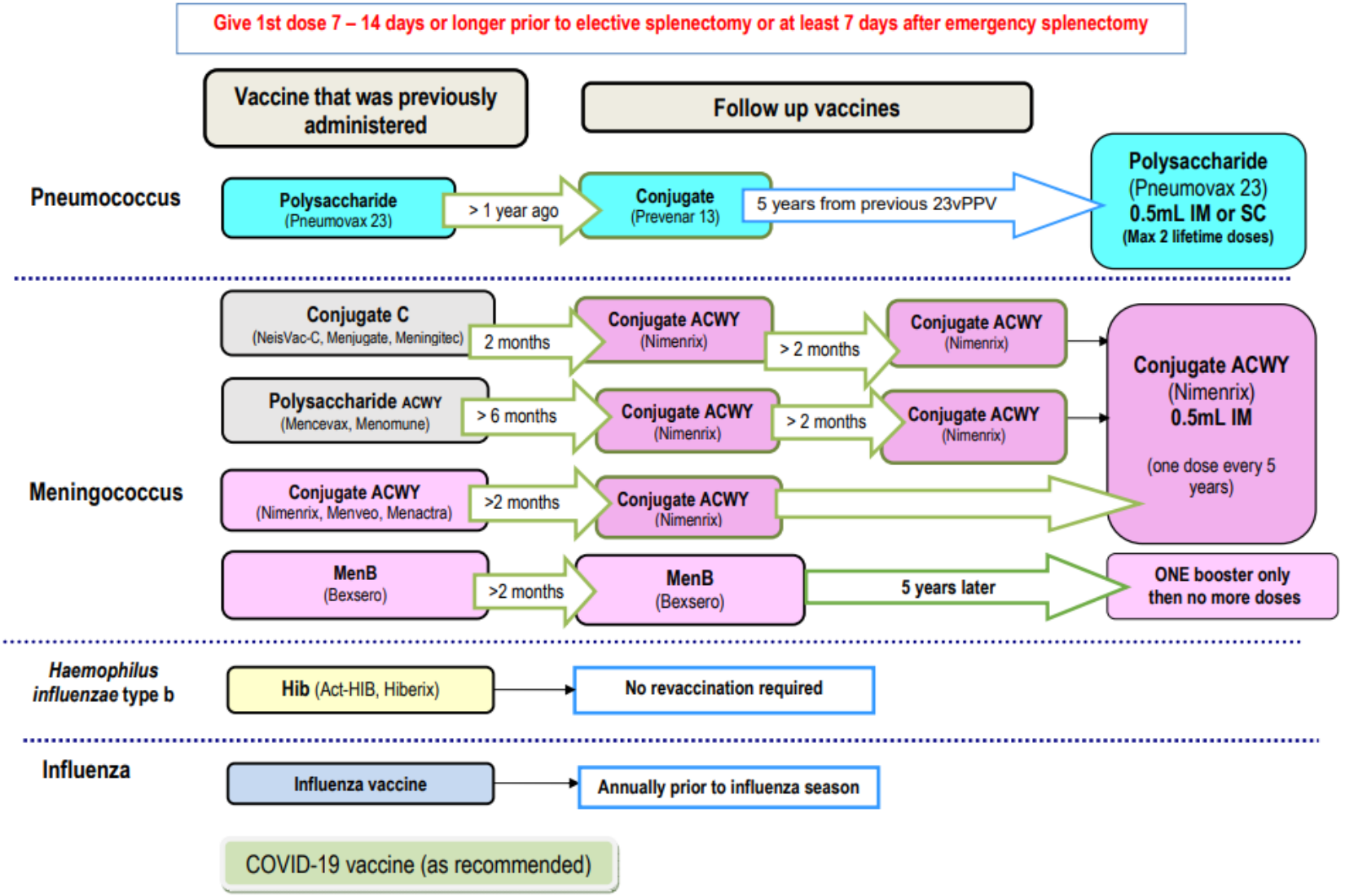


Table 1	Additional information for people without a functioning spleen
Government funding of "spleen vaccines"	From July 1st 2020, the following vaccine brands will be part of the National Immunisation Program (NIP) **Prevenar 13** (pneumococcal conjugate 13v), **Pneumovax 23** (pneumococcal polysaccharide 23v), **Nimenrix** (ACWY meningococcal conjugate), **Bexsero** (meningococcal B), **Act-HIB** (*Haemophilus influenzae* type b) https://www.health.gov.au/resources/publications/atagi-clinical-advice-on-vaccination-recommendations-for-people-with-risk-conditions-from-1-july-2020
Antibiotic Prophylaxis	1. Oral amoxicillin 250mg once daily OR phenoxymethyl penicillin (penicillin V) 250mg twice daily: In patients reporting a penicillin allergy – a thorough clinical history must be obtained and a penicillin allergy assessment undertaken - see Antibiotic Therapeutic Guideline (Diagnosis of Antimicrobial hypersensitivity section). In some cases of hypersensitivity, penicillin desensitisation/oral provocation may be appropriate (refer to the TG); if these options are not possible seek expert advice for clinical alternatives in the setting of local antimicrobial susceptibility. 2. Duration - Immunocompromised patients - lifelong; otherwise healthy patients - recommend daily antibiotics for at least 3 years, or lifelong 3. Provide emergency antibiotics (see below) irrespective of prophylaxis
Emergency plan	1. Emergency supply of antibiotic to have at home. If signs of bacterial infection (fever, shivers, shakes, chills and/or vomiting/diarrhoea) take emergency antibiotics and consult a doctor or present at local hospital emergency department as soon as possible. 2. Amoxicillin 2 g (four - 500 mg capsules) stat; if medical review is delayed, 1g 8 hourly until medical review. 3. In patients reporting a penicillin allergy – ensure thorough penicillin allergy assessment undertaken (as above). For patients with immediate non-severe or delayed non-severe hypersensitivity to penicillin - cefuroxime 500mg stat (preferably taken with food), if medical review is delayed take 500mg orally, 12-hourly. For immediate severe or delayed severe hypersensitivity to penicillin, seek expert advice in the setting of local antimicrobial susceptibility.
Administering vaccines	• Verbal consent should be obtained prior to administration of vaccines • Vaccines can be administered safely, at the same time (in different sites). Vaccines should be given in deltoid muscle. • If concerned in patients with bleeding disorders, delay administration until corrected – consult patient's doctor or Spleen Australia.
Pneumococcal vaccinations	• **13vPCV (Prevenar 13)** is a once only vaccine, currently no booster of this vaccine is required. • **23vPPV (Pneumovax 23)** First dose of Pneumovax 23 can be given anywhere from 2 to 12 months after Prevenar 13, and a second dose 23vPPV is recommended 5 years later. The recommended number of lifetime doses of 23vPPV is TWO doses. • Spacing between vaccinations: If 23PPV (Pneumovax 23)is given initially, then wait 12 months to give 13vPCV (Prevenar)
Meningococcal ACWY CONJUGATE and Men B vaccines	• Nimenrix – for the initial two dose course, the ***minimum*** interval is 8 weeks. Booster dose of this vaccine is every five years. People can receive a booster dose of Nimenrix brand irrespective of meningococcal ACWY brand used for primary vaccination. MenB (Bexsero), for the two dose course, the ***minimum*** interval is 8 weeks and no boosters. Spleen Australia recommends the use of Bexsero in people aged over 50 despite lack of studies because of the increased risk of meningococcal disease in this patient group. • **Men B (Trumenba)** is available but is not interchangeable with Bexsero and requires 3 doses – refer to Immunisation Handbook • **BEXSERO (Jan 2023)** new recommendation a booster (3rd dose) – 5 years after 2nd dose https://immunisationhandbook.health.gov.au/resources/tables/table-recommendations-for-menb-vaccine-for-people-with-a-specified-medical-condition-that-increases-their-risk-of-invasive-meningococcal-disease

Chemo/Radiotherapy Immunosuppression	As a guide, vaccination should generally be administered 2 weeks before immunosuppressive therapy and delayed at least 3 to 6 months after chemotherapy or radiotherapy or until adequate immunological function. It may be worthwhile to contact the patient's specialist physician to discuss this suggested timing, as they might decide to give vaccination during immunosuppressive therapy.
Patient education	1. Patient and family/friends should know about increased lifelong risk of bacterial infections and prevention strategies (antibiotics/vaccinations/doctor review) 2. Patients should not worry about minor viral infections (eg cold symptoms without fever or other systemic symptoms) 3. Animal bites/scratches -should be reviewed by a doctor. Animals carry some bacteria on their claws and teeth; a course of antibiotics may be required. 4. **Dental procedures as a rule**, do not require additional antibiotic cover unless they have an associated medical condition 5. Pregnancy or breastfeeding - underlying risk for overwhelming sepsis is not increased but timing of recommended vaccinations for asplenia/hyposplenism need to be discussed with GP **6. Spleen Australia distributes "education kits"** that contains many items including vaccination cards & alerts. Registered patients, their GPs and clinic nurses are encouraged to go to website www.spleen.org.au for the current medical recommendations and health updates. We will also inform patients about important health information by email as required. Patients without access to the internet may receive posted information. Information on the updated Spleen smart phone App will be on website too.
Blood tests	FBE & film – can demonstrate lack of splenic function as shown by the presence of Howell-Jolly Bodies on film and IgM memory B cell marker tests are available in Victoria & QLD – contact Spleen Australia.
Travel Recommendations	1. Seek medical advice before overseas travel. Contact your GP or seek advice from a specialised travel medicine clinic. 2. Travellers to malaria-endemic areas should take malaria chemoprophylaxis, avoid mosquito bites (by wearing insect repellent and protective clothing and sleeping in screened or air-conditioned rooms or under a bed net), and seek early medical attention if become ill. 3. Ensure all routine and recommended vaccinations are up to date, including pneumococcal, meningococcal and influenza vaccines. 4. Seek medical attention early in the event of an animal bite or tick bite.
Alerts	Patient should be encouraged to wear or carry a medi-alert medallion or wallet card at all times. Patient's medical notes should display a medical alert sticker.
Children	Please refer to spleen.org.au website https://spleen.org.au/wp-content/uploads/2020/03/RECOMMENDATIONS_Spleen_Registry_p.pdf Spleen Australia can also offer extra support.

Vaccine Brand name	Type of vaccine	Abbreviation
Prevenar 13	13 valent pneumococcal *conjugate* vaccine	13vPCV
Pneumovax 23	23 valent pneumococcal *polysaccharide* vaccine	23vPPV
Nimenrix (preferred - NIP) Menveo, Menactra	(Conjugate ACWY) Quadrivalent meningococcal *conjugate* vaccine	MenACWY
Bexsero (preferred - NIP) Trumenba	Meningococcal B *recombinant* vaccine	MenB
Act-HIB (preferred – NIP) Hiberix	***Haemophilus influenzae*** type b conjugate	Hib

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Abbreviations

AAST	American Association for the Surgery of Trauma
AIS	Abbreviated injury scale
CT	Computed tomography
EFAST	Extended focused assessment with sonography in trauma
HDU	High dependency unit
HJB	Howell jolly bodies
ICU	Intensive care unit
IR	Interventional radiology
NIP	National immunisation program
NOM	Non-operative management
OPSI	Overwhelming post-splenectomy infection
PCA	Patient controlled analgesia
PIPTAZ	Piperacillin/Tazobactam
QAS	Queensland Ambulance Service
ROTEM	Rotational thromboelastometry
RSQ	Retrieval Services Queensland
SAE	Splenic artery embolisation
SIRS	Systemic inflammatory response syndrome
TEG	Thromboelastography
VTE	Venous thromboembolism

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Queensland Persistent Pain Clinical Network
Queensland Stroke Clinical Network
Queensland Ambulance Service
Retrieval Services Queensland
Statewide Anaesthesia and Perioperative Care Clinical Network

Version control

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