

Splenic Injury

Key Points

- Splenic trauma is one of the commonest injuries in trauma patients.
- CT with intravenous contrast is the imaging modality of choice.
- Management is dependent on type of splenic injury, haemodynamic parameters and the presence of other injuries.
- Management may be operative or non-operative.
- Liaison with the Trauma Centre within the Trauma Network is imperative.

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Abbreviations

AAST	American Association for the Surgery of Trauma
AE	Angio-embolisation
AG	Angiography
CT	Computed Tomography
DOACs	Direct oral anticoagulant
GCS	Glasgow Coma Score
HIV	Human immunodeficiency virus
IV	Intravenous
MTC	Major Trauma Centre
NOM	Non-operative management
OPSI	Overwhelming post-splenectomy infections
OM	Operative management
PSA	Pseudoaneurysm
RCR	Royal College of Radiologists
US	Ultrasound
WSES	World Society of Emergency Surgery

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Introduction

Splenic injury is one of the most common trauma-related injuries. It can be fatal not just at the time of the initial insult, but also in the delayed context of subcapsular haematoma rupture or pseudoaneurysm (PSA) rupture. Furthermore, if the immunological function of the spleen is lost, overwhelming post-splenectomy infections (OPSI) are a serious late complication. This range of risks necessitates standardised guidelines for management of splenic injury.

Significant injuries, polytrauma or complex cases mandate liaison with the Network Trauma Centre. For Frimley Park Hospital this is St George's Hospital, Tooting, while for Wexham Park Hospital this is the John Radcliffe Hospital, Oxford.

The primary aim of treatment is haemostasis and (especially in children) the preservation of a functioning spleen. This requires a multidisciplinary team including surgeons, intensivists, radiologists and haematologists. When managing splenic injury, the treating team will consider the physiology of the patient (haemodynamic status), the anatomy of the injury, and any associated injuries.

Although the management of splenic injury has in recent years moved in favour of non-operative management (NOM) where possible, children should always be treated in dedicated paediatric trauma centres. For Frimley Park Hospital this is St George's Hospital, Tooting, while for Wexham Park Hospital this is the John Radcliffe Hospital, Oxford.

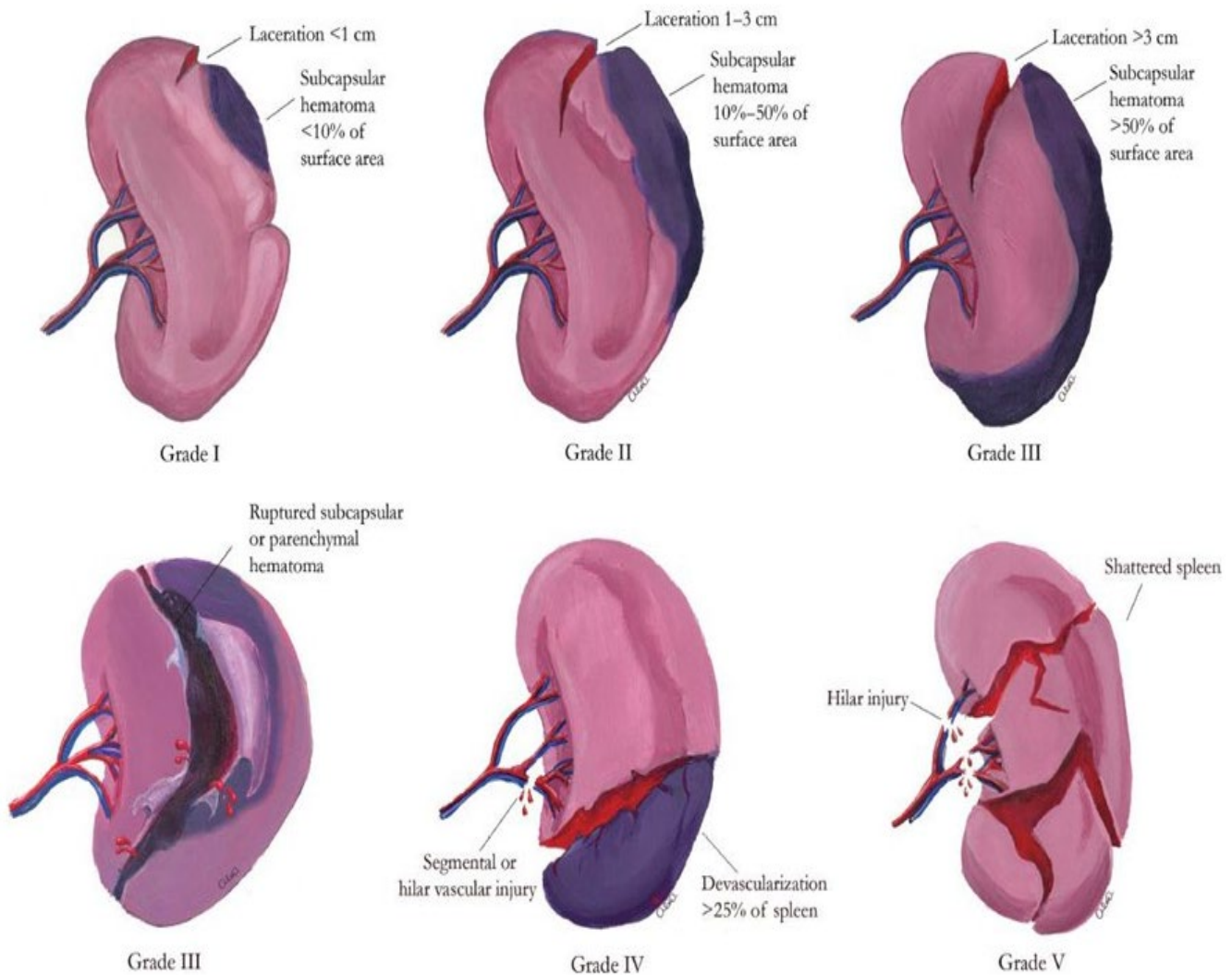
NOM options range from simple observation and monitoring through to angiography (AG) and angio-embolisation (AE).

Grade

Table 1. AAST Classification of Spleen Injuries

AAST Grade and Type of Injury		Description
I		
Hematoma		Subcapsular, <10% of surface area
Laceration		Capsular tear, <1 cm of parenchymal depth
II		
Hematoma		Subcapsular, 10%–50% of surface area; intraparenchymal, <5 cm in diameter
Laceration		1–3 cm in parenchymal depth
III		
Hematoma		Subcapsular, >50% of surface area; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma, >5 cm in diameter
Laceration		>3 cm parenchymal depth or involving trabecular vessels
IV		
Laceration		Laceration involves segmental or hilar vessels producing major devascularization (>25% of spleen)
V		
Laceration		Completely shattered spleen
Vascular		Hilar vascular injury that devascularized spleen

Grade of injury can be understood using the AAST (American Association for the Surgery of Trauma) classification (**Table & Figure 1**). This classification uses the anatomy of the injury to grade severity.

Figure 1. Diagram of AAST Classification of Spleen Injuries

The World Society of Emergency Surgery (WSES) classifies the severity of splenic injury according to AAST grade, effect on haemodynamic stability and mechanism of injury:

- Minor spleen injuries:
 - WSES class I includes hemodynamically stable AAST-OIS grade I–II blunt and penetrating lesions.
- Moderate spleen injuries:
 - WSES class II includes hemodynamically stable AAST-OIS grade III blunt and penetrating lesions.
 - WSES class III includes hemodynamically stable AAST-OIS grade IV–V blunt and penetrating lesions.
- Severe spleen injuries:
 - WSES class IV includes hemodynamically unstable AAST-OIS grade I–V blunt and penetrating lesions.

Diagnosis

- The diagnostic technique used in splenic injury must be based on the haemodynamic status of the patient.
- Care must be taken to perform a full assessment of the patient. This should include a history, a full examination with assessment of haemodynamic status and identification of other injuries, and laboratory tests with appropriate cross-matching.
- CT scan with intravenous (IV) contrast is the gold-standard investigation for splenic injury in haemodynamically stable trauma patients, or patients deemed safe to scan.
- E-FAST (extended focussed assessment with sonography for trauma) is appropriate in the compromised patient unsafe for CT scan and will identify free intra-abdominal fluid.
- There is no role for ultrasound in the assessment of the injured child (as per RCR guidelines).
- Doppler ultrasound (US) and contrast-enhanced US can evaluate splenic vascularisation, as well as aiding in identifying potential complications of splenic injury. In patients under 15 found to have a PSA on admission CT, contrast-enhanced US should be performed at discharge.

Non-Operative Management

- As stated above, NOM avoiding splenectomy is the preferred management where possible.
- CT Scan with IV contrast should be performed in all patients being considered for NOM to characterise the splenic injury and any other associated injuries.
- Irrespective of injury grade, haemodynamically stable patients without other abdominal organs requiring surgery should initially be trialled with NOM.
- However, in moderate or severe splenic injuries, NOM is only possible in a clinical environment that allows intensive monitoring, has a readily available operating theatre, has capability to perform AG/AE, and has blood products immediately available.
- In haemodynamically stable patients with arterial blush on CT, AG/AE can be the first-line intervention regardless of injury grade.
- Contraindications to NOM of splenic injury are as follows:
 - Unresponsive haemodynamic instability
 - Other indicates for laparotomy: peritonitis, hollow organ injuries, bowel evisceration, impalement
- Criteria to consider in determining NOM vs operative management (OM), though not absolute contraindications to NOM, are:
 - Age >55
 - Large haemoperitoneum
 - Hypotension prior to resuscitation
 - GCS <12
 - Low haematocrit on admission
 - Associated abdominal injuries
 - Blush on CT scan
 - HIV
 - Taking anticoagulant drugs at time of injury
 - Drug addiction
 - Liver cirrhosis
 - Requirement of blood transfusion

- Blunt trauma – NOM is considered the gold-standard treatment (90% success in some studies) in the absence of NOM contraindications listed above.
- Penetrating trauma – OM (laparotomy) has been the gold-standard treatment (33% grade I injuries; 84% grade IV injuries managed this way in some studies).
- However, in haemodynamically stable patients with bleeding vascular injuries, AG/AE as part of NOM is feasible with a high success rate, if those techniques are readily available.
- Patients should not be transferred from one Trauma Unit to another (e.g., WPH to FPH) for Interventional Radiology or other procedures. Any patient that is not able to be managed in the Trauma Unit should be transferred to the relevant MTC.

Operative Management

- As alluded to above, OM is indicated in patient with:
 - Haemodynamic instability
 - Associated injuries indicating surgical exploration such as peritonitis, impalement and bowel evisceration.
- Where intensive monitoring or AG/AE is not available, OM is indicated in all moderate and severe lesions.
- Splenectomy is indicated when NOM with AG/AE has failed and the patient remains haemodynamically unstable.
- In patients with AAST grade IV-V splenic injury, concomitant blunt spinal trauma and/or severe traumatic brain injury, and absence of AG/AE facilities, a survival benefit is conferred by immediate splenectomy over NOM. This benefit is not found where AG/AE are available.
- Based on the present classification, WSES suggests two management algorithms for both adult and paediatric patients, shown below:

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graph TD
    A[Splenic Trauma] --> B[In the E.D.: FAST-E, Thoracic and Pelvic X-ray,]
    A --> C[Hemodynamically Stable]
    A --> D[Hemodynamically Unstable or transient responders @]
    
    C --> E[Contrast Enhanced CT-Scan + Local Exploration in SW #]
    E -.-> F[Bowel Evisceration-impalement-Peritonitis  
Other indications for laparotomy]
    E --> G[Minor Lesions  
WSES I  
(AAST I-II)]
    E --> H[Moderate Lesions  
WSES II  
(AAST III)]
    E --> I[Moderate Lesions  
WSES III  
(AAST VI-V)]
    
    G --> J[NOM *]
    H --> J
    I --> K[Angiography]
    
    J -.-> L[Consider Angio if positive blush or early aneurysm]
    L --> K
    
    K --> M[Positive blush or early aneurysm]
    M --> N[NO]
    M --> O[YES]
    
    N --> P[Pre-emptive Angioembolization]
    O --> Q[Uneffective Angioembolization]
    O --> R[Effective Angioembolization]
    
    P --> S[Serial Clinical/Laboratory/  
Radiological Evaluation  
Consider Re-Angio if indicated]
    Q --> S
    R --> S
    
    S --> T[Hemodynamic/Clinical Stability  
Absence of other indications to laparotomy]
    T --> U[NO]
    T --> V[YES]
    
    U --> W[Laparotomy ± Splenectomy/  
Splenic salvage]
    V --> X[Continue NOM *]
    
    D --> Y[Positive E-FAST]
    Y --> Z[Severe Lesions  
WSES IV  
(AAST I-V)]
    Z --> W
    
    F -.-> W
    F -.-> X
  
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ADULT PATIENTS

Splenic Trauma

In the E.D.: FAST-E, Thoracic and Pelvic X-ray,

Hemodynamically Stable

Contrast Enhanced CT-Scan + Local Exploration in SW #

Minor Lesions WSES I (AAST I-II)

Moderate Lesions WSES II (AAST III)

Moderate Lesions WSES III (AAST VI-V)

NOM *

Consider Angio if positive blush or early aneurysm

Angiography

Positive blush or early aneurysm

NO

Pre-emptive Angioembolization

Serial Clinical/Laboratory/Radiological Evaluation Consider Re-Angio if indicated

Hemodynamic/Clinical Stability Absence of other indications to laparotomy

NO

YES

Continue NOM *

Uneffective Angioembolization

Effective Angioembolization

Laparotomy ± Splenectomy/ Splenic salvage

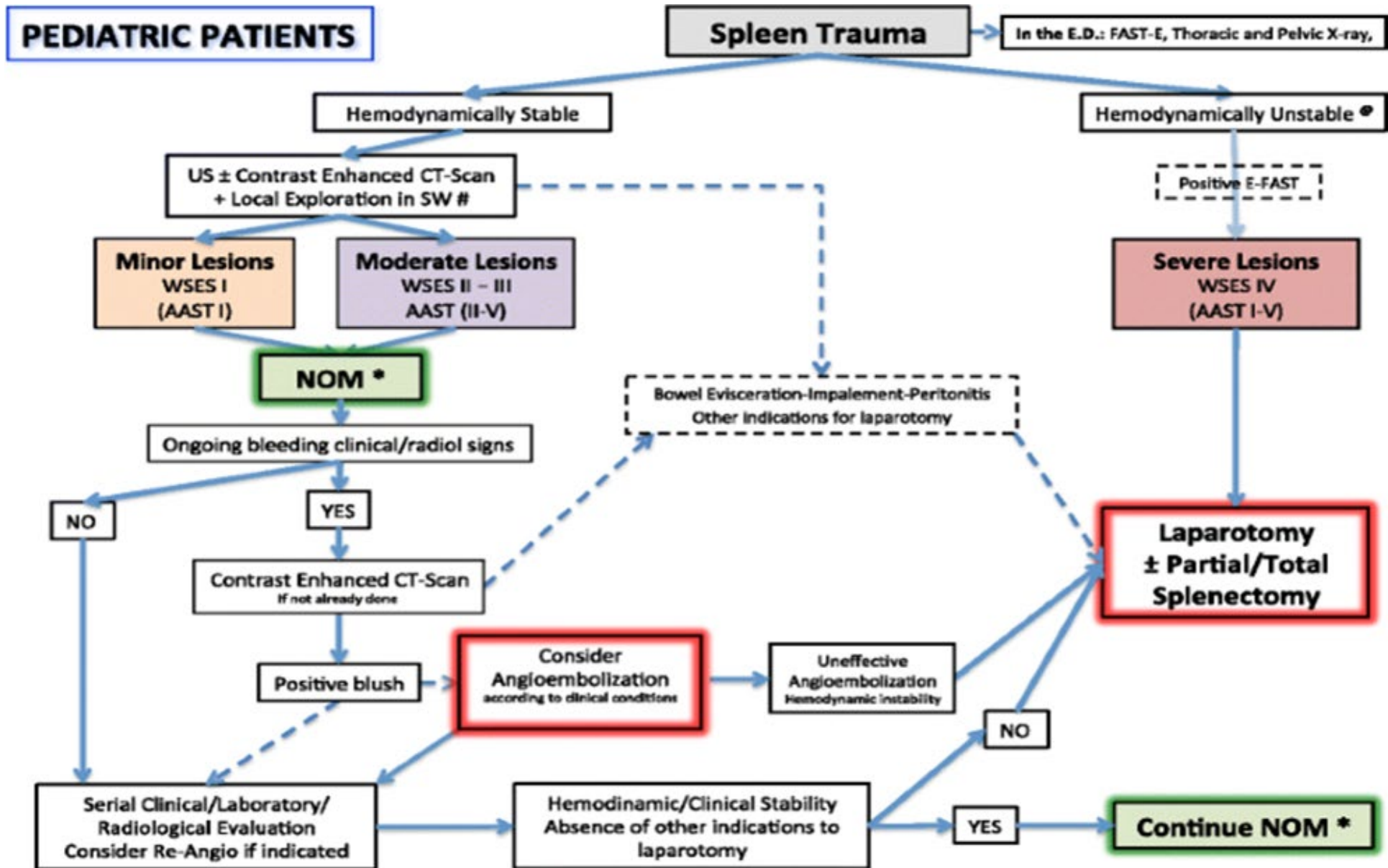
Hemodynamically Unstable or transient responders @

Positive E-FAST

Severe Lesions WSES IV (AAST I-V)

Bowel Evisceration-impalement-Peritonitis
Other indications for laparotomy

Figure 3. Spleen Trauma Management Algorithm for Paediatric Patients (taken from the WSES guidelines)



Consideration of Complications

- Pancreatic, diaphragmatic and colic injuries, most associated with penetrating trauma, frequently necessitate an OM approach due to the risk of septic complications.

Feeding and Thromboprophylaxis

- No special instructions surrounding feeding exist outside of the usual NBM considerations if a patient is for OM, or for a patient being managed with NOM with clinical suspicion that OM may be required.
- Mechanical thromboprophylaxis is safe in all patients without absolute contraindications.
- LMWH-based thromboprophylaxis can be started as soon as possible post-trauma in patients no longer actively bleeding.
- Patients anticoagulated with oral agents (e.g. DOACs) should have the risk-benefit balance of reversal assessed by the treating team on an individual basis.

Follow-Up

- During the recovery phase, patients should be encouraged to not remain alone for long periods and to return immediately to the hospital in case of increasing abdominal pain, light-headedness, nausea, or vomiting
- Moderate to severe lesions should be observed in a clinical setting for 48-72 hours, with the patient on bedrest.
- Repeat CT Scan pre-discharge can be considered in patients with:
 - Moderate to severe lesions
 - Decreasing haematocrit
 - Vascular anomalies
 - Splenic pathology
 - Coagulopathy
 - Neurological impairment
- Longer admission is advised in patients with low haemoglobin level on admission, higher grade injury and suspicion of injury to other abdominal structures.
- Post-discharge CT Scan can be considered in patients with:
 - Underlying splenic pathology
 - Coagulopathy
 - Neurological impairment
- Activity restriction for 4-6 weeks in minor injuries and 2-4 months in moderate to severe injuries
- In patients under 15 found to have a PSA on admission CT, contrast-enhanced US should be performed at discharge.

Immunisation

- In asplenic/hyposplenic patients infection prophylaxis is a key consideration. Vaccination programmes against the encapsulated bacteria (*S. Pneumoniae*, *H. influenzae*, *N. meningitidis*) should commence no sooner than 14 days post-splenectomy
- Annual flu immunisation is recommended in all patients over 6 months of age.
- Malaria vaccination is recommended in people travelling to endemic areas.
- Asplenic/hyposplenic patients should be supplied with a rescue course of antibiotics in the event of any sudden onset malaise, fever, chills or other systemic symptoms concerning for sepsis. Antibiotics indicated for this purpose are:
 - Amoxicillin 3g STAT followed by 1g 8-hourly
 - Levofloxacin 500mg daily/moxifloxacin 400mg daily (in penicillin-allergic)

Reference

Adapted and referenced from

Coccolini F., Montori G., Catena F. *et al.* Splenic Trauma: WSES Classification and Guideline for Adult & Paediatric Patients 2017. *World Journal of Emergency Surgery* **12**, 40 (2017).

<https://wjes.biomedcentral.com/articles/10.1186/s13017-017-0151-4>

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Full Version Control Record

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Version History

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1.0	June 2024	H De'Ath	Final	New guideline.

Related Documents

None