

RESEARCH ARTICLE

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# Grade III blunt splenic injury without contrast extravasation - World Society of Emergency Surgery Nijmegen consensus practice

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## Abstract

**Background:** Recent trauma guidelines recommend non-operative management for grade III splenic injury without contrast extravasation on computed tomography. Nevertheless, such recommendations rely on low-quality evidence, and practice variation characterizes clinical management for this type of injury. We aimed to identify the role of eleven selected clinical factors influencing the management of grade III splenic injury without contrast extravasation by expert consensus and a modified Delphi approach.

**Methods:** A questionnaire was developed with the endorsement of the World Society of Emergency Surgery (WSES). This was delivered and answered live by acute care surgeons attending the 6<sup>th</sup> WSES congress in Nijmegen in 2019. A dedicated mobile phone application was utilized to collect the answers. All answers were evaluated for areas of discrepancy with an 80% threshold for consensus between respondents.

**Results:** Three factors generated discrepancy in opinion for managing this pattern of injury: the patients' injury severity, the presence of a bleeding diathesis, and an associated intra-abdominal injury. Agreement was obtained for the other eight factors.

**Conclusion:** Researchers should focus their efforts on the identified area of discrepancy. Clinicians should use additional care in the presence of the three factors for which discordant opinions were found.

**Keywords:** Trauma, Spleen, Injury, Blunt, Grade III, WSES, Consensus, Questionnaire, Practice variation

## Background

The spleen is the most commonly injured solid organ in blunt abdominal trauma and contributes to worldwide trauma associated mortality and morbidity [1]. Over the last 30 thirty years, there has been a prominent shift towards a more conservative approach in the management

of splenic injury, with an emphasis on the preservation of splenic parenchyma and function [2]. Indeed, current data suggests up to 90% of patients with splenic injury can be treated non-operatively, boasting a success rate of over 80% in avoiding surgical intervention [3]. This shift was aided by haemostatic resuscitation, enhanced diagnostic, monitoring facilities and advances in the field of interventional radiology with selective or non-selective splenic artery angioembolisation [4]. As a result, patients have benefited from lower mortality rates,

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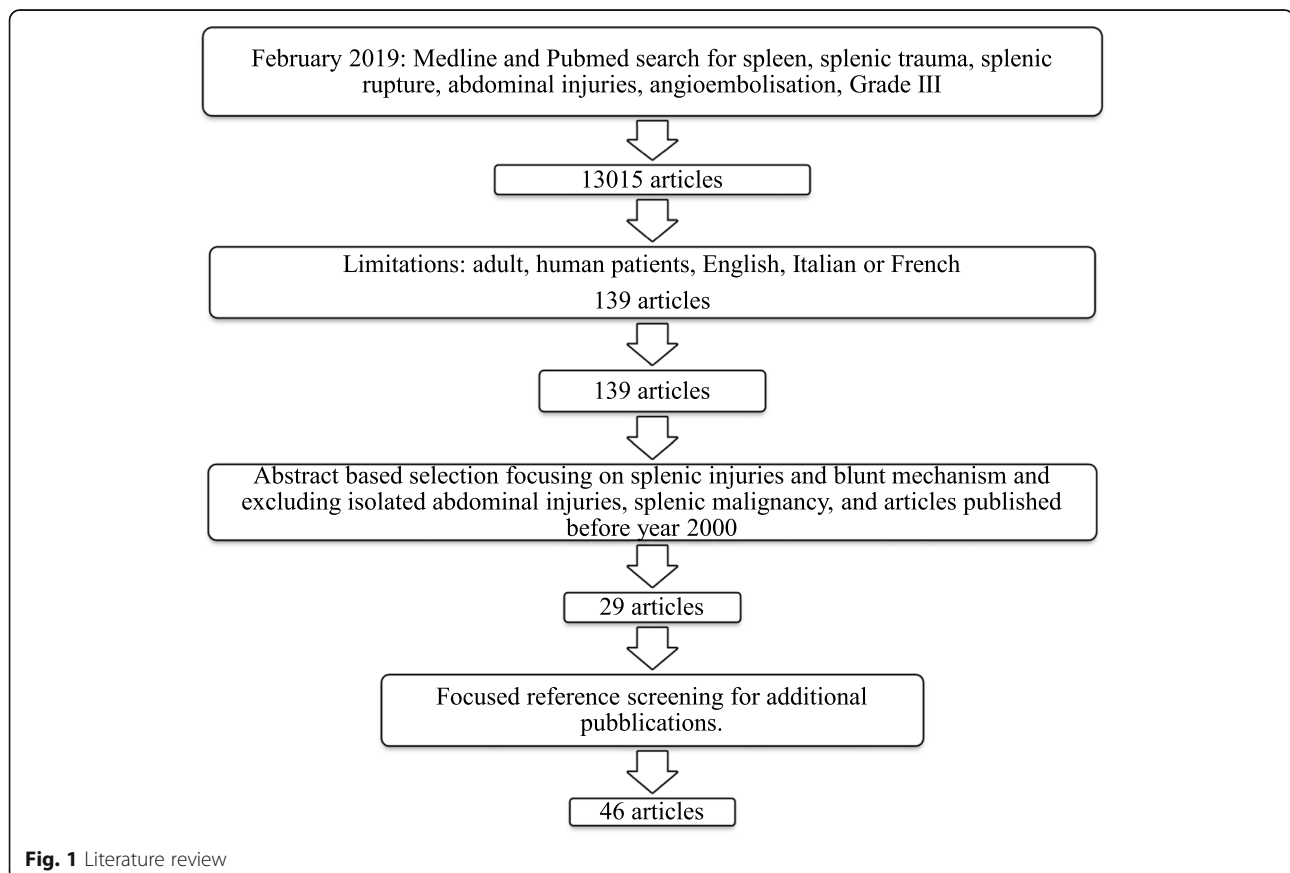
shorter hospital stays and decreased burden of post-splenectomy complications.

High level evidence for management of splenic injury is limited [5], and guidelines necessarily rely on studies with less than optimal design [6]. The American Association for the Surgery of Trauma (AAST) grading (herein referred upon as grade) and the presence of contrast extravasation on computed tomography (CT) (henceforth referred upon as blush) play an important role in planning the management of splenic injuries. While the management of splenic injury with blush [7] and/or grade IV-V splenic injuries [8] is supported by studies on large databases, the management of grade III injury without blush is not supported by large cohort studies. As a result, previous attempts to gain consensus on the management of this specific injury pattern have consistently failed [9]. The World Society of Emergency Surgery (WSES) guidelines indicate such injury not warranting angiography/angioembolisation [6]. Nevertheless, a high rate of practice variation hinders management of grade III splenic lesions [10]. This can be also confounded by factors like patient age, associated injury, presence of haemoperitoneum, co-morbidities and overall injury severity [11].

We hypothesized that experienced clinicians would meet consensus on areas of clinical variation regarding the management of grade III blunt splenic injuries without CT blush when presented with a clinically relevant hypothetical scenario. A modified Delphi questionnaire was utilised in the form of a phone application, with the aim to obtain expert opinion and enhance effective decision-making in the management of grade III blunt splenic injury without blush.

## Methods

Factors influencing the management of grade III splenic injuries without blush were identified in order to incorporate debatable key topics in this work. For this purpose, in February 2019, we performed a PubMed and Medline database literature search for articles published since 2000 in English, Italian and French. The terms “spleen”, “splenic trauma”, “splenic rupture”, “abdominal injuries”, “angioembolisation” and “grade III” were searched. One hundred and thirty-nine articles were found. Following subsequent abstract-based paper selection and focused reference screening for additional relevant publications, 46 articles were identified to assist in the creation of the questionnaire (Fig. 1) (Appendix).



“What would be your management plan from the emergency department for an adult patient admitted primarily to your hospital 1 hour after a car crash with the following clinical picture: blood pressure 120/80 mmHg, heart rate 90 beats per minute, saturation of Oxygen 100% with oxygen being given at a rate of 15 L/minute through a non-rebreather mask, respiratory rate of 19 breaths per minute. A venous blood gas analysis upon admission shows lactate < 2.0 mmol/L, base excess -1.5 mmol/L, pH 7.34. Arterial and portal vein phase CT on admission identifies an AAST grade III splenic injury without blush.”

mmHg: millimetre of mercury, L/minute: litres per minute, mmol/L: millimole per litre, CT: computerised tomography, AAST: The American Association for the Surgery of Trauma.

**Fig. 2** Clinical scenario. “What would be your management plan from the emergency department for an adult patient admitted primarily to your hospital 1 hour after a car crash with the following clinical picture: blood pressure 120/80 mmHg, heart rate 90 beats per minute, saturation of Oxygen 100% with oxygen being given at a rate of 15 L/minute through a non-rebreather mask, respiratory rate of 19 breaths per minute. A venous blood gas analysis upon admission shows lactate <2.0 mmol/L, base excess -1.5 mmol/L, pH 7.34. Arterial and portal vein phase CT on admission identifies an AAST grade III splenic injury without blush”. mmHg, millimetre of mercury; L/min, litres per min; mmol/L, millimole per litre; CT, computerised tomography; AAST, The American Association for the Surgery of Trauma

A clinically relevant hypothetical patient scenario was crafted for clinicians to formulate optimal management plans. Blood pressure, heart rate, oxygen saturation, supplemental oxygenation, venous lactate, base excess, pH and haemoglobin were provided (Fig. 2). Questions were endorsed by the WSES and designed to reflect real world practice. Clinicians were required to select their preferred course of action.

Each component of the questionnaire targeted an area of potential practice variation around eleven key patient and injury-related factors. Seven questions were related to injury variables and four to patient variables (Table 1). Experts were asked if each variable independently influenced their management. The option was given to answer “no”—with the patient receiving standard non-operative management or “yes”—with the option to favour angiography/angioembolisation or operative management.

The questionnaire was completed by trauma and acute care surgery experts who convened to the 6th WSES congress in Nijmegen, The Netherlands, in June 2019. Participants were invited to respond live utilising a mobile phone application to facilitate response. The method solicited the opinions of experts, which were anonymously collated for analysis. Answers were examined for areas of discrepancy. Consensus was defined as an agreement of 80% amongst respondents (total of same answers divided by the number of respondents) [12].

## Results

There were fifty-three respondents. There were three questions that demonstrated a significant discrepancy: the presence of several other injuries, the presence of

associated intra-abdominal injury and the presence of a non-reversible bleeding diathesis. Experts did not agree and did not reach the stipulated consensus level of 80% when asked if any of these three variables influenced their management plan. Consensus agreement was instead obtained for the other variables, with respondents

**Table 1** Questions on areas of practice variation

### Injury-related factors

- 1 Does the presence of a peri-splenic haemoperitoneum alone influence your management plan?
- 2 Does the presence of a head injury alone influence your management plan?
- 3 Does your perception of a worsening overall injury severity alone influence your management plan?
- 4 Does the presence of associated intra-abdominal injury alone influence your management plan?
- 5 Does the presence of associated extra-abdominal injury alone influence your management plan?
- 6 Does the initial need for administration of intravenous fluid replacement to achieve normal haemodynamic status alone influence your management plan?
- 7 Does an increasing time from injury alone influence your management plan?

### Patients related factors

- 8 Does an increasing age alone influence your management plan?
- 9 Does a history of previous left upper quadrant abdominal surgery alone influence your management plan?
- 10 Does the presence of a worsening comorbidity status alone influence your management plan?
- 11 Does the presence of a congenital or acquired non-reversible bleeding diathesis alone influence your management plan?

indicating non-operative management as the preferred management option (Table 2).

## Discussion

We observed broad agreement amongst WSES members. Experts confirmed their preference for a non-operative approach in response to most presented clinical variables, in keeping with previously published WSES guidelines [6]. Deviation from optimal care is a concern especially for grade III injury without blush, and an improvement in the management of this injury can result in higher splenic salvage rates and lower health care costs.

The following areas of agreement were identified amongst patient-related variables: older age, comorbidity status and previous surgery within the left upper quadrant of the abdomen. The audience agreed that non-operative management was indicated in the presence of these variables. Notwithstanding, the correlation between failure of non-operative management and age is noted within existing literature [11]. With regards to injury-related variables, non-operative management was the respondents' preferred choice for patients with head injury, extra-abdominal injury, increased time of assessment from initial injury, presence of blood within the peri-splenic space or along the left paracolic gutter in proximity of the spleen and requirement of intravenous therapy to normalise haemodynamic status. The audience's position on the latter of these aspects is supported in the literature [6]. Haemodynamic instability normally corresponds to intravenous fluid requirement and has in fact proved non-significant as predictor of non-operative management failure in a recent publication by Smith et al. [13].

The three areas of disagreement represent an interesting result of this work. Although some authors report a direct correlation between the overall injury severity and non-operative management failure, other groups showed different findings [11, 13]. This ambiguity is reflected in the answers we collected, with no agreement reached on the role of multiple injuries. It is noteworthy that there may be a potential source of bias from respondents driven by the difference between the perceived injury severity in the emergency department and a final calculated Injury Severity Score. This may relate to delays between time of finalising clinical assessment in the emergency department and time of imaging, or relate to the loss in discrimination power of ISS scores greater than 15 [14]. The question on the presence of a congenital or acquired non-reversible bleeding diathesis was another area which failed to reach consensus. This finding could be attributed to ill-defined factors linked to that question, for example, aetiology of the bleeding diathesis. A potential concern related to patient comorbidities is also possible. While multiple therapeutic options exist, coagulopathy is known to negatively impact the outcomes of patients with splenic injury [15] and is therefore worthwhile investigating in future research. The third area of disagreement is related to the presence of associated intra-abdominal injury. On this regard, the presence of concurrent solid organ injury has been found to have a significant correlation with prolonged admission and intensive care length of stay [16]. In review, this question may have been better phrased using the expression "solid organs" to allow for enhanced understanding amongst respondents avoiding potential confusion with intra-abdominal hollow viscus injury.

Targeted medical audiences have been surveyed for years with paper-based telephone and mail administered

**Table 2** Collated answers

Questions	n (%)			
		No-NOM	Yes-AG/AE	Yes-OM
1	Peri-splenic haemoperitoneum	45 (90)	4 (8)	1 (2)
2	Head injury	43 (88)	3 (6)	3 (6)
3	Multiple injuries	17 (32)	21 (40)	15 (28)
4	Associated intra-abdominal injury	30 (62)	5 (10)	14 (28)
5	Associated extra-abdominal injury	42 (87)	2 (5)	4 (8)
6	Intravenous fluid replacement	41 (82)	4 (8)	5 (10)
7	Increasing time from injury	45 (95)	0	2 (5)
8	Age	41 (85)	1 (3)	6 (12)
9	Previous left upper quadrant surgery	46 (95)	1 (2)	1 (2)
10	Multiple comorbidities	42 (88)	5 (10)	1 (2)
11	Bleeding diathesis	22 (46)	17 (35)	9 (18)

NOM non-operative management, AG/AE angiography/angioembolisation, OM operative management

questionnaires [17]. A more modern internet and application-based approach has streamlined participants' interrogation, but high response rates remain a problem. A reward-based approach in online surveys could help overcome that challenge. However, interference from the stakeholders could limit the results. A Cochrane review of fourteen studies regarding the use of applications in public health and clinical research has determined that their use may be equivalent to other delivery modes such as paper or email. Indeed, it found that responses were generally achieved faster, and data was more complete with a perhaps greater level of adherence to sampling than comparative paper models [18]. In the present study, experts from around the world gathered in one location; therefore, the response was immediate. Bringing the respondent to the survey instead of delivering the questionnaire to the recipient's inbox might represent a better approach to this study methodology. Mobile phone-based questionnaires delivered to the audience of professional society meetings might provide an opportunity to maximise response rate, with minimal logistical effort and immediate turnaround time.

Blinded respondents and anonymous analysis are also strengths of the proposed approach. Also, this approach allows to comment on some specific aspects that might benefit from clarification in real time (i.e., role of subcapsular haematoma). One limitation of this study is the performance of this questionnaire as a single round study, with answers not adjusted by respondents' geographical origin or level of expertise. Answers were also burdened by a discrepant number of respondents, potentially due to presentation format and the time restraints. Additionally, the presentation and questionnaire were undertaken in English. Given the international setting, this may have posed a barrier for some non-English speaking respondents. Furthermore, potential bias from cumulative effect is a limitation to this approach that still provides low quality evidence, and phrasing is a well understood obstacle in any questionnaire-based research

## Conclusions

The present study indicated some discrepancy in the management of grade III blunt splenic injury without contrast extravasation among expert physicians, namely, splenic injury in the context of polytrauma with high extra-abdominal injury severity, congenital or acquired bleeding diathesis and associated intra-abdominal injury. These findings were obtained through real-time assessment tool of clinical practice of experts in a scientific meeting. This study could help guide future research pertaining to splenic injury.

## Appendix

### Appendix. Articles selected to focus the questionnaire on areas of practice variation

- 1 Alabbasi T, Nathens A, Tien H. Blunt splenic injury and severe brain injury: a decision analysis and implications for care. *Canadian Journal of Surgery*. 2015;58(3):S108-S117.
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### Appendix. Articles selected to focus the questionnaire on areas of practice variation (Continued)

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#### Abbreviations

WSES: World Society of Emergency Surgery; AAST: The American Association for the Surgery of Trauma; CT: Computerised tomography

**Acknowledgements**

The authors would like to acknowledge the administrative staff at Radboud university medical centre for their valuable contribution to this work.

**Authors' contributions**

All authors made substantial contribution to the conception and design of the work, contributed to analysis and interpretation of the data and to the final version of the manuscript. The authors read and approved the final manuscript.

**Funding**

None

**Availability of data and materials**

Available upon request to the corresponding author.

**Ethics approval and consent to participate**

Not applicable.

**Consent for publication**

Not applicable

**Competing interests**

All authors declare to have no competing interests.

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Received: 4 May 2020 Accepted: 7 June 2020

Published online: 03 August 2020

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