The World Society of Emergency Surgery (WSES) spleen trauma classification: a useful tool in the management of splenic trauma

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Abstract

Background: The World Society of Emergency Surgery (WSES) spleen trauma classification meets the need of an evolution of the current anatomical spleen injury scale considering both the anatomical lesions and their physiologic effect. The aim of the present study is to evaluate the efficacy and trustfulness of the WSES classification as a tool in the decision-making process during spleen trauma management.

Methods: Multicenter prospective observational study on adult patients with blunt splenic trauma managed between 2014 and 2016 in two Italian trauma centers (ASST Papa Giovanni XXIII in Bergamo and Sant’Anna University Hospital in Ferrara). Risk factors for operative management at the arrival of the patient and as a definitive treatment were analyzed. Moreover, the association between the different WSES grades of injury and the definitive management was analyzed.

Results: One hundred twenty-four patients were included. At multivariate analysis, a WSES splenic injury grade IV is a risk factor for the operative management both at the arrival of the patients and as a definitive treatment. WSES splenic injury grade III is a risk factor for angioembolization.

Conclusions: The WSES classification is a good and reliable tool in the decision-making process in splenic trauma management.

Keywords: Spleen trauma, Classification, Validation, Practice, Surgery, Outcome, Non-operative management, Quality

Introduction

The most commonly used classification of splenic trauma is the American Association for the Surgery of Trauma (AAST)-Organ Injury Severity Score (OIS). It was initially ideated to allow the comparison between different series of patients; then, it has been used as a classification system to drive treatment strategies. It is based on spleen lesion anatomy [1]. This scale was validated by several studies with large sample sizes [2–4] showing as both the management at the patient arrival (operative management (OM) vs non-operative management (NOM)), and the NOM failure rate was associated with the ASST lesion grade in patients with blunt splenic trauma. In fact, the anatomy of the lesions plays a fundamental role in determining the conditions of the patients. In some situations, however, patient conditions lead to an emergent transfer to the operating room (OR) without the opportunity to define the grade of splenic lesions before the surgical exploration. In these cases,
the physiopathologic status of the patients leads the therapeutic decision, more than the anatomy of the splenic lesions. Moreover, there are patients with high-grade splenic lesions without hemodynamic repercussions that can be managed with NOM thanks to the modern tools in bleeding management. As a counterpart, there exists a cohort of patients with hemodynamic instability requiring urgent surgical intervention due to low-grade splenic injuries. In May 2017, during the World Society of Emergency Surgery (WSES) World Congress in Campinas, Brazil, the final version of the WSES guidelines on spleen trauma was approved (Fig. 1) [5]. The WSES grading system takes into account both the patient’s condition and the anatomy of lesions.

The aim of the present study is to evaluate the efficacy and trustfulness of the WSES classification as a tool in decision-making process during spleen trauma management.

Methods
This is an analysis of two prospectively enrolled adult patient cohorts with blunt splenic trauma managed between 2014 and 2016 in two Italian trauma centers (TC) (ASST Papa Giovanni XXIII in Bergamo and Sant’Anna University Hospital in Ferrara) stratified according to the WSES classification. Ethical committee and patients’ consent to participate were waived because no personal or sensible data were recorded and no specific intervention was adopted other than the usual clinical practice. Patients’ characteristics were collected (age, sex, comorbidity, ASA (American Society of Anesthesiologists) score, antiplatelet or anticoagulant therapy). Trauma mechanism of injury, patient conditions at the arrival in the emergency department (ED) (systolic blood pressure (SBP), heart rate (HR), shock index (SI), need of red blood cell (RBC) transfusion), blood gas test (pH, base excess (BE), lactates (Lac)), blood exams (CBC, platelet count, INR, fibrinogen), and eco-fast results were reported. We defined a patient “hemodynamically unstable” if, after resuscitation in the ED and without vasoactive drugs, he/she had a SBP lower than 90 mmHg, a shock index higher than 1, or a BE lower than −5.

For patients who underwent CT at the arrival, the AAST classification for the splenic injury, the number of abdominal quadrants with hemoperitoneum, and the presence of vascular lesions (contrast blush (CB), pseudoaneurysm (PSA), arterovenous fistula (AVF)) were reported. For patients who underwent urgent surgical intervention, intraoperative (for splenectomized patients) or postoperative CT findings were registered. The Injury Severity Score (ISS) and the presence of associated abdominal, pelvic, or cerebral lesions were reported. Patients were classified according to the 2017 WSES classification. The management at the arrival (observation, distal angioembolization (AE), proximal AE, splenectomy, intraperitoneal packing, hemostasis of the splenic injury, surgical intervention for other organ lesions), the time between the arrival in the ED and the first urgent intervention, and the need of further intervention during hospital stay (AE or splenectomy) have been recorded.

It was defined OM if the patient underwent urgent surgical intervention at the arrival at the ED and if during the surgical procedure, a splenectomy or a hemostatic splenic technique (e.g., splenic packing or splenorrhaphy) was performed. The NOM could include AE or not. Failure of NOM (fNOM) was defined as the

### WSES Classification

| Splenic Injury Grade | WSES Class | AAST | Haemodynamic |
|----------------------|------------|------|--------------|
| MINOR                | WSES I     | I- II| Stable       |
| MODERATE             | WSES II    | III  | Stable       |
|                      | WSES III   | IV-V | Stable       |
| SEVERE               | WSES IV    | I-V  | Unstable     |
need of performing a splenectomy after starting NOM.

To validate the 2017 WSES classification, the risk factors for OM at the arrival of the patient and for OM as a definitive treatment (including both patients treated with OM at the arrival and patients operated for fNOM) have been analyzed. It was verified if the WSES grade was a risk factor for OM at the arrival and as a definitive treatment for adult patients with blunt splenic trauma.

**Table 1 Patient characteristics**

| Characteristics                        | N = 124 Mean ± SD | Median (range) |
|----------------------------------------|-------------------|----------------|
| Age (years)                            | 50.23 ± 18.36     | (17.00–91.00)  |
| M/F                                    | 91/33             | (73.4%/26.6%)  |
| Trauma mechanism of injury             |                   |                |
| - Invested pedestrian                  | 11 (8.9%)         |                |
| - Car                                  | 38 (30.6%)        |                |
| - Motorbike                            | 39 (31.5%)        |                |
| - Bike                                 | 5 (4.0%)          |                |
| - Precipitation                        | 17 (13.7%)        |                |
| - Others                               | 14 (11.3%)        |                |
| ISS                                    | 27.93 ± 13.02     | (5.00–75.00)   |
| HR at arrival in ED (bpm)              | 90.27 ± 20.27     | (48.00–145.00) |
| SBP at arrival in ED (mmHg)            | 113.91 ± 25.00    | (53.00–170.00) |
| pH                                     | 7.31 ± 0.12       | (6.80–7.47)    |
| BE (mmol/L)                            | – 3.23 ± 3.43     | – 28           |
| Hb (g/dL)                              | 12.63 ± 2.53      |                |
| INR (s)                                | 1.37 ± 0.72       | (0.80–5.93)    |
| Fibrinogen (mg/dL)                     | 231.66 ± 122.74   | (26.00–1120.00) |
| Platelets (x 10^3/mL)                  | 218.92 ± 72.27    | (55.00–460.00) |
| Number of RBC units transfused in ED   | 0.48 ± 0.96       |                |

**Table 1 Patient characteristics (Continued)**

| Characteristics                        | N = 124 Mean ± SD | Median (range) |
|----------------------------------------|-------------------|----------------|
| Positive eco-fast                       | 62 (50.0%)        |                |
| Negative eco-fast negativa              | 44 (35.5%)        |                |
| N.A.                                   | 18 (14.2%)        |                |
| AAST 1                                 | 3 (2.3%)          |                |
| AAST 2                                 | 48 (38.7%)        |                |
| AAST 3                                 | 34 (27.4%)        |                |
| AAST 4                                 | 30 (24.2%)        |                |
| AAST 5                                 | 5 (4.0%)          |                |
| AAST > 3                               | 35 (28.2%)        |                |
| AAST ≤ 3                               | 87 (70.2%)        |                |
| WSES I                                 | 44 (35.5%)        |                |
| WSES II                                | 27 (21.8%)        |                |
| WSES III                               | 18 (14.5%)        |                |
| WSES IV                                | 30 (24.2%)        |                |
| Presence of CB                         | 33 (26.6%)        |                |
| Absence of CB                          | 74 (59.7%)        |                |
| Presence of PSA/FAV                    | 4 (3.2%)          |                |
| Absence of PSA/FAV                     | 101 (81.5%)       |                |
| Number of quadrants with hemoperitoneum| 1.59 ± 1.45       |                |
| Associated abdominal and pelvic lesions| 58 (46.8%)        |                |
| No associated abdominal and pelvic lesions| 66 (53.2%)    |                |
| Associated brain injuries              | 24 (19.4%)        |                |
| No associated brain injuries           | 100 (80.6%)       |                |

M/F male/female, ISS Injury Severity Score, HR heart rate, N.A. not available, SBP systolic blood pressure, ED emergency department, BE base excess, Lac lactates, Hb hemoglobin, RBC red blood cell, AAST American Association for the Surgery of Trauma, WSES World Society of Emergency Surgery, CB contrast blush, INR International Normalized Ratio
Continuous variables were expressed as mean and standard deviation; categorical data were expressed as proportions and percentages. The Student’s t test was used for continuous variables with normal distribution and the Mann-Whitney test for non-normal distribution variables. Parametric variables were compared with chi-square test. Multivariate models were calculated with the linear logistic regression method including all the variables resulted significantly associated (p < 0.05) with the selected outcome at univariate analysis. All the statistical analysis was performed with IBM SPSS 20 (IBM Corp. released 2011; IBM SPSS Statistics for Windows, Version 20.0; Armonk, NY: IBM Corp.).

### Results

The study includes 124 patients older than 17 years with blunt splenic lesion, of whom 66 managed in ASST Papa Giovanni in Bergamo and 58 in Sant’Anna University Hospital in Ferrara. The two groups of patients were similar in terms of epidemiological features, trauma mechanism of injury, ISS, and splenic injury grade. Patient characteristics are reported in Table 1.

NOM rate was 53.2% (66 patients) and OM rate 46.0% (58 patients). Among OM patients, we had 84.5% (49 patients) of patients treated with splenectomy and 15.5% (9 patients) with hepatic and splenic packing (in patients with hepatic lesion associated) and/or splenic hemostasis (Table 2). Among NOM patients, 22 underwent AE (17.8% of total patients and 33.3% of NOM patients) at the arrival or during the hospital stay (Table 2).

### Discussion

After the introduction of AE and the modern tools in bleeding management, the NOM failure rate decreased from 23–67% to 4–42% [6–10] and it was no longer associated with the AAST injury grade (i.e., anatomical degree of lesion) [11]. So it has been accepted that the physiopathologic status of the patients, more than the anatomy of the splenic lesions, should lead the therapeutic decision in splenic...
Furthermore, many studies [8, 12–16] showed that the vascular lesions (CB, PSA, AVF), which have significant incidence also in low-grade injuries [12, 16], were predictive factors for NOM failure and that they should be considered indications to

Table 3 Univariate analysis of risk factors for OM at the arrival of patient at the ED

| Variable | NOM Mean ± SD Median (range) | p value | OM Mean ± SD Median (range) | p value |
|----------|------------------------------|---------|------------------------------|---------|
| Age < 55 years | 42.3% | 57.7% | n.s. |
| Age > 55 years | 50.0% | 50.0% | |
| Age (years) | 50.54 ± 18.17 | 49.87 ± 18.73 | n.s. |
| No anticoagulant/antiplatelet drugs | 48.8% | 51.2% | n.s. |
| Anticoagulant/antiplatelet drugs | 40.0% | 60.0% | |
| HR (mean ± SD) | 85.95 ± 18.66 | 95.24 ± 21.07 | 0.009 |
| Median (range) (bpm) | 80.00 (48.00–133.00) | 95.00 (55.00–145.00) | |
| HR > 120 bpm | 46.8% | 53.2% | |
| SBP(mmHg) | 120.40 ± 21.35 | 105.00 ± 26.92 | 0.002 |
| SBP > 90 mmHg | 60.4% | 51.2% | 0.001 |
| SBP < 90 mmHg | 21.7% | 78.3% | |
| Shock index < 1 | 60.2% | 39.8% | 0.002 |
| Shock index > 1 | 26.9% | 73.1% | |
| AAST 1 | 100.0% | 0.0% | < 0.001 |
| AAST 2 | 81.3% | 18.7% | |
| AAST 3 | 44.1% | 55.9% | |
| AAST 4 | 26.7% | 73.3% | |
| AAST 5 | 0.0% | 100.0% | |
| AAST ≤ 3 | 66.7% | 33.3% | < 0.001 |
| AAST > 3 | 22.9% | 77.1% | |
| WSES I | 86.4% | 13.6% | < 0.001 |
| WSES II | 44.4% | 55.6% | |
| WSES III | 44.4% | 55.6% | |
| WSES IV | 20.0% | 80.0% | |
| WSES I–III | 63.8% | 36.2% | < 0.001 |
| WSES IV | 20.0% | 80.0% | |
| ISS | 24.38 ± 12.68 | 32.05 ± 12.27 | < 0.001 |
| ISS < 25 | 72.0% | 28.0% | 0.001 |
| ISS > 25 | 40.9% | 59.1% | |
| Lac | 3.01 ± 1.90 | 3.51 ± 1.85 | n.s. |
| BE (mmol/L) | 2.66 (0.80–9.24) | 3.08 (1.30–8.00) | n.s. |
| pH | 7.32 ± 0.07 | 7.28 ± 0.16 | n.s. |
| Hb (g/dL) | 13.31 ± 2.33 | 11.70 ± 2.63 | < 0.001 |
| Hb > 12 g/dL | 13.60 (5.60–16.80) | 11.70 (3.30–16.40) | |
| Hb ≤ 12 g/dL | 46.7% | 33.3% | 0.001 |

Table 3 Univariate analysis of risk factors for OM at the arrival of patient at the ED (Continued)

| Variable | NOM Mean ± SD Median (range) | p value | OM Mean ± SD Median (range) | p value |
|----------|------------------------------|---------|------------------------------|---------|
| BE ≥ − 5 mmol/L | 57.7% | 42.3% | n.s. |
| BE < − 5 mmol/L | 66.7% | 33.3% | n.s. |
| Brain injuries | 41.7% | 58.3% | |
| No brain injuries | 56.0% | 44.0% | |
| Associated abdominal lesions | 34.8% | 55.2% | n.s. |
| No associated abdominal lesions | 60.6% | 39.4% | |
| Trauma mechanism of injury | |
| - Invested pedestrian | 72.7% | 27.3% | |
| - Car | 44.7% | 55.3% | |
| - Motorbike | 56.4% | 43.6% | |
| - Bike | 60.0% | 40.0% | |
| - Precipitation | 52.9% | 47.1% | |
| - Others | 50.0% | 50.0% | |
| Contrast blush | 42.4% | 57.6% | 0.010 |
| No contrast blush | 68.9% | 31.1% | |
| Pseudoaneurysm | 50.0% | 50.0% | n.s. |
| No pseudoaneurysm | 61.4% | 38.6% | |
| Hemoperitoneum at TC | 54.4% | 45.6% | n.s. |
| Number of quadrants with hemoperitoneum | |
| - ≤ 1 | 42.0% | 58.0% | < 0.001 |
| - > 1 | 69.4% | 30.6% | |
| INR (s) | 1.12 ± 0.15 | 1.69 ± 1.11 | 0.001 |
| INR > 1.5 s | 23.5% | 76.5% | 0.014 |
| INR < 1.5 s | 55.7% | 44.3% | |
| Fibrinogen (mg/dL) | 215.52 ± 53.98 | 205.00 (156.0–491.00) | 0.020 |
| Fibrinogen < 200 mg/dL | 38.1% | 61.9% | 0.031 |
| Fibrinogen > 200 mg/dL | 60.4% | 39.6% | |
| PLT/mm³ | 217.38 ± 49.76 | 198.29 ± 83.93 | n.s. |
| Positive eco-fast | 33.9% | 66.1% | < 0.001 |
| Negative eco-fast | 72.7% | 27.3% | |
| RBC transfusion at the ED | 34.6% | 65.4% | 0.032 |
| No RBC transfusion at the ED | 58.2% | 41.8% | |

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ISS Injury Severity Score, HR heart rate, SBP systolic blood pressure, ED emergency department, BE base excess, Lac lactates, Hb hemoglobin, RBC red blood cell, AAST American Association for the Surgery of Trauma, WSES World Society of Emergency Surgery, PLT platelet, INR International Normalized Ratio trauma. Furthermore, many studies [8, 12–16] showed that the vascular lesions (CB, PSA, AVF), which have significant incidence also in low-grade injuries [12, 16], were predictive factors for NOM failure and that they should be considered indications to
AE. Vascular lesions are not considered in the AAST classification. The WSES spleen trauma classification considers both the anatomical injury grade and the clinical conditions of the patients, so it can be considered as a complete tool to lead splenic trauma management, especially if associated to dedicated guidelines. From the analysis emerged, all the factors related to OM and noM are those linked to the physiology of the patients and more than the anatomy. AAST classes related to the OM + fNOM mainly for the anatomical basis that represents a proxy of the preparedness of the system to manage them with NOM is not high rate. In fact, even patients with low injury grade were splenectomized. Present data showed, even in this context, as the WSES spleen injury grade IV is a significant risk factor for OM, both at the arrival of the patients and as a definitive treatment. Furthermore, a WSES spleen injury grade III is a risk factor for AE (WSES 3 (38.9%) vs WSES 1-2-4 (13.9%), \( p = 0.010 \)). WSES grade IV represents the only factor related to the OM as management at the patient admission. In fact, the hemodynamic status is the only determinant of the necessity to proceed to operating room. The anatomical grade of damage is not influent on the emergency management in presence of hemodynamic instability at admission. However, the relative high OM rate, also in lower injury grade (OM rate is 36.2% in WSES I, I, and III injury grade), reflects the need for standardized and widely shared guideline in order to increase conservative management. Even if in presence of such a big variability in patient management, the WSES classification showed to be effective in driving the management. Therefore, the benefits deriving from the use the WSES trauma spleen classification could have their greatest expression if associated with the application of the widely approved WSES spleen trauma guidelines. Their combined large-scale application could realistically increase successful NOM rate and improve the spleen trauma management.

The limitations of this study are that this is an observational study, even if prospective, and that patients did not have isolated spleen injury and so the associated lesions could have partially influenced results; however, as said, it reports the reality in the trauma centers’ daily practice. As a counterpart, however, this study stresses the necessity to diffuse and apply a common way to proceed. This will allow to reduce the number of operated patients and to improve the management quality by reducing even the short- and long-term morbidity and mortality of unnecessary laparotomies and splenectomies.

**Table 4** Multivariate analysis of risk factors for OM at the arrival of patient at the ED

| Variables                                      | \( p \text{ value} \) | OR    |
|------------------------------------------------|------------------------|-------|
| ISS > 25                                       | n.s.                   | /     |
| Contrast blush                                 | n.s.                   | /     |
| Positive e-fast                                | n.s.                   | /     |
| RBC transfusion in ED                          | n.s.                   | /     |
| Fibrinogen \( \leq 200 \text{ mg/dL} \)        | n.s.                   | /     |
| INR > 1.5 s                                    | n.s.                   | /     |
| Quadrants with hemoperitoneum > 1              | n.s.                   | /     |
| Hb \( \leq 12 \text{ g/dL} \)                  | n.s.                   | /     |
| WSES IV                                        | 0.049                  | 5.64  |

**Notes:** ISS Injury Severity Score, CB contrast blush, ED emergency department, RBC red blood cell, SI shock index, AAST American Association for the Surgery of Trauma, Hb hemoglobin, WSES World Society of Emergency Surgery, INR International Normalized Ratio
Table 5 Univariate analysis for OM as a definitive treatment

| Characteristics                  | Mean ± SD | Median (range) | p value |
|----------------------------------|-----------|----------------|---------|
| Successful NOM/OM + fNOM         |           |                |         |
| WSES I                           | 79.5%     | 20.5%          | < 0.001 |
| WSES II                          | 33.3%     | 66.7%          |         |
| WSES III                         | 27.8%     | 72.2%          |         |
| WSES IV                          | 13.3%     | 86.7%          |         |
| ASST 1                           | 100.0%    | 0.0%           | < 0.001 |
| ASST 2                           | 68.8%     | 31.2%          |         |
| ASST 3                           | 35.3%     | 64.7%          |         |
| ASST 4                           | 16.7%     | 83.3%          |         |
| ASST 5                           | 0.0%      | 100.0%         |         |
| WSES I-II-III                    | 53.2%     | 46.8%          | < 0.001 |
| WSES IV                          | 13.3%     | 86.7%          |         |
| ASST ≤ 3                         | 56.3%     | 43.7%          | < 0.001 |
| ASST > 3                         | 43.7%     | 56.3%          |         |
| Age (years)                      | 48.79 ± 17.94 | 51.36 ± 18.74 | n.s.   |
| No anticoagulant/antiplatelet drugs | 39.29% | 60.71%          | n.s.   |
| Anticoagulant/antiplatelet drugs | 40.00%    | 60.00%         |         |
| HR (bpm)                         | 85.57 ± 17.94 | 93.87 ± 21.32 | 0.039  |
| HR > 120 bpm                     | 50.00%    | 50.00%         |         |
| SBP (mmHg)                       | 122.21 ± 20.18 | 107.54 ± 26.57 | 0.001  |
| SBP > 90 mmHg                    | 50.5%     | 49.5%          | < 0.001 |
| Shock index < 1                  | 51.0%     | 49.0%          | 0.021   |
| Shock index > 1                  | 15.4%     | 84.6%          |         |
| ISS                              | 21.89 ± 10.25 | 32.81 ± 13.02 | < 0.001 |
| ISS < 25                         | 70.0%     | 30.0%          | < 0.001 |
| ISS > 25                         | 26.8%     | 73.2%          |         |
| Lactate                          | 2.99 ± 1.96 | 3.45 ± 1.78  | n.s.   |
| BE (mmol/L)                      | 2.44 (0.80–9.24) | 3.08 (1.27–8.00) | n.s.   |
| pH                               | 7.32 ± 0.08 | 7.29 ± 0.15  | n.s.   |
| Hb (g/dL)                        | 13.78 ± 1.88 | 11.29 ± 2.66 | < 0.001 |
| Hb ≤ 12 g/dL                     | 24.1%     | 75.9%          | < 0.001 |

Table 5 Univariate analysis for OM as a definitive treatment (Continued)

| Characteristics                  | Mean ± SD | Median (range) | p value |
|----------------------------------|-----------|----------------|---------|
| Successful NOM/OM + fNOM         |           |                |         |
| Hb > 12 g/dL                     | 60.6%     | 39.4%          |         |
| BE > −5 mmol/L                   | 57.7%     | 42.3%          | n.s.   |
| BE < −5 mmol/L                   | 50.0%     | 50.0%          |         |
| Brain injuries                   | 29.2%     | 70.8%          | n.s.   |
| No brain injuries                | 47.0%     | 53.0%          |         |
| Associated abdominal lesions     | 36.2%     | 63.8%          |         |
| No associated abdominal lesions  | 50.0%     | 50.0%          |         |
| Trauma dynamic                   |           |                |         |
| -Invested pedestrian             | 45.5%     | 54.5%          |         |
| -Car                              | 26.3%     | 73.7%          |         |
| -Motorbike                        | 53.9%     | 46.1%          |         |
| -Bike                             | 60.0%     | 40.0%          |         |
| -Precipitation                    | 52.9%     | 47.1%          |         |
| -Others                           | 42.9%     | 57.1%          |         |
| Number of quadrants with hemoperitoneum at CT scan | 43.0% | 57.0%          | n.s.   |
| PLT/mm³                           | 218.82 ± 47.96 | 200.76 ± 79.31 | n.s.   |
| INR > 1.5 s                      | 11.8%     | 88.2%          | 0.002   |
| INR < 1.5 s                      | 48.5%     | 51.5%          |         |
| Positive eco-fast                 | 29.0%     | 71.0%          | 0.002   |
| Negative eco-fast                 | 59.1%     | 40.9%          |         |
| RBC transfusion at the ED        | 11.5%     | 88.5%          | < 0.001 |
| No RBC transfusion at the ED     | 53.0%     | 47.0%          |         |

ISS Injury Severity Score, HR heart rate, SBP systolic blood pressure, ED emergency department, BE base excess, Lac lactates, Hb hemoglobin, RBC red blood cells, AAST American Association for the Surgery of Trauma, WSES World Society of Emergency Surgery, PLT platelet, CB contrast blush, PSA pseudoaneurysms, INR International Normalized Ratio
Table 6 Multivariate analysis of risk factors for OM as a definitive treatment

| Variables                              | p value | OR  |
|----------------------------------------|---------|-----|
| INR > 1.5 s                            | n.s.    | /   |
| RBC transfusion in ED                  | n.s.    | /   |
| Hb ≤ 12 g/dL                           | n.s.    | /   |
| ISS > 25                               | 0.013   | 5.75|
| Contrast blush                         | n.s.    | /   |
| Positive e-fast                        | n.s.    | /   |
| Quadrants with hemoperitoneum > 1      | n.s.    | /   |
| WSES IV                                | 0.029   | 7.22|

ISS: Injury Severity Score; ED: emergency department; RBC: red blood cell; SI: shock index; AAST: American Association for the Surgery of Trauma; Hb: hemoglobin; WSES: World Society of Emergency Surgery; CB: contrast blush; INR: International Normalized Ratio

Fig. 2 OM and NOM rate at the arrival of patient according to WSES splenic injury grade (NOM, Non Operative Management; OM, Operative Management)

Fig. 3 OM and NOM rate as a definitive treatment according to the WSES splenic injury grade (SNOM, Successful Non Operative Management; OM, Operative Management; FNOM, Failure of Non Operative Management)

Conclusions
The WSES classification is a good and reliable tool in the decision-making process in splenic trauma management.

Abbreviations
AAST: American Association for the Surgery of Trauma; AE: Angioembolization; AG: Angiography; ASA: American Society of Anesthesiologists; AVF: Arterovenous fistula; BE: Base excess; CB: Contrast blush; ED: Emergency department; FNOM: Failure of non-operative management; HR: Heart rate; INR: International normalized ration; LAC: Lactates;

NOM: Non-operative management; OIS: Organ Injury Severity Score; OM: Operative management; OR: Odds ratio; PSA: Pseudoaneurysm; RBC: Red blood cell; RR: Risk ratio; SBP: Systolic blood pressure; SI: Shock index; SNOM: Successful non-operative management; TC: Trauma center; WSES: World Society of Emergency Surgery

Acknowledgements
Not applicable

Authors’ contributions
FeCo, PF, LM, and MC contributed to the manuscript conception, literature revision, and analysis. LA, FaCa, SM, YK, and GLB helped with the analysis.
FeCo and PF drafted the paper that was critically reviewed by MS, SO, MT, NA, and SM. All the authors read and approved the final version of the manuscript.

Funding
None

Availability of data and materials
Not applicable

Ethics approval and consent to participate
Not applicable

Consent for publication
Not applicable

Competing interests
The authors declare that they have no competing interests.

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Received: 30 January 2019 Accepted: 22 May 2019
Published online: 17 June 2019

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