INTRODUCTION
The spleen is the most easily injured organ in abdominal trauma. Isolated splenic injuries can be found in about one-third of blunt trauma and in 25-30% of patients who suffered a traffic accident. The history of the splenectomy can be traced back to Aristotle, who was the first person to consider the spleen to be a non-essential organ. The idea that a splenectomy is the only appropriate treatment for blunt splenic injuries (BSIs) was based on the concept that the spleen is a fragile, vascular structure unsuitable for suturing lacerations, that there is a risk of uncontrollable bleeding in the absence of surgical removal and the high mortality rate associated with nonoperative management (NOM) (90-100%).

The first change in the attitude towards OM occurred with the article by King and Schumacker in 1952, which was based on the concept that the spleen is a fragile, vascular structure unsuitable for suturing lacerations, that there is a risk of uncontrollable bleeding in the absence of surgical removal and the high mortality rate associated with nonoperative management (NOM) (90-100%).

The results of this study demonstrated that conservative treatment is efficacious in select patients.

When it comes to visceral injuries following abdominal trauma, there is nothing as radical as the nonoperative management (NOM) of hepatic and splenic injuries. The treatment for blunt abdominal trauma has significantly changed thanks to new diagnostic methods and the accurate assessment of organ damage.

In order for nonoperative management (NOM) of splenic injuries to be the standard goal of therapy in hemodynamically stable patients, it is necessary to have an accurate knowledge of patient selection criteria for nonoperative management, as well as a precise assessment of the factors precluding conservative therapy. In general, non operative management of splenic injuries has numerous potential benefits including fewer blood transfusions, shorter hospital...
stays, avoidance of long-term infectious complications and lower surgical costs.\[7,8\]

**AIMS AND OBJECTIVE**

The aim of the study is to determine the demographic profile, common clinical presentation and to study the safety and advantage of nonoperative management in splenic trauma patient

**MATERIALS AND METHODS**

A retrospective analysis of 39 patients of isolated splenic trauma who were admitted in LLRM Medical College Meerut, UP, INDIA (A level 2 trauma centre and teaching hospital) within a span of 24 months (from November 2013 to October 2015) was done.

All patients underwent an initial assessment upon arrival to the emergency room using the Advanced Life Trauma Support (ATLS) protocol that describes the absolute priorities using the acronym ABCDE: A (Airway), B (Breathing), C (Circulation), D (Disability) and E (Exposure).\[1\] Then, the patients underwent a FAST scan, which detects abdominal free fluid with a high degree of accuracy and has good sensitivity for liver and spleen injuries.\[9\]

Subsequent diagnostic procedures were utilized based on the hemodynamic stability of patients, evaluated according to the criteria established by ATLS, which recognizes three categories.

- **A** hemodynamically stable
- **B** hemodynamically stabilized
- **C** hemodynamically unstable.\[9\]

Patients from all age groups and both sexes were considered. Patient who were hemodynamically unstable at the time of admission and had grade 4 and 5 injuries on CECT Scan were excluded from study.

All patients who were alert and haemodynamically stable without or with minimal peritoneal irritation on abdominal examination, with AAST (American Association for the Surgery of Trauma) organ injury scale 1-3 on CT scan and absence of other clear indication for laparotomy were chosen for Non operative management.

A decision for laparotomy was taken when the patient deteriorated either clinically or haemodynamically. All NOM-group patients were admitted to the surgical intensive care unit and had regular physical examination, haematocrit check and imaging when in doubt.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury type</th>
<th>Description of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Subcapsular, nonexpanding, &lt;10% della surface area</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear, nonbleeding, &lt;1 cm parenchymal depth</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Subcapsular, nonexpanding, 10-50% surface area</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Intraparenchymal, &lt;2 cm in diameter, nonexpanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capsular tear, active bleeding, 1-3 cm parenchymal depth</td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>Subcapsular, &gt;50% surface area or expanding</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Ruptured subcapsular hematoma with active bleeding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intraparenchymal, &gt;2 cm in diameter, or expanding &gt;3 cm parenchymal depth</td>
</tr>
<tr>
<td>IV</td>
<td>Hematoma</td>
<td>Ruptured intraparenchymal hematoma with active bleeding</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Involvement of segmental or hilar vessels producing devascularization &gt;25%</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Shattered spleen</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Hilar vascular injury devascularizes spleen</td>
</tr>
</tbody>
</table>

GRADE III splenic injury managed operative approach (FAILED NOM)

**RESULTS**

**Demographic profile**

We included 39 blunt trauma patients; 33 (84%) were males and 6 (16%) females.

Most of patients were in age group 21yr to 40 yr.
Table 2 - Age wise distribution in years

<table>
<thead>
<tr>
<th>Age in years</th>
<th>&gt;20</th>
<th>21-40</th>
<th>41-60</th>
<th>&gt;60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>4 (10%)</td>
<td>24 (62%)</td>
<td>10 (22%)</td>
<td>1 (2%) **</td>
</tr>
</tbody>
</table>

Epidemiological factors
Road traffic accidents involving both pedestrians and vehicular accidents accounted for majority of injuries (85%).

Table 3: Mode of trauma.

<table>
<thead>
<tr>
<th>Mode of trauma</th>
<th>MVA</th>
<th>Physical assault</th>
<th>Bicycle injury</th>
<th>Fall from height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patient</td>
<td>33 (85%)</td>
<td>3 (8%)</td>
<td>2 (5%)</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>

Mode of presentation
Most of patients who was selected for NOM were in grade 1 and 2 shock. Patient in grade 3 shock also responded well to fluid management.

Table 4.

<table>
<thead>
<tr>
<th>Grade of shock</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patient</td>
<td>21 (54%)</td>
<td>14 (36%)</td>
<td>4 (10%)</td>
</tr>
</tbody>
</table>

CT Grading
In all patient of NOM CT Grading of injury was done after initial positive FAST. Patient with grade 4 and 5 injury were excluded from study

Table 5.

<table>
<thead>
<tr>
<th>CT Grading</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patient</td>
<td>16 (41%)</td>
<td>17 (43%)</td>
<td>6 (16%)</td>
</tr>
</tbody>
</table>

Failed NOM: Six patient with splenic injury who were initially considered for conservative management underwent splenectomy due to clinical deterioration. Most of who failed to NOM were operated with in 48 hr of admission.

Table 6

<table>
<thead>
<tr>
<th>Duration of failed NOM</th>
<th>&lt;48hr</th>
<th>48hr-72hr</th>
<th>3days – 5days</th>
<th>&gt;5 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patient</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1 *</td>
</tr>
</tbody>
</table>

*after discharge on 9th day possibly because of retrauma.
** only mortality (2%) was a male patient who was 70 year old and having grade 2 injury with multiple rib fracture. Patient expired on fourth day of NOM due to lung injuries and not because of splenic injury.

GRADE II and III splenic injury managed by non operative approach successfully
DISCUSSION
NOM (non operative management) of blunt abdominal injuries is well established and strategies based on haemodynamic stability and CT scan findings are now being widely used in the treatment of solid organ injuries including liver, spleen, kidneys, pancreas and pelvic injuries.[11] Non-therapeutic laparotomy (NTL) for trauma patients varies from 1.7% to 38% depending on the experience and practice patterns of the individual trauma centre.[12] In one prospective study of 938 laparotomies for abdominal injury, 27% were deemed unnecessary.[13] NTL is associated with significant morbidity and cost to the health system.

-Always keep the mechanism of injury in mind.
-The patient should be in alert, awake and responsive.
-The patient should be examined repeatedly.
-The patient should be haemodynamically stable and have no coagulation disorders.
-There should be no other clear indication for laparotomy.
-Maintain high index of clinical suspicion.
-Be very cautious in multiple injured patients.

-Higher level of care with round-the-clock availability of laboratory, radiology and operation theatre.
NOM to be abandoned (14) when there is a) Deterioration of vital signs.
b) Development of new peritoneal signs.
c) Continued need for blood transfusion.
d) Falling haemotocrit or progressing haematoma.

The risks[14] associated with NOM are.
-Missed injuries.
-Delayed diagnosis and treatment.
-Retained hematoma, sepsis and/or abscess.
-Bowel/biliary/pancreatic/urinary leaks.
-Pseudoaneurysm formation and delayed rupture.
-Delayed treatment of vascular injuries and their complications.
-Risks involved in blood transfusion.

Our NOM success rate was 84.6%, which is similar to the past literature, which quotes rates around 80%.[15]

In our analysis, the NOM failure rate was 15.4%, which is similar to the 17% failure rate reported in previous studies.[15]

No complications occurred in patients who underwent NOM. We must however emphasize patients who underwent NOM had less severe spleen injuries due to the exclusion criteria for NOM.
The study by Di Saverio and Moore\[16\] highlighted how patients with grade IV through V splenic injury were at increased risk for developing complications and had a higher NOM failure rate, even though NOM is being utilized increasingly more for high-grade lesions.

Similarly, the study by Peitzman and Richardson\[17\] showed that the NOM failure rate was proportional to the splenic injury grade: 5% in grade I, 10% in grade II, 20% in grade III, 33% in grade IV and 75% in grade V. Comparable failure rates were seen in the study conducted by Velmahos\[18\] in 14 trauma centers, in which the failure rate was 34.5% for patients with grade IV lesions and 60% for grade V lesions.

Mortality in the NOM group was 2.5% in our study, and similarly, the rate was 12.6% in the past literature (12.6%).\[17\] The patient who died in the NOM group was who was 70 year old and having grade 2 injury with multiple rib fracture. Patient expired on fourth day of NOM due to lung injuries and not because of splenic injury.

CONCLUSION
In our experience, NOM was the treatment of choice for multiple reasons in blunt splenic injuries grade I, II and III. Splenectomy was the chosen technique in patients with exclusion criteria for NOM, as well as in those with grade IV and V injury. In the literature, the use of NOM in patients with grade IV and V splenic injuries is still under debate, and no unanimous opinion has been reached to date.

Non-operative management in blunt abdominal trauma management is challenging owing to the diversity of presentation and wide range of visceral injuries. However, it is quite satisfying to manage them by conservative approach which is highly successful in selective cases. The advent of sophisticated imaging and the availability of interventional radiologists has somewhat lightened the trauma surgeons’ operative burden. However, even today, nothing surpasses the value of repeated clinical examination by an experienced surgeon in guiding the ultimate therapeutic decision.

“When in doubt it is better to open and see than to wait and watch” - Grey Turner.

REFERENCES