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Epidemiological Profile, Diagnostic and Therapeutic Management

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Abstract **Original Research Article**

Background: Hepatic trauma represents a major cause of morbidity and mortality in abdominal trauma. Its management has evolved significantly thanks to advances in imaging and non-operative treatment. ***Patients and Methods:*** A retrospective study of 35 cases of hepatic trauma managed in the Department of Visceral Surgery at Ibn Tofail Hospital, Mohammed VI University Hospital in Marrakech, between January 2021 and December 2022. ***Results:*** Male predominance (91%), mean age 30 years. Road traffic accidents were the main etiology (85%). Non-operative management was adopted in 91.4% of cases. Three patients required surgical management. No deaths were recorded. One complication (hepatic abscess) was observed. ***Conclusion:*** Non-operative management represents the cornerstone of hepatic trauma care in hemodynamically stable patients. Rigorous monitoring and adequate technical facilities are essential to its success.

Keywords: hepatic trauma · non-operative management · laparotomy · abdominal CT scan · surgical emergencies.

I. INTRODUCTION

The liver is the largest solid organ in the abdominal cavity and one of the most frequently injured organs during blunt abdominal trauma, accounting for 15 to 20% of all traumatic visceral injuries [1,2]. Its subcostal anatomical location and large volume make it a preferential target during direct impacts or sudden decelerations.

Due to its exceptional vascular richness — receiving approximately 25% of cardiac output — any hepatic injury can rapidly become life-threatening. Massive hemorrhage of hepatic origin remains one of the leading causes of preventable death following abdominal trauma [3,4].

The management of hepatic trauma has undergone a conceptual revolution over the past three decades. Systematic laparotomy, long considered the gold standard, has progressively given way to non-operative management (NOM), made possible by remarkable advances in computed tomography, resuscitation, and interventional radiology [5,6].

This evolution has been accompanied by the development of standardized hepatic injury classifications, notably the American Association for the Surgery of Trauma (AAST) classification, which now guides therapeutic decisions [7]. However, optimal management remains based on individualized assessment integrating hemodynamic status, injury grade, and available resources.

In this context, we report a retrospective series of 35 cases of hepatic trauma managed in the Department of Visceral Surgery at Ibn Tofail Hospital, Mohammed VI University Hospital in Marrakech, analyzing the epidemiological profile, diagnostic and therapeutic modalities, and comparing our results with international literature.

II. MATERIALS AND METHODS

1. Study Type and Setting

This is a retrospective, descriptive, and analytical study conducted within the Department of Visceral and Digestive Surgery at Ibn Tofail Hospital, Mohammed VI University Hospital of Marrakech. This hospital serves as the regional referral center for the management of abdominal surgical emergencies.

2. Study Population

All patients hospitalized for hepatic trauma, regardless of the mechanism of injury, between January 2021 and December 2022 were included. Exclusion criteria included incomplete medical records and patients transferred to other facilities before complete evaluation.

3. Data Collection

Data were collected from medical records, operative reports, and imaging reports. The variables studied included:

- Demographic data: age, sex
- Mechanism of injury: road traffic accident (RTA), assault, fall
- Type of trauma: blunt or penetrating
- Laboratory workup: complete blood count, liver function tests, lipase, renal function, blood type
- Imaging: abdominal ultrasound (FAST protocol), contrast-enhanced abdominopelvic CT scan
- Therapeutic strategy: non-operative or surgical management
- Outcomes: complications, length of hospital stay, mortality

4. Statistical Analysis

Quantitative data are expressed as means ± standard deviation, and qualitative data as frequencies and percentages. Descriptive statistical analysis was performed using Microsoft Excel 2019.

III. RESULTS

1. Epidemiological Data

During the study period (January 2021 – December 2022), 35 patients were managed for hepatic trauma in our department. The mean age was 30 years (range: 25–55 years), reflecting a preferential involvement of the young working-age population. A clear male predominance was noted with 32 men (91%) versus 3 women (9%), corresponding to a sex ratio of 10.7.

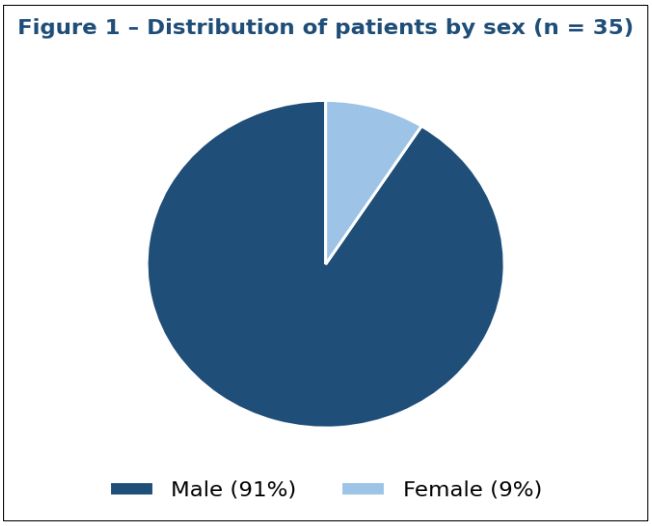

Figure 1: Distribution of patients by sex (n = 35).

2. Mechanisms and Types of Injury

Blunt trauma accounted for 97% of cases (n = 34), compared to a single penetrating trauma (3%). Road traffic accidents were the predominant etiological mechanism (85%, n = 30), followed by assaults (11%, n = 4) and falls (4%, n = 1).

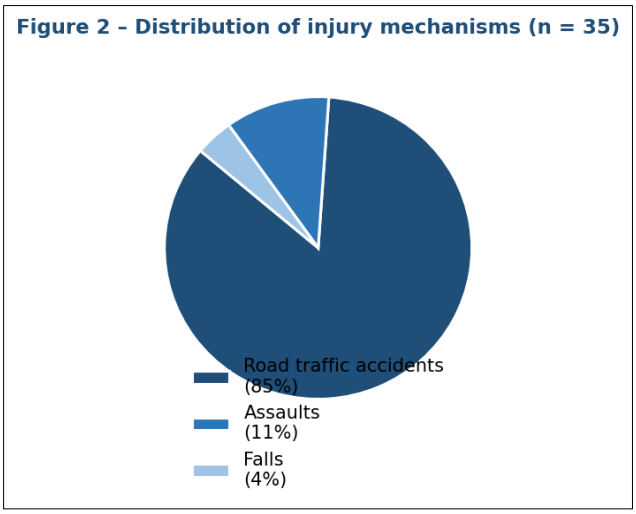

Figure 2: Distribution of injury mechanisms (n = 35)

3. Clinical and Paraclinical Evaluation

Upon admission, nearly all patients presented with abdominal pain and tenderness on palpation of the right hypochondrium. Hemodynamic status was systematically assessed according to the ATLS (Advanced Trauma Life Support) criteria.

The routine laboratory workup included: complete blood count (CBC), transaminase and alkaline phosphatase levels, lipase, renal function, and blood typing with irregular antibody screening.

Abdominal ultrasound (FAST — Focused Assessment with Sonography in Trauma protocol) was performed as first-line investigation to detect peritoneal effusion. Contrast-enhanced abdominopelvic CT scan was the reference examination for injury assessment, enabling injury classification according to the AAST score and detection of contrast extravasation ("blush"), a sign of active arterial bleeding.

4. Summary Table

Table 1: Summary of the main characteristics of the series.

Parameter	Value
Number of patients	35
Mean age	30 years (range: 25–55 years)
Sex ratio (M/F)	10.7 (32 M / 3 F)
Blunt trauma	97% (n = 34)
Road traffic accidents (main mechanism)	85% (n = 30)
Non-operative management rate	91.4% (n = 32)

5. Therapeutic Management

The therapeutic decision was based on the patient's hemodynamic status, the grade of hepatic injury, and the presence of associated injuries.

Non-operative management (NOM) was adopted in 32 patients (91.4%), in accordance with current international recommendations. This approach consisted of close clinical and biological monitoring (every 6 hours during the first 24 hours), supplemented by a systematic CT scan follow-up at 48–72 hours.

Surgical management was required in 3 patients (8.6%) due to:

- **Persistent hemodynamic instability despite resuscitation:** 2 patients (emergency exploratory laparotomy)
- **Associated hollow viscus injury:** 1 patient (laparotomy with repair of the visceral injury)

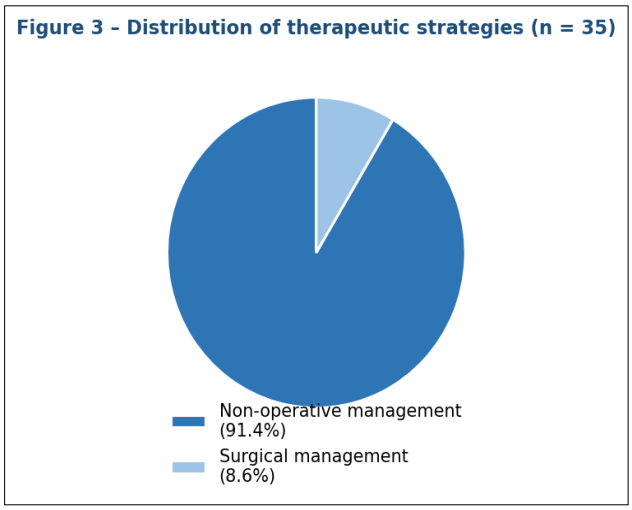

Figure 3: Distribution of therapeutic strategies adopted (n = 35)

6. Outcomes and Complications

The outcome was favorable in the vast majority of cases. No deaths were recorded in our series, reflecting the quality of care provided and the moderate severity of the injuries included.

A single late complication was observed: a hepatic abscess that developed during outpatient follow-up of a patient managed conservatively. This complication was treated by CT-guided percutaneous drainage, with a favorable outcome.

IV. DISCUSSION

1. Epidemiology and Demographic Data

The epidemiological data in our series are in perfect agreement with the major studies published in the international literature. Male predominance, with a sex ratio of 10.7, is a universally shared finding in hepatic

trauma series. For comparison, Kozar *et al.,* reported 78% men in their North American series [8], while Tinkoff *et al.,* found similar proportions (75–85%) in a multicenter analysis of 862 patients [9].

The mean age of 30 years in our study reflects a preferential involvement of the young, active age group, directly correlated with exposure to road traffic accidents. This demographic profile is comparable to results from African and Middle Eastern series [10,11]. Paradoxically, this young population demonstrates better physiological tolerance to hemorrhage and greater hepatic functional reserve, which partly contributes to the good NOM outcomes in these groups [12].

2. Injury Mechanisms

Road traffic accidents remain, in our series as in the majority of global studies, the leading cause of hepatic trauma, accounting for 85% of cases. These data are consistent with those reported by Croce *et al.,* (82%) [13] and the multicenter study of the Eastern Association for the Surgery of Trauma (EAST) [14]. In high-income countries, penetrating trauma represents a larger proportion, notably in the United States (20–40% depending on the center) [15]; in our context, they accounted for only 3% of cases, which is consistent with North African series and reflects a lower prevalence of firearm injuries.

The predominance of blunt trauma (97%) is characteristic of series from countries where armed violence is less prevalent, and aligns with previously published Tunisian, Algerian, and Moroccan data [16,17].

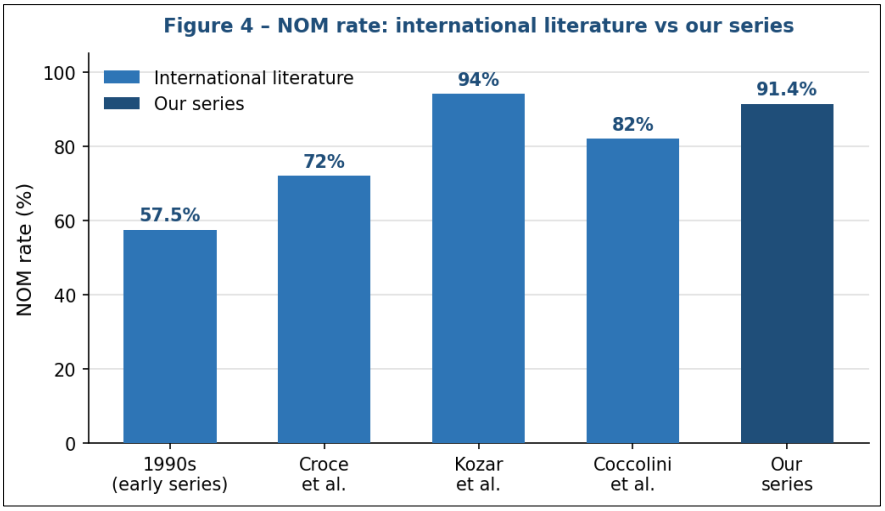

Figure 4: Evolution of the NOM rate: international literature compared to our series

3. Diagnostic Approach

The diagnostic approach in hepatic trauma relies on an integrated strategy combining clinical evaluation, laboratory workup, and imaging. The FAST (Focused Assessment with Sonography in Trauma) protocol occupies a central role in the initial emergency department assessment. Its rapid execution and availability make it an indispensable tool for detecting hemoperitoneum [18]. However, its sensitivity remains limited for precise injury characterization (sensitivity 63–80%), which justifies systematic CT scanning in cases of suspected significant injury [19].

Contrast-enhanced abdominopelvic CT scan has established itself as the diagnostic reference standard. It enables detection of arterial "blush" as evidence of active bleeding, assessment of the AAST grade, and identification of associated injuries [20]. The 6-grade AAST classification directly conditions the therapeutic strategy: grades I–III generally fall under NOM, while grades IV–V are associated with a higher risk of conservative treatment failure and may require arterial embolization or surgical intervention [7,21].

Biologically, elevated transaminases (AST, ALT) constitute a sensitive marker of traumatic hepatocellular injury. Some studies suggest that a threshold of AST > 200 IU/L or ALT > 125 IU/L is associated with a significant probability of hepatic injury on CT scan [22]. Lipase measurement also enables screening for potential associated pancreatic injury, which is common in trauma to the supramesocolic region.

4. Non-Operative Management: Contemporary Therapeutic Paradigm

Non-operative management today represents the gold standard for hepatic trauma care in hemodynamically stable patients. The NOM rate in our series (91.4%) falls within the current global trend and exceeds data from the first series published in the 1990s (50–65%) [23], reflecting the continuous improvement in monitoring and available technical resources.

Major reference studies confirm the feasibility and safety of NOM. Kozar *et al.,* reported a NOM success rate of 94% in a series of 2,557 patients [8].

Hurtuk *et al.,* demonstrated that AAST grade, hemoperitoneum volume, and the presence of arterial blush are the main predictors of NOM failure [24]. In the meta-analysis by Coccolini *et al.,* covering more than 10,000 cases, the overall NOM success rate was 82%, with significantly lower mortality than that observed after surgical intervention for low-grade injuries [25].

Transcatheter splanchnic arterial embolization (TAE) has broadened the indications for NOM, particularly in cases of arterial blush on CT or grade IV–V injuries. It demonstrates success rates of 85–95% in contemporary series, with a significant reduction in the need for surgery [26,27]. In our series, the absence of embolization reflects logistical limitations related to 24/7 access to interventional radiology, a constraint frequently reported in resource-limited centers [28].

5. Surgical Indications

In our series, 3 patients required laparotomy (8.6%), including 2 for persistent hemodynamic instability despite resuscitation and 1 for an associated hollow viscus injury. These indications are fully consistent with current international recommendations [14,25].

Persistent hemodynamic instability — defined as a shock state unresponsive to transfusion of 2 to 4 packed red blood cell units or vasopressor administration — represents the absolute surgical indication in hepatic trauma [29]. In the presence of uncontrollable hepatic bleeding, "damage control surgery" is the reference strategy: perihepatic packing, temporary abdominal closure, then surgical re-intervention at 24–48 hours after correction of the lethal triad (hypothermia, acidosis, coagulopathy) [30,31].

The presence of associated hollow viscus injuries (gastric, small bowel, or colonic perforation) constitutes another formal indication for laparotomy. These injuries, often initially underestimated, require rapid surgical management to prevent peritonitis and sepsis. The association of a high-grade hepatic injury with a hollow viscus injury is reported in 10 to 30% of laparotomies for hepatic trauma in major series [32].

6. Complications and Mortality

The absence of mortality in our series is an encouraging result, consistent with the fact that the majority of our patients presented with moderate-grade injuries and a stable hemodynamic profile on admission. However, overall mortality from severe hepatic trauma (grade IV–V) remains high in the literature, ranging from 15 to 45% depending on the severity of associated injuries [33,34].

A single case of hepatic abscess was observed in our series (2.9%). This well-described complication following NOM of hepatic trauma occurs in 0.5 to 4% of cases and is favored by necrosis of the contused hepatic parenchyma, intraparenchymal hematoma, and relative trauma-related immunosuppression [35]. CT or ultrasound-guided percutaneous drainage constitutes the first-line treatment, reserving surgery for refractory cases [36].

Other complications described in the literature include biloma, biliary fistula, hemobilia, and hepatic arterial pseudoaneurysm — this last complication being potentially fatal and requiring emergency arterial embolization [37,38]. Systematic CT follow-up at 6–8 weeks is advocated by some teams to screen for these late complications.

7. Study Limitations

Our study has several limitations inherent to its retrospective design and the relatively small cohort size (n = 35). The absence of systematic data on the AAST grade of each injury, hemoperitoneum volume, and resuscitation parameters represents a limitation in the analysis of predictors of NOM failure. A multicenter prospective study with more complete data would better define the decision-making criteria in our institutional context.

V. CONCLUSION

Hepatic trauma represents a frequent surgical emergency whose prognosis has considerably improved thanks to advances in diagnostic and therapeutic practices. Our series confirms the feasibility and safety of non-operative management in hemodynamically stable patients, with a success rate of 91.4% and zero mortality.

The therapeutic decision must rely on a rigorous and dynamic assessment of hemodynamic status, CT injury findings, and available resources. The development of interventional radiology, still insufficiently accessible in our institution, constitutes a priority development axis for further improving the outcomes of non-surgical management of high-grade injuries.

Continuous training of surgical, anesthesia, and radiology teams in damage control protocols and in the indications for hepatic arterial embolization is essential to optimize the management of these injuries in our context.

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