

Trauma Services BC
Specialist Trauma Advisory Network

Thoraco-Abdominal Trauma
Specialist Advisory Group

Clinical Practice Guideline

for the management of

BLUNT LIVER INJURY

in adults 16 years of age or older

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Guideline development group

THORACOABDOMINAL TRAUMA SPECIALIST ADVISORY GROUP MEMBERSHIP:

Chair

Michelle Goecke, MD Royal Columbian Hospital, Fraser Health Authority

Members

Alex Mihailovic, MD Victoria general Hospital, Island Health

Heather Wilson, MD Kelowna General Hospital, Interior Health Authority

Dean Percy, MD Trauma Services BC, Provincial Health Services Authority

Shawn MacKenzie, MD Royal Columbian Hospital, Fraser Health Authority

Lily Tung, MD Abbotsford Regional Hospital, Fraser Health Authority

CLINICAL, ADMINISTRATIVE AND TECHNICAL LEADERSHIP:

Jo-Ann Hnatiuk Trauma Services BC, Provincial Health Services Authority

Rujie Ronnie Feng Trauma Services BC, Provincial Health Services Authority

Helen Kang, PhD Clearview Consultants

Purpose

The purpose of this clinical practice guideline (CPG) is to outline:

1. The preferred clinical management of isolated blunt liver trauma in adult patients (age >16)
2. Key performance indicators (KPIs) by which the delivery of appropriate care can be assessed across the province.

Key management questions

1. OPERATIVE MANAGEMENT

1. What are the indications for operative management (OM) of blunt liver injuries?

I. NON-OPERATIVE MANAGEMENT

2. What are the indications for non-operative management (NOM) in blunt liver injuries?

II. ANGIOGRAPHY/ANGIOEMBOLIZATION

3. What are the indications for angiography/angioembolization (AG/AE) in blunt liver injuries?

III. TRANSFER TO HIGHER LEVEL OF CARE

4. What are the indications for transfer of patients with blunt liver injuries to a higher-level trauma center?

IV. ACUTE HOSPITAL CARE

5. When is supplementary imaging required in the hospitalized patient?
6. What type and duration of monitoring are necessary for patients with blunt liver injuries?
7. What are the common complications and their management in patients with blunt liver injuries?
 - a. Pseudoaneurysm
 - b. Biliary complications (biloma, bile leak, biliary fistula)
 - c. Liver abscess/necrosis
8. What activity restrictions should be imposed on patients with blunt liver injuries, in hospital and post-discharge?

V. VENOUS THROMBOEMBOLISM (VTE) PROPHYLAXIS

9. What is the optimal timing for initiating DVT prophylaxis in patients with blunt liver injuries?

VI. POST HOSPITAL CARE

10. What is the optimal timing for repeat imaging after blunt liver injury?
Which imaging modality should be used to follow-up blunt liver injury?

Guidelines referenced

ORGANIZATION	TITLE, YEAR	GRADING SYSTEM
<p>Eastern Association for the Surgery of Trauma</p>		<p>Level 1: Convincingly justifiable based on available scientific information alone. Supported by prospective randomized studies or prospective, noncomparative studies or retrospective series with controls.</p> <p>Level 2: Reasonably justifiable by available scientific evidence and strongly supported by expert opinion. Supported by prospective, noncomparative studies or retrospective series with controls or a preponderance of retrospective analyses.</p> <p>Level 3: Supported by available data but lacking adequate evidence. Supported by retrospective analyses.</p>
<p>World Society for Emergency Surgery</p>		<p>1A: Strong recommendation, high-quality evidence</p> <p>1B: Strong recommendation, moderate-quality evidence</p> <p>1C: Strong recommendation, low-quality or very low-quality evidence</p> <p>2A: Weak recommendation, high-quality evidence</p> <p>2B: Weak recommendation, moderate-quality evidence</p> <p>2C: Weak recommendation, low-quality or very low-quality evidence</p>

AAST Liver Injury Scale (1994 revision)

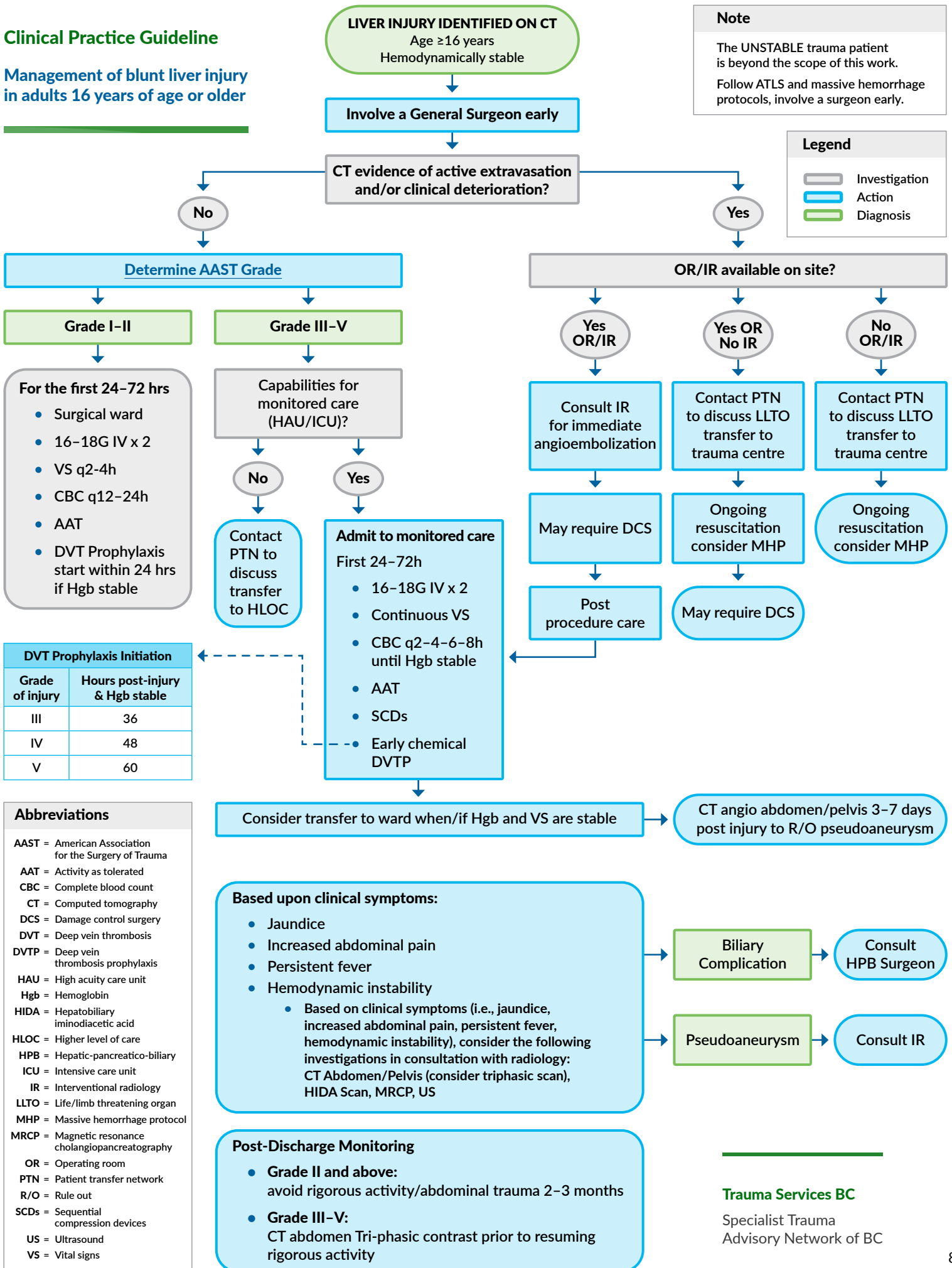
GRADE	INJURY TYPE	INJURY DESCRIPTION
I	Haematoma	Subcapsular < 10% surface
	Laceration	Capsular tear < 1cm parenchymal depth
II	Haematoma	Subcapsular 10–50% surface area; intraparenchymal, < 10cm diameter
	Laceration	1–3cm parenchymal depth, < 10cm in length
III	Haematoma	Subcapsular > 50% surface area or expanding, ruptured subcapsular or parenchymal haematoma. Intraparenchymal haematoma > 10cm
	Laceration	> 3cm parenchymal depth
IV	Laceration	Parenchymal disruption 25–75% of hepatic lobe
V	Laceration	Parenchymal disruption involving > 75% of hepatic lobe
	Vascular	Juxtavenous hepatic injuries i.e. retrohepatic vena cava / central major hepatic veins
VI	Vascular	Hepatic avulsion

Advance one grade for multiple injuries up to Grade III

Generally, Grade 1 and 2 injuries are considered **low grade injuries** while Grade 3–5 are considered **high grade injuries**

Clinical Practice Guideline

Management of blunt liver injury in adults 16 years of age or older



Summary of recommendations

All recommendations are newly drafted by the Thoraco-Abdominal SAG, unless indicated otherwise.

I. INITIAL ASSESSMENT AND MANAGEMENT

1. Initial resuscitation and management of the patient with blunt abdominal trauma should follow the Advanced Trauma and Life Support (ATLS) principles.
2. The general surgeon at the local hospital must be consulted promptly when liver injury is suspected or proven. If no general surgeon is available on site, the general surgeon and TTL on call at the identified HLOC referral centre should be contacted through PTN to assist with management planning. [New recommendation]

II. OPERATIVE MANAGEMENT

1. In centres with general surgical capability, urgent laparotomy for management of liver injury is indicated in hemodynamically unstable non-responders to appropriate resuscitation where control of liver hemorrhage is considered necessary for hemodynamic stabilization and is recommended prior to transfer to higher LOC in consultation with the receiving general or trauma surgeon/TTL. [New recommendation]
2. Grade or severity of liver injury is not, in and of itself, an indication for surgical management of the injured liver. The decision to proceed to surgery should be based on the clinical presentation of the patient and situational context*. [New recommendation]
*Situational context refers to the capabilities of the site, resources available, transport availability, transfer related issues.
3. A general surgeon should be involved in early assessment and decision-making for suspected or proven liver injury. Tele-conferencing through PTN with a general surgeon and TTL on call at the HLOC trauma referral centre to discuss optimal management (i.e. transport vs laparotomy) for the patient with suspected or proven liver injury is encouraged. [New recommendation]
If no general surgeon is available on site, the general surgeon and TTL on call at the identified HLOC referral centre should be contacted through PTN to assist with management planning. [New recommendation]

III. NON-OPERATIVE MANAGEMENT

1. A trial of non-operative management (NOM) for liver injury is indicated in patients with proven liver injury who are hemodynamically stable or who were hemodynamically unstable and responded to appropriate resuscitation. There are no absolute contraindications to a trial of NOM of known liver injury in the hemodynamically stable or stabilized patient. [New recommendation]
2. Hemodynamically stable patients with a negligible risk of ongoing or delayed hemorrhage (CT-confirmed Grade 1–2 liver injuries without evidence of active haemorrhage or pseudoaneurysm, anticoagulated patient, or limited physiologic reserve) may be safely managed in a rural/remote facility provided at least 2 units of packed red blood cells are available. This management plan should be reviewed with a general surgeon or with a general surgeon and TTL on call at the HLOC trauma referral centre
3. NOM of Grade 4, 5 liver injury or Grade 3 with contrast blush, should only be considered in a hospital that has capabilities for physiologic monitoring, serial clinical evaluations by a general surgeon, the ability to transfuse 4 or more units of blood, CT imaging, and 24-7 operating room access. Access to 24-7 interventional radiology for angiography/angioembolization is recommended. It is recommended that this management plan be reviewed with a general surgeon and TTL on call at the HLOC trauma referral centre. For transfer indications, see **V. TRANSFER TO HIGHER LEVEL OF CARE.**

IV. ANGIOGRAPHY/ANGIOEMBOLIZATION (AG/AE)

1. Emergent angiography/angioembolization is indicated in hemodynamically unstable patients who have responded to appropriate resuscitation and demonstrate active vascular extravasation on contrast CT. [Adopted from WSES]
2. Emergent angiography/angioembolization is indicated in hemodynamically stable patients with major or active extravasation not likely to abate. [New recommendation]
3. Patients with liver injury demonstrating contrast blush on CT are at an elevated risk for failing NOM. The consulting surgeon and interventional radiologist should communicate once initial imaging is completed and collaborate on a management plan. [New recommendation]
4. Angiography/angioembolization should be considered in patients with liver injury demonstrating delayed or repeat bleed. [Adopted from WSES]
5. Post-operative AG/AE should be considered in patients with initial operative hemostasis and a blush on CT, or as adjunct in suspected arterial bleeding despite laparotomy and hemostasis attempt. [Adopted from WSES]
6. Consider a hybrid OR for management of high grade liver injuries requiring operative management. [New recommendation]

V. TRANSFER TO HIGHER LEVEL OF CARE**Immediate Transfer (< 24 hours):**

1. All hepatic trauma patients with major injuries to multiple systems and/or multiple solid viscus injuries should be discussed with receiving TTL and general surgeon and considered for transfer to a HLOC. [New recommendation]
2. Patients who are hemodynamically stable with associated injuries requiring urgent higher level of care (e.g. TBI,) should be transferred promptly. [Adopted from WSES]
3. In centres without general surgery capability, hemodynamically stable patients with an **ISOLATED** liver injury and a negligible risk of ongoing or delayed hemorrhage (CT-confirmed Grade 1–2 liver injuries without evidence of active haemorrhage or pseudoaneurysm, anticoagulated patient, or limited physiologic reserve) may be safely managed in a rural/remote facility provided at least 2 units of packed red blood cells are available. This management plan should be reviewed with a general surgeon or with a general surgeon and TTL on call at the HLOC trauma referral centre. [New recommendation]
4. Patients with Grade 3–5 liver injury, contrast blush, or associated major injury should be transferred to an appropriate trauma referral centre. Centres receiving these patients should have 24-7 IR capability to facilitate angioembolization if needed. A general surgeon must be actively involved in the transfer process and the ongoing care of transferred patients. [New recommendation]
5. Initiate PTN transfer process and communication to accepting HLOC prior to undergoing emergent surgical management and subsequent transfer to HLOC. Arrangements for transfer through PTN should be made as early as possible, preferably pre-operatively or intraoperatively to avoid delay. [New recommendation]

Delayed Transfer (> 24 hours):

1. Development of late complications (biliary complications, abscess, necrosis) should be considered for transfer to HLOC with interventional and surgical hepatobiliary expertise.

VI. ACUTE HOSPITAL CARE

1. Patients with Grade 1–2 liver injury can be monitored in a SURGICAL ward. The patient should have adequate IV access (16–18g IVs) and frequent vital signs. [New recommendation]
2. Patients with Grade 3–5 liver injuries undergoing NOM should be observed initially in a monitored intermediate care unit. Appropriate initial monitoring includes the capacity to provide hourly vital signs, cardiac, oxygen saturation and urine output monitoring. Serial examination by a general surgeon is essential. Hemoglobin should be monitored at regular intervals until stabilized, either q4, q6 or q8 hours depending on patient status. Any changes in clinical status should prompt urgent investigations and/or CT if the patient status permits. [Adopted from WSES, EAST]
3. There is no need to restrict mobilization in patients with liver injury and early mobilization is encouraged. Patients with high risk injuries should remain supervised until assessed as safe to ambulate independently off unit. [Adopted from WSES, EAST]

VII. VENOUS THROMBOEMBOLISM (VTE) PROPHYLAXIS

1. Pharmacologic prophylaxis to prevent venous thromboembolism (VTE) can be used for patients with isolated blunt liver injuries without increasing the failure rate of non-operative management. Although the optimal timing of safe initiation has not been determined, DVT prophylaxis may be started as soon as possible after trauma and within 12 hours for every grade of liver injury (e.g. 36 hours for Grade 3 injury) or sooner if the hemoglobin is stable. [Adopted from EAST and WSES]
2. Mechanical prophylaxis is safe and should be considered in all patients without absolute contraindication to its use, except in patients with lower extremity trauma in which case mechanical prophylaxis is not efficacious. [Adopted from WSES]

VIII. POST HOSPITAL CARE

1. Post-discharge, patients with Grades 2 injuries should avoid contact sports or rigorous activities for at least 2–3 months. [New recommendation]
2. Grade 3–5 liver injuries should have repeat imaging at 2–3 months post-injury to document extent of healing. Patient should have imaging prior to resuming a high risk activity. Abdominal triphasic CT is the preferred modality. [New recommendation]
3. Patients should have clinical re-assessment 4–8 weeks to assess for signs of complications including persistent pain, jaundice, fever, or other signs of potential liver or biliary dysfunction. [New recommendation]
4. If a pseudoaneurym is noted on follow-up imaging, discussion with interventional radiology is recommended for determine best management. Non-vascular complications should have follow-up or referral with a surgeon with hepatopancreaticobiliary (HPB) expertise. [New recommendation]

Rationale

I. OPERATIVE MANAGEMENT

KMQ-1. What are the indications for operative management (OM) of blunt liver injuries?

RECOMMENDATIONS

- A.** Operative management should be performed in patients with hemodynamic instability and/or peritonitis, bowel evisceration, or impalement requiring surgical exploration, regardless of grade of hepatic injury. Severe traumatic brain injury (TBI) does not alter this recommendation. [Adopted from WSES with modification]

Caveats:

- B.** Primary aim of surgical intervention should be to control hemorrhage and/or bile leak. Major hepatic resections should be avoided and time in the OR minimized in concordance with the principles of damage control laparotomy. [Adopted from WSES with modification]
- C.** Operative management should be performed when:
- i.** non-operative management with AG/AE fails
 - ii.** the patient remains hemodynamically unstable
 - iii.** the patient has a significant drop in hemoglobin levels or continuous transfusion is required, after other sources of hemorrhage have been excluded. [Adopted from WSES with modification]

Hemodynamically unstable patients and non-responders should be transferred promptly to the operating room.¹ The advanced operative management of hepatic injury is outside of the scope of this guideline, however the general goal of operative management should be to control bleeding and address any other life threatening injuries. Minimizing operative time is paramount, and generally < 1 hour is cited by most experts as a goal, to help prevent the development of hypothermia, coagulopathy and acidosis.² Damage control surgical techniques, temporary abdominal closure and staged procedures may be necessary in severely injured patients.^{3,4} It has also been shown that the routine use of post-operative AG/AE reduces mortality in Grade 4/5 hepatic injury.⁵

II. NON-OPERATIVE MANAGEMENT

KMQ-2. What are the indications for non-operative management (NOM) in blunt liver injuries?

RECOMMENDATIONS

- A. NOM should be the treatment of choice for all hemodynamically stable patients regardless of injury grade, in the absence of other internal injuries requiring surgery. [Adopted from WSES]

Caveats:

- B. In patients considered transient responders, NOM should be considered only in selected settings provided the immediate availability of trained surgeons, operating room, continuous monitoring ideally in an ICU or ER setting, access to angiography, angioembolization, blood, and blood products, and in locations where a system exists to quickly transfer such patients to higher level of care facilities see **TRANSFER TO HIGHER LEVEL OF CARE**. [Adopted from WSES]
- C. A CT scan with intravenous contrast should always be performed in patients being considered for NOM. [Adopted from WSES]
- D. Serial clinical evaluations (physical exams and laboratory testing) must be performed to detect a change in clinical status during NOM. [Adopted from WSES]
- E. NOM should be attempted in the setting of concomitant head trauma and/or spinal cord injuries with reliable clinical exam, unless the patient cannot achieve specific hemodynamic goals for the neurotrauma and the instability is felt to be due to intra-abdominal bleeding. NOM in this patient population should only be attempted at an appropriate higher level of trauma centre. [Adopted from WSES]

Non-operative management is the standard of care for stable blunt liver trauma, in the absence of other injuries requiring surgery. Success rate for Grade 1–3 injuries managed non-operatively is 95–100%, and for Grade 4–5 it is approximately 33%⁶. Delayed hemorrhage after NOM (subcapsular hematoma or pseudo-aneurysm) occurs in approximately 1.7–5.9% of patients, with a mortality rate up to 18%¹. The majority of these bleeds (69%) can be treated with AG/AE¹.

There is no accepted consensus for predicting failure of NOM in liver injuries, however patients with ongoing resuscitation requirements, multiple solid-organ injuries, higher injury severity score and large hemoperitoneum are more likely to fail NOM⁷.

No study has specifically addressed the role of NOM for liver injuries in patients with traumatic brain injury (TBI) or spinal cord injury (SCI). Historically, neurotrauma it has been considered a contraindication to NOM, however there is no rationale in denying NOM in such patients, as long as hemodynamic goals to optimize cerebral perfusion pressure are able to be maintained¹.

III. ANGIOGRAPHY / ANGIOEMBOLIZATION (AG/AE)

KMQ-3. What are the indications for angiography/angioembolization (AG/AE) in blunt liver injuries?

RECOMMENDATIONS

- A. In centres with interventional radiology (IR), angiography/angioembolization may be considered the first-line intervention in patients with hemodynamic stability and:
- arterial blush or moderate hemoperitoneum on CT scan, or
 - evidence of ongoing bleeding,

irrespective of injury grade. In centres without IR, consider transfer for IR. For transfer indications, see **TRANSFER TO HIGHER LEVEL OF CARE**. [Adopted from WSES with modification]

Caveats:

- B. Contrast blush on CT scan alone is not an absolute indication for an operation or angiographic intervention. Factors such as patient age, grade of injury, and presence of hypotension need to be considered in the clinical management of these patients. [Adopted from EAST]
- C. In patients with bleeding liver vascular injuries and in those with intraperitoneal blush, AG/AE should be performed as part of NOM only in centers where AG/AE is rapidly available. In other centres and in case of rapid hemodynamic deterioration, damage control laparotomy should be considered with the expectation of transfer to a referral centre as soon as possible in the post operative period. [Adopted from WSES]

Both the WSES and EAST guidelines recommend considering AG/AE in hemodynamically stable patients with evidence of contrast extravasation and/or blush on CT^{1,7}, although this is not an absolute indication for AG/AE. These cases should be discussed with interventional radiology. In transient responders, angiography with embolization may be considered as a first-line intervention.⁷ AG/AE is also recommended for the management of delayed bleeding or pseudoaneurysms.¹

AG/AE has an overall success rate of 83%.⁸ In cases of failure, repeat AG/AE can be considered.¹ The complication rate of AG/AE in liver injury is 29–58% in some series, and includes arterial dissection, puncture site complications, hepatic necrosis/abscess, biliary necrosis/bile leak and even cholecystitis.⁹

IV. TRANSFER TO HIGHER LEVEL OF CARE

KMQ-4. What are the indications for transfer of patients with blunt liver injuries to a higher-level trauma center?**RECOMMENDATIONS****Immediate transfer (< 24 hours):**

- A.** In centres without OR capabilities, all patients with liver injuries are candidates for immediate transfer. [New SAG recommendation]
- B.** Patients who are hemodynamically stable with associated injuries requiring urgent higher level of care (e.g. TBI, spinal cord injury) should be transferred immediately. [New SAG recommendation]
- C.** In centres without interventional radiology (IR) capabilities, consider immediate transfer to first available 24-7 IR capable hospital in patients with hemodynamic stability and arterial blush on CT scan, irrespective of injury grade. Patients should be transferred under the care of an accepting surgeon. [New SAG recommendation]

Delayed transfer (> 24 hours):

- D.** In centres without IR capabilities, consider transfer for IR if the patient is hemodynamically stable and follow-up imaging reveals a vascular lesion requiring IR. Involvement of the Interventional Radiologist in the PTN transfer discussion is recommended. [New SAG recommendation]
- E.** Patients with complications (biloma, liver necrosis/abscess, etc.) consultation with a Hepatobiliary surgeon is recommended and transfer to a higher level of care may be required.

Recommendations regarding transfer to higher level of care were drafted, based on provincial realities and the expert opinion of the SAG. Given the high rate of failure of NOM in high grade injuries, the pivotal role of AG/AE in the management of liver injury, the requirement for continuous monitoring and the reality that many patients with blunt liver injury have other associated injuries, transfer to HLOC should strongly considered in Grade 3–5 blunt liver trauma.

Late complications (see KMQ-7) often require advanced percutaneous/endoscopic interventions and these patients often require management at a HLOC with advanced HPB expertise and capabilities.

V. ACUTE HOSPITAL CARE

KMQ-5. When is supplementary imaging required in the hospitalized patient?**RECOMMENDATIONS**

- A.** Routine interval imaging is not required, however repeat CT scan should be ordered if there is a clinical suspicion of complication [Adopted from WSES]

Routine early follow-up imaging is generally not indicated in the absence of clinical suspicion of a complication.¹ Abnormal inflammatory response, abdominal pain, fever, jaundice, a decrease in hemoglobin level not otherwise accounted for, or worsening liver function based on liver function tests should prompt repeated CT scan.¹⁰

Ultrasound can also be helpful in assessing for bile leak/biloma especially in high grade injuries¹. HIDA scan is a valuable tool to assess for bile leak. For management of these complications, refer to KMQ-7.

KMQ-6. What type and duration of monitoring are necessary for patients with blunt liver injuries?**RECOMMENDATIONS**

- A.** All patients with blunt liver injuries should be monitored in an environment with capacity for close monitoring, regular serial examinations, hemoglobin levels every 4–8 hours for the first 48 hours, and have established large bore IV access. [New SAG recommendation]
- B.** Admission to a higher acuity monitored setting or ICU is recommended for patients with higher Grade (3–5) injuries. [Adopted from WSES]

There are no standardized early or late follow-up algorithms in blunt liver trauma. Clinical and laboratory observation are the cornerstones in the first 48–72 hour follow-up¹. Most societal guidelines recommend repeating bloodwork at regular intervals for the initial 24–48 hours, or until stability is achieved. This includes serial abdominal exams, preferably by a surgeon or the same clinician. This should also be performed at a facility that has access to blood products, especially red blood cells and plasma.

ICU admission for Grade III–V injuries have been shown to reduce mortality, and therefore should be strongly considered in high grade injuries, regardless of clinical stability¹. This should include hourly vital signs, cardiac monitoring, oxygen saturation and urine output until stable.

KMQ-7. What are the common complications and their management in patients with blunt liver injuries?**RECOMMENDATIONS**

- A.** Hepatic artery pseudoaneurysm should be managed with angioembolization. [Adopted from WSES]
- B.** Biliary complications including biloma, bile leak and biliary fistula may require percutaneous or endoscopic retrograde cholangiopancreatography (ERCP), and should be managed in conjunction with interventional radiologists, gastroenterologists and surgeons with HPB expertise. [Adopted from WSES]
- C.** HIDA scan may be helpful in differentiating liver abscess from biloma. [New SAG recommendation]
- D.** Liver abscess should be managed with antibiotics and percutaneous drainage. [Adopted from WSES]

Overall complications occur in 12–14% of patients with blunt liver injury, and occur more frequently in higher grade injuries.¹ Hepatic artery pseudoaneurysm occurs in 1% of patients and should be treated with angioembolization as it poses a high risk of rupture.¹ Biliary complications occur in 8.2–30% of patients, and include biloma, bile leak, or bile fistula. The majority of these resolve on their own, however percutaneous drainage and/or ERCP may be required to manage these injuries.¹ Liver abscess is rare, with a rate of 0.6–7%, and generally are associated with higher grade injuries. Percutaneous drainage is the preferred approach.

KMQ-8. What activity restrictions should be imposed on patients with blunt liver injuries, in hospital and post-discharge?**RECOMMENDATIONS**

- A.** In hospital, mobilization on unit is recommended with no off-unit privileges within 48 hours of injury. Patients with high grade injuries or risk of falling based on associated injuries or comorbidities should mobilize only with supervision after 48 hours. [New SAG recommendation]
- B.** Post-discharge activity restriction should be considered based on grade and intensity/risk of activity. Low grade (I-II) can return to high risk activity after 2–3 months. High grade injuries should have interval imaging at 2–3 months to ensure resolution, prior to resuming high risk activities. [New SAG recommendation]

There is no evidence for activity restrictions in adult patients with blunt liver injuries, and early mobilization should be achieved in stable patients.¹ Early mobilization does not increase the risk of failure of non-operative management of liver injuries and should be encouraged to help reduce the venous thromboembolism (VTE) and pulmonary embolism (PE).

For long-term activity restrictions following liver injury, there are no widely accepted guidelines. There is evidence to show that most liver injuries will completely heal by 4 months, with higher grade injuries taking longer time to heal.¹² Using splenic injury recommendations is likely conservative when applied to hepatic injury, but with these recommendations Grade 1–2 injuries should be considered for 4–6 weeks of restricted activity, Grade 3 for 8 weeks. In Grade 4–5 injuries, normal physical activity is safe to resume after 3–4 months.¹

VI. VENOUS THROMBOEMBOLISM (VTE) PROPHYLAXIS

KMQ-9. What is the optimal timing for initiating DVT prophylaxis in patients with blunt liver injuries?

RECOMMENDATIONS

- A. Pharmacologic prophylaxis to prevent venous thromboembolism (VTE) can be used for patients with isolated blunt liver injuries without increasing the failure rate of non-operative management. Although the optimal timing of safe initiation has not been determined, DVT prophylaxis may be started as soon as possible from trauma and within 12 hours for every grade of liver injury (e.g. 36 hours for Grade 3 injury) or sooner if hemoglobin is stable. [Adopted from EAST and WSES with modification]
- B. Mechanical prophylaxis is safe and should be considered in all patients without absolute contraindication to its use, except in patients with lower extremity trauma in which case mechanical prophylaxis is not efficacious. [Adopted from WSES with modification]

All major trauma associations recommend mechanical DVT prophylaxis in all solid viscus trauma, and is considered safe in all patients without an absolute contraindication.^{1,7} Specific guidelines regarding timing of administration of LMWH are lacking, however pharmacologic thromboprophylaxis should be started as soon as possible.¹

Upwards of 50% of major trauma patients without thrombo-prophylaxis can develop deep vein thrombosis (DVT) and pulmonary embolism (PE), which carries a mortality rate up to 50%.¹³ Fourfold increase in VTE rates has been observed when LMWH is administered more than 72h after admission.¹³ No differences in complication, mortality, or NOM failure rate were demonstrated when thrombo-prophylaxis was administered within and after 48 and 72 h from the initial injury in patients without significant neurotrauma.¹

VII. POST HOSPITAL CARE

**KMQ-10. What is the optimal timing for repeat imaging after blunt liver injury?
Which imaging modality should be used to follow-up blunt liver injury?****RECOMMENDATIONS**

- A.** Routine follow-up imaging is not required in all blunt liver injury. Imaging should be considered based on:
- i.** Clinical symptoms or
 - ii.** High grade injury (Grade 3 with blush, or Grades 4–5) or
 - iii.** Prior to the patient returning to high risk activities (see KMQ-8)

CT scan is the preferred modality. [New SAG recommendation]

Unlike blunt splenic injury, there are no widely accepted recommendations for routine follow-up imaging after blunt liver injury. Mandatory repeat imaging is not required, unless the patient's clinical condition suggests evolution of a complication (fever, abdominal pain, jaundice, abnormal liver parameters)¹. While specific data are lacking, repeat imaging should be considered in high grade injuries, and/or prior to resumption of high-risk activities, at the treating physicians discretion.

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