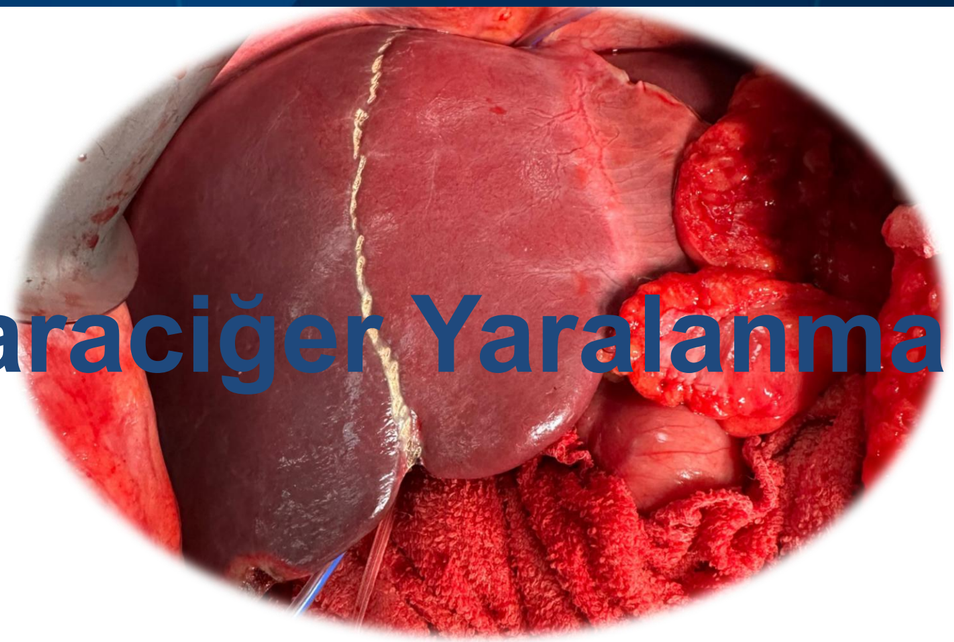


Karaciğer Yaralanmaları

Dr. Mustafa ŞENTÜRK

Necmettin Erbakan Üniversitesi Meram Tıp Fakültesi
Genel Cerrahi Anabilim Dalı
Hepatopankreatobiliyer Cerrahi ve Karaciğer Transplantasyonu Birimi

- ✓ Travma, önemli bir küresel halk sağlığı sorunudur. Tüm yaş gruplarında birincil ölüm nedenleri arasında yer almaktadır.

- ✓ Çoklu travma hastalarında, karın travması ikinci en sık ölüm nedenidir.

Beshay, M.; Mertzlufft, F.; Kottkamp, HW; Reymond, M.; Schmid, RA; Branscheid, D.; Vordemvenne, T. Modern bir travma merkeziyle karşılaştırmalı olarak torasik travma hastalarında risk faktörlerinin analizi: Tek merkezli bir çalışma. *World J. Emerg. Surg.* **2020** , *15* , 45.
Abo-Elhoda, MF; Attia, SM; Ahmed, ME; Abdeldaiem, KAE Künt karın travması hastalarında katı organ yaralanmaları. *Mısır. J. Hosp. Med.* **2021** , *83* , 1477–1483.
Arumugam, S.; Al-Hassani, A.; El-Menyar, A.; Abdelrahman, H.; Parchani, A.; Peralta, R.; Zarour, A.; Al-Thani, H. Karın travmasının sıklığı, nedenleri ve örüntüsü: 4 yıllık tanımlayıcı analiz. *J. Emerg. Trauma Shock* **2015** , *8* , 193–19

- ✓ Travma nedeniyle tüm acil servis başvurularının yaklaşık %5'ini karaciğer yaralanmaları oluşturur.
- ✓ Künt karın travmasında ikinci en sık yaralanan solid organdır.
- ✓ Karaciğer yaralanması, %10-15'lik bir ölüm oranıyla künt karın travmalarında en sık görülen ölüm nedenidir.

Segalini, E., Morello, A., Leati, G. *et al.* Primary angioembolization in liver trauma: major hepatic necrosis as a severe complication of a minimally invasive treatment—a narrative review. *Updates Surg* **74**, 1511–1519 (2022).
Stracieri, L.D.D.S.; Scarpelini, S. Hepatic injury. *Acta Cir. Bras.* **2006**, *21*, 85–88

- ✓ Boyutunun büyüklüğü,
- ✓ Vaskülarizasyonun yoğun olması,
- ✓ Parankiminin zayıflığı,
- ✓ Kırılgan kapsülü



Segalini, E., Morello, A., Leati, G. *et al.* Primary angioembolization in liver trauma: major hepatic necrosis as a severe complication of a minimally invasive treatment—a narrative review. *Updates Surg* **74**, 1511–1519 (2022).
Stracieri, L.D.D.S.; Scarpelini, S. Hepatic injury. *Acta Cir. Bras.* **2006**, *21*, 85–88

Künt

Penetran

?

Operatif Yönetim

Non Operatif Yönetim

Segalini, E., Morello, A., Leati, G. *et al.* Primary angioembolization in liver trauma: major hepatic necrosis as a severe complication of a minimally invasive treatment—a narrative review. *Updates Surg* **74**, 1511–1519 (2022).
Stracieri, L.D.D.S.; Scarpelini, S. Hepatic injury. *Acta Cir. Bras.* **2006**, *21*, 85–88

Karaciğer travmasının cerrahi tedavisi

II. Dünya Savaşı'nın başlarında	→	İntraparankimal paketleme(packing)
1970'lerde indeks eksplorasyonu	→	Rezeksiyon
1980'ler ve 90'lar	→	Rezeksiyonsuz hasar kontrol teknikleri

Hemostatik resüsitasyondaki gelişmeler,
Yoğun bakım,
Anjiyografik embolizasyon ortaya çıkışı,

Karaciğer yaralanması için cerrahi olmayan yönetimin yaygınlaşmasına yol açmıştır.

Reed, Christopher R. MD; Brown, Joshua B. MD, MSc; Peitzman, Andrew B. MD. Liver injury: What you need to know. Journal of Trauma and Acute Care Surgery ():10.1097/TA.0000000000004684, July 4, 2025.

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Outline

Liver injury: What you need to know

Reed, Christopher R. MD; Brown, Joshua B. MD, MSc; Peitzman, Andrew B. MD

TABLE 1 - Liver Injuries (N = 26,592 Adult Liver Injuries)

		Grades I/II	Grade III	Grade IV	Grade V
Blunt liver injury, 20,668 (% of blunt injuries)	%78	12,155 (59%)	4,728 (23%)	2,801 (13%)	984 (5%)
Blunt liver injury: operation/NOM		10%/90%	8%/92%	14%/86%	29%/71%
Penetrating liver injury, 5,924 (% of penetrating injuries)	%22	3,034 (51%)	1,224 (21%)	1,172 (20%)	494 (8%)
Operative mortality: blunt, penetrating		31%; 15%	28%; 10%	31%; 14%	56%; 38%

From 2022 American College of Surgeons Trauma Quality Improvement Program.

American Association for the Surgery of Trauma (AAST) Guideline
World Society of Emergency Surgery (WSES) Guideline
Western Trauma Association Blunt Hepatic Injury Guideline
The Eastern Association for the Surgery of Trauma (EAST) Guideline
European Association for Trauma & Emergency Surgery Guideline

Segalini, E., Morello, A., Leati, G. *et al.* Primary angioembolization in liver trauma: major hepatic necrosis as a severe complication of a minimally invasive treatment—a narrative review. *Updates Surg* **74**, 1511–1519 (2022).
Stracieri, L.D.D.S.; Scarpelini, S. Hepatic injury. *Acta Cir. Bras.* **2006**, *21*, 85–88

Liver injury scale 1989

Grade*	Injury Description†	ICD-9	AIS 85	AIS 90
I. Hematoma:	Subcapsular, nonexpanding, <10% surface area	864.01 864.11	2	2
Laceration:	Capsular tear, nonbleeding, <1 cm parenchymal depth	864.02 864.12	2	2
II. Hematoma:	Subcapsular, nonexpanding, 10–50% surface area Intraparenchymal, nonexpanding, <2 cm in diameter	864.01 864.11	2	2
Laceration:	Capsular tear, active bleeding; 1–3-cm parenchymal depth, <10 cm in length	864.03 864.13	2	2
III. Hematoma:	Subcapsular, >50% surface area or expanding; Ruptured subcapsular hematoma with active bleeding; Intraparenchymal hematoma >2 cm or expanding		3	3
Laceration:	>3 cm parenchymal depth	864.04 864.14	3	3
IV. Hematoma:	Ruptured intraparenchymal hematoma with active bleeding		3	4
Laceration:	Parenchymal disruption involving 25–50% of hepatic lobe	864.04 864.14	4	4
V. Laceration:	Parenchymal disruption involving >50% of hepatic lobe		5	5
Vascular:	Juxtahepatic venous injuries; i.e., retrohepatic vena cava/major hepatic veins		5	5
VI. Vascular:	Hepatic avulsion			6

* Advance one grade for multiple injuries to the same organ.
† Based on most accurate assessment at autopsy, laparotomy, or radiologic study.

AAST liver trauma classification

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, < 10 cm 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

AAST liver injury scale (1994 revision)

TABLE 2. Liver Injury Scale—2018 Revision

AAST Grade	AIS Severity	Imaging Criteria (CT Findings)	Operative Criteria	Pathologic Criteria
I	2	– Subcapsular hematoma <10% surface area – Parenchymal laceration <1 cm in depth	– Subcapsular hematoma <10% surface area – Parenchymal laceration <1 cm in depth Capsular tear	– Subcapsular hematoma <10% surface area – Parenchymal laceration <1 cm Capsular tear
II	2	– Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma <10 cm in diameter – Laceration 1–3 cm in depth and ≤ 10 cm length	– Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma <10 cm in diameter – Laceration 1–3 cm in depth and ≤ 10 cm length	– Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma <10 cm in diameter – Laceration 1–3 cm depth and ≤ 10 cm length
III	3	– Subcapsular hematoma >50% surface area; ruptured subcapsular or parenchymal hematoma – Intraparenchymal hematoma >10 cm – Laceration >3 cm depth – Any injury in the presence of a liver vascular injury or active bleeding contained within liver parenchyma	– Subcapsular hematoma >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma – Intraparenchymal hematoma >10 cm – Laceration >3 cm in depth	– Subcapsular hematoma >50%-surface area; ruptured subcapsular or intraparenchymal hematoma – Intraparenchymal hematoma >10 cm – Laceration >3 cm in depth
IV	4	– Parenchymal disruption involving 25–75% of a hepatic lobe – Active bleeding extending beyond the liver parenchyma into the peritoneum	– Parenchymal disruption involving 25–75% of a hepatic lobe	– Parenchymal disruption involving 25–75% of a hepatic lobe
V	5	– Parenchymal disruption >75% of hepatic lobe – Juxtahepatic venous injury to include retrohepatic vena cava and central major hepatic veins	– Parenchymal disruption >75% of hepatic lobe – Juxtahepatic venous injury to include retrohepatic vena cava and central major hepatic veins	– Parenchymal disruption >75% of hepatic lobe – Juxtahepatic venous injury to include retrohepatic vena cava and central major hepatic veins

Vascular injury is defined as a pseudoaneurysm or arteriovenous fistula and appears as a focal collection of vascular contrast that decreases in attenuation with delayed imaging, Active bleeding from a vascular injury presents as vascular contrast, focal or diffuse, that increases in size or attenuation in delayed phase. Vascular thrombosis can lead to organ infarction.

Grade based on highest grade assessment made on imaging, at operation or on pathologic specimen.

More than one grade of liver injury may be present and should be classified by the higher grade of injury.

Advance one grade for multiple injuries up to a grade III.

From: Liver trauma: WSES 2020 guidelines

	WSES grade	AAST	Hemodynamic
Minor	WSES grade I	I–II	Stable
Moderate	WSES grade II	III	Stable
Severe	WSES grade III	IV–V	Stable
	WSES grade IV	I–VI	Unstable

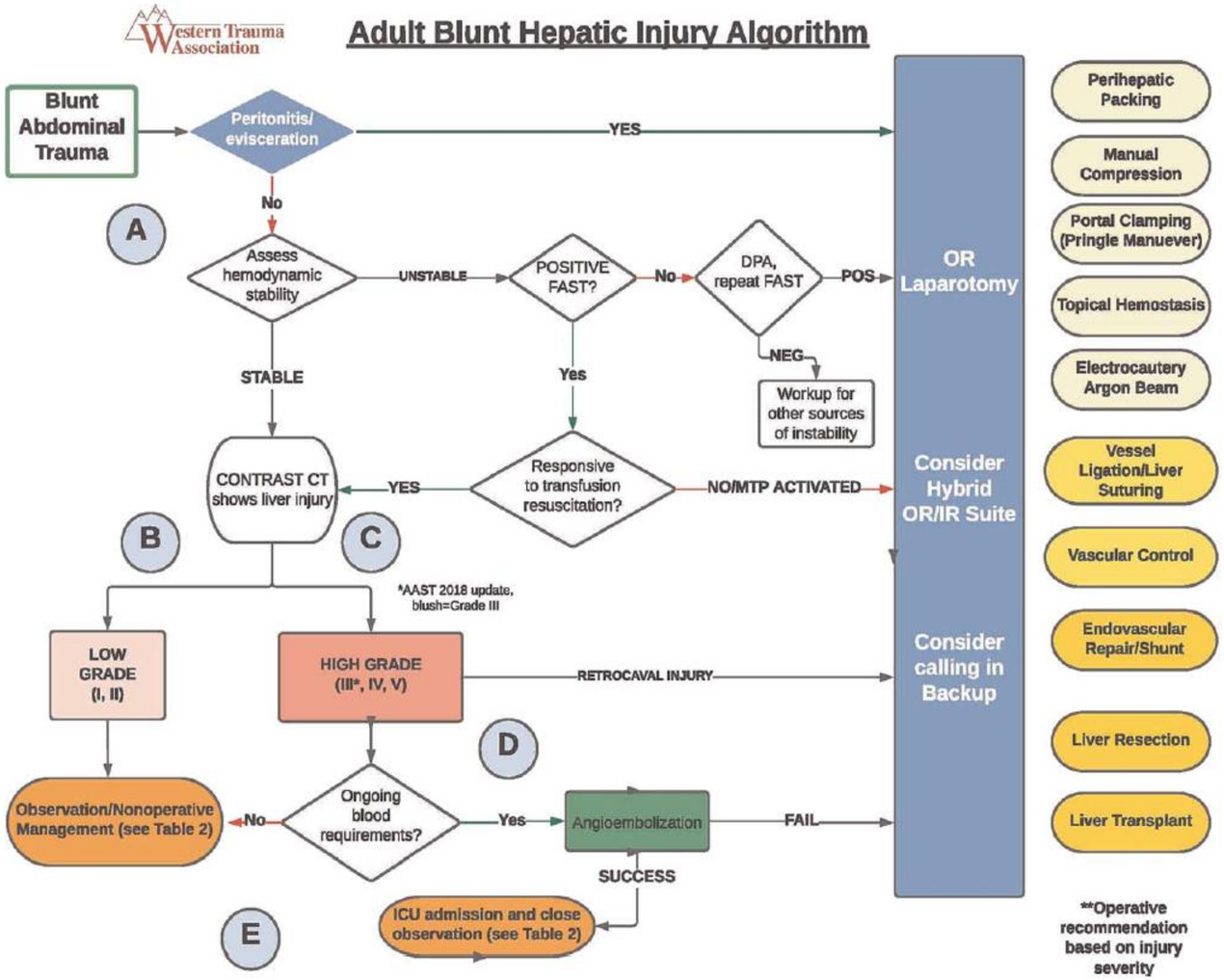


Figure 1. Western Trauma Association algorithm for the diagnosis and management of blunt hepatic injury in adults. Circled letters correspond to lettered sections in the article's text. OR, operating room; IR, interventional radiology.

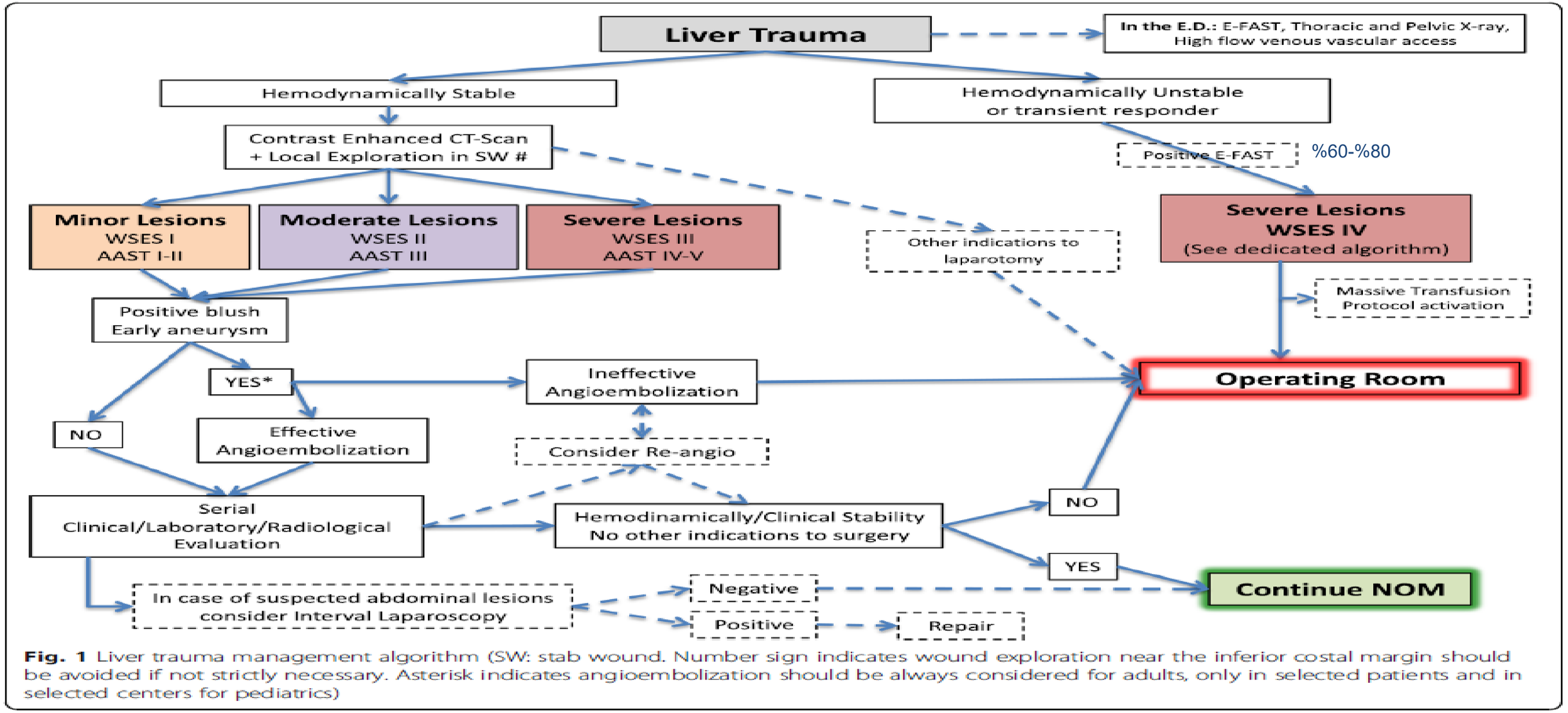


Fig. 1 Liver trauma management algorithm (SW: stab wound. Number sign indicates wound exploration near the inferior costal margin should be avoided if not strictly necessary. Asterisk indicates angioembolization should be always considered for adults, only in selected patients and in selected centers for pediatrics)

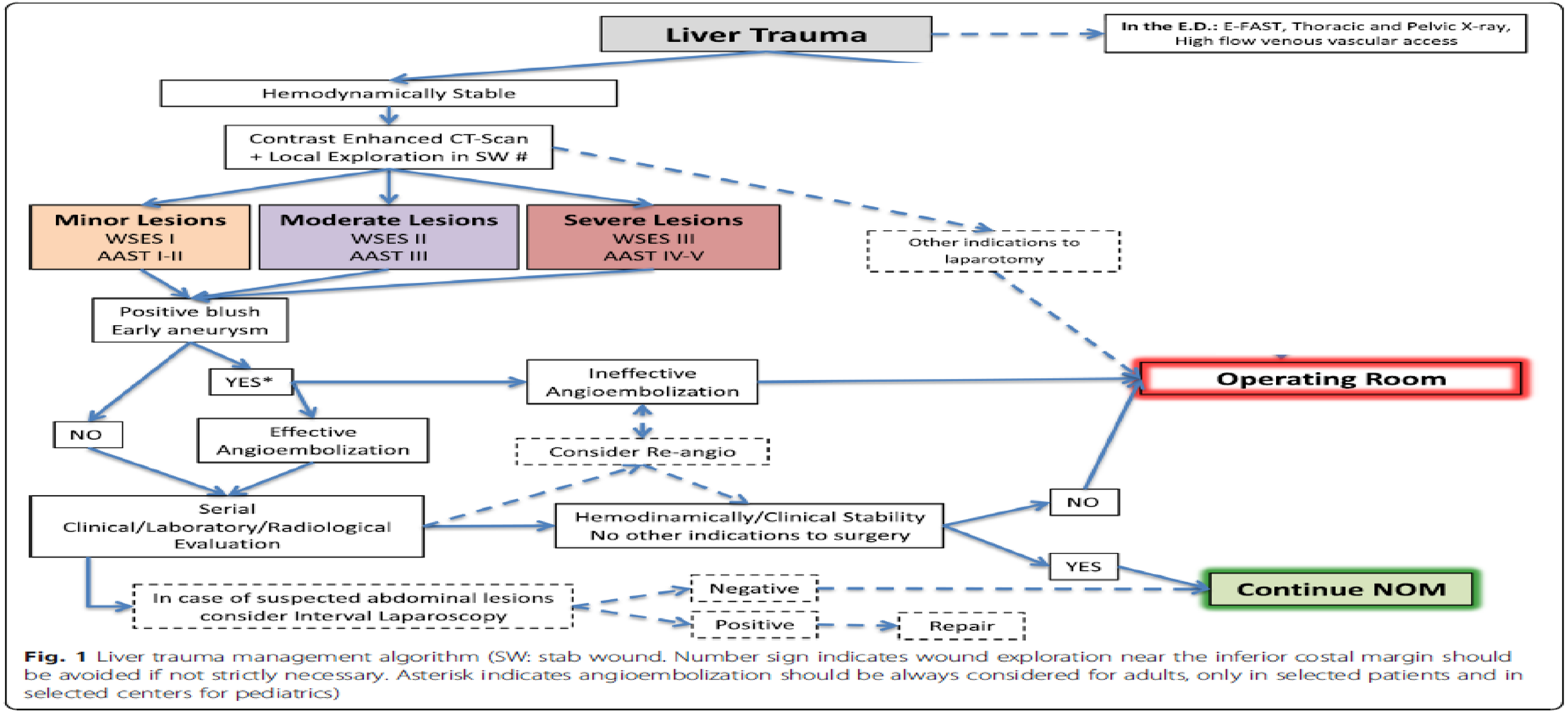


Fig. 1 Liver trauma management algorithm (SW: stab wound. Number sign indicates wound exploration near the inferior costal margin should be avoided if not strictly necessary. Asterisk indicates angioembolization should be always considered for adults, only in selected patients and in selected centers for pediatrics)

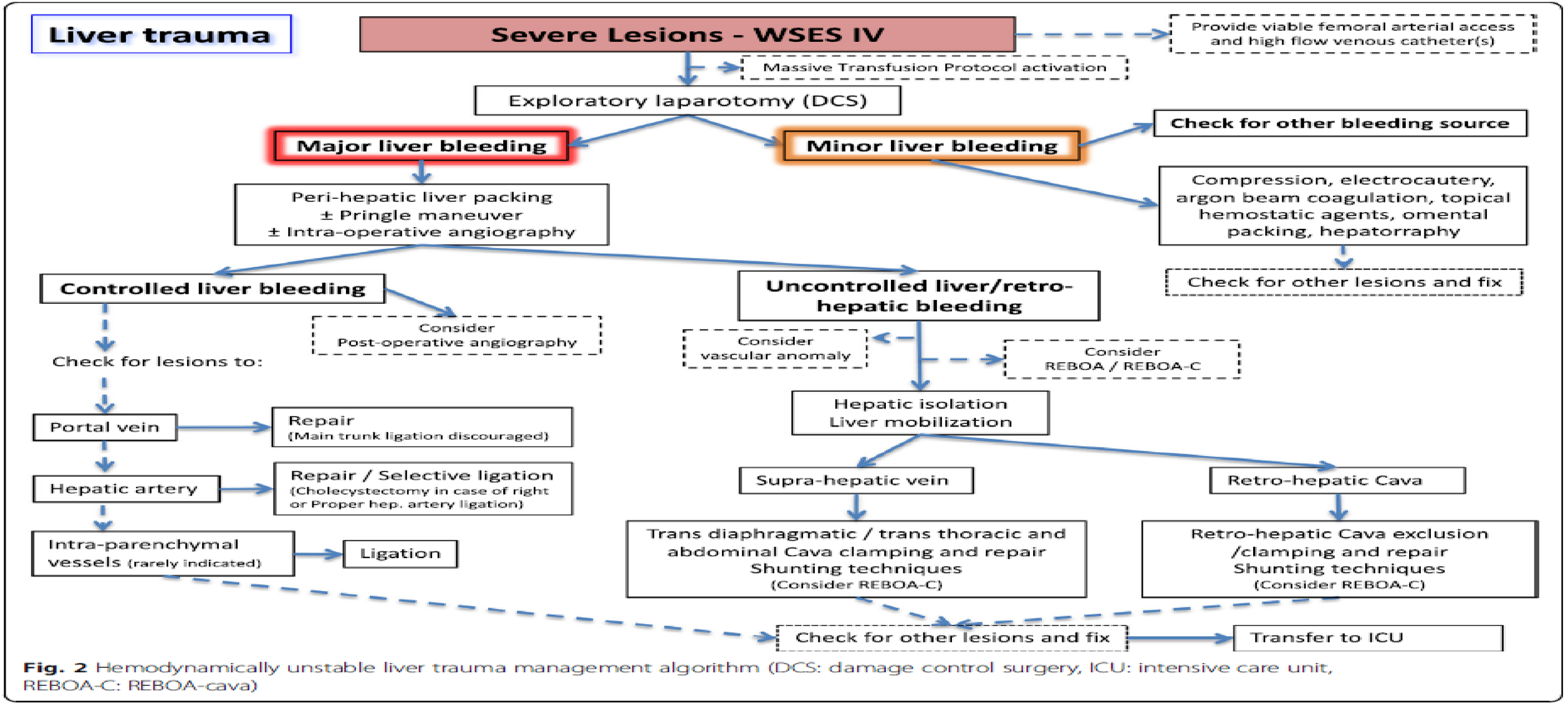


Fig. 2 Hemodynamically unstable liver trauma management algorithm (DCS: damage control surgery, ICU: intensive care unit, REBOA-C: REBOA-cava)

ANJİOEMBOLİZAYON

- ✓ Embolizasyonun karaciğere özgü komplikasyon oranı (biloma, nekroz, apse) %7 ile %94 arasındadır.

- ✓ Anjiyoembolizasyon yapılan hastaların %16'sın hepatik nekroz gelişebilmektedir.

- ✓ Yaralanmanın radyolojik özellikleri, transfüzyon gereksinimi, cerrahi hemostaz planları ve her vaka için komplikasyon olasılığı dikkate alınarak anjioembolizasyon planlanmalıdır.

Segalini E, Morello A, Leati G, Di Saverio S, Aseni P. Primary angioembolization in liver trauma: major hepatic necrosis as a severe complication of a minimally invasive treatment—a narrative review. *Updates Surg*. 2022;74(5):1511–1519.
Dabbs DN, Stein DM, Scalea TM. Major hepatic necrosis: a common complication after angioembolization for treatment of high-grade liver injuries. *J Trauma*. 2009;66(3):621–627; discussion 7–9.

✓ Kanama kontrolünden önce aşırı resüsitasyondan kaçınmak

✓ Hayatı tehdit eden retrohepatik venlerde veya vena kava yaralanması olan hastalarda venöz hidrostatik basınç artışından kaçınılmalı

✓ Kanama cerrahi olarak kontrol altına alınana kadar hipotansif resüsitasyon (sistolik kan basıncı ≤90 mm Hg-ortalama arter basıncı ≤60 mm Hg),

Reed, Christopher R. MD; Brown, Joshua B. MD, MSc; Peitzman, Andrew B. MD. Liver injury: What you need to know. Journal of Trauma and Acute Care Surgery ():10.1097/TA.0000000000004684, July 4, 2025.

TABLE 2 - Western Trauma Association Blunt Hepatic Injury Guideline for Nonoperative and Postintervention Management

	Low Grade	High Grade
AAST Grade	**I and II**	**III, IV, and V**
ICU	No	Yes — 24 h minimum*
Laboratories	Every 12 h until stable × 2	CBC — every 6 h until stable × 2, LFTs
Monitoring	Vital signs every 4 h	Vital signs every 1 h Continuous heart rate with every 2-h BP check
Diet	Diet ad lib as tolerated Clear liquid diet for 12 h	NPO × 12 h
VTE prophylaxis	Start within 24 h of stable Hgb	Start within 24–48 h of stable Hgb
Follow-up contrast CT scan	Clinical change (sepsis, abdominal pain, jaundice) Laboratory change (elevated transaminases or decrease in Hgb)	Clinical change (sepsis, abdominal pain, jaundice) Laboratory change (elevated transaminases or decrease in Hgb) Consider screening CT at 3–5 d before discharge to evaluate for PSA, AVF, biliary issues
Biloma/bile leak	ERCP/IR	ERCP/IR Surgical management if recurrent, failure of NOM
Abscess	Drain/IR Surgical management if recurrent, failure of NOM	Drain/IR Surgical management if recurrent, failure of NOM
Discharge criteria (minimum admission time)	Stable Hgb 24 h from injury Tolerating oral intake	Stable Hgb 72 h from injury Tolerating oral intake
Return to normal activity	Grade + 2 = weeks to return	6 wk and clinical clearance by MD

*Select high-grade injuries without evidence of hemorrhage may not require ICU admission.
Reprinted with permission from Ref. [39].
AVF, arteriovenous fistula; BP, blood pressure; CBC, complete blood count; ERCP, endoscopic retrograde cholangiopancreatography; Hb, hemoglobin; IR, interventional radiology; LFT, liver function test; MD, medical doctor; NPO, nothing by mouth; PSA, pseudoaneurysm; VTE, venous thromboembolism.

Reed, Christopher R. MD; Brown, Joshua B. MD, MSc; Peitzman, Andrew B. MD. Liver injury: What you need to know. Journal of Trauma and Acute Care Surgery ():10.1097/TA.0000000000004684, July 4, 2025.

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Blunt and Penetrating Liver Trauma have Similar Outcomes in the Modern Era

A. A. Keizer, J. H. C. Arkenbosch, [...], and D. L. Clarke +4 View all authors and affiliations

- ✓ 2012-2018 yılları arasında
- ✓ 808 hasta

	Penetrating	Blunt	p-value
Total N = 808	367	441	
1	56 (15.3%)	61 (13.8%)	0.094
2	119 (32.4%)	157 (35.6%)	
3	69 (18.8%)	91 (20.6%)	
4	25 (6.8%)	51 (11.6%)	
5	3 (0.8%)	13 (2.9%)	
Surgery, n (%)	308 (83.9)	143 (32.4)	<0.0001
Outcome			
Mortality (%)	28 (7.6%)	40 (9.1%)	0.463
Complications (%)	214 (58.3%)	240 (54.4%)	0.267

SD: standard deviation; ICU: intensive care unit; RTS: Revised Trauma Score; ISS: Injury Severity Score; IQR: interquartile range; AAST: American Association for the Surgery of Trauma; IAV: Intra-abdominal Vascular Injuries.

- ✓ Operatif müdahale gerektiren yüksek dereceli karaciğer yaralanmalarının, yalnızca %2,5'sinde anatomik rezeksiyon veya vasküler onarım gerektirir.

Anatomik + Klinik

Non Operatif Takip

Field X, Crichton J, Kong V, Ko J, Laing G, Bruce J, et al. AAST grade of liver injury is not the single most important consideration in decision making for liver trauma. *Injury*. 2024;55(9):111526.


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