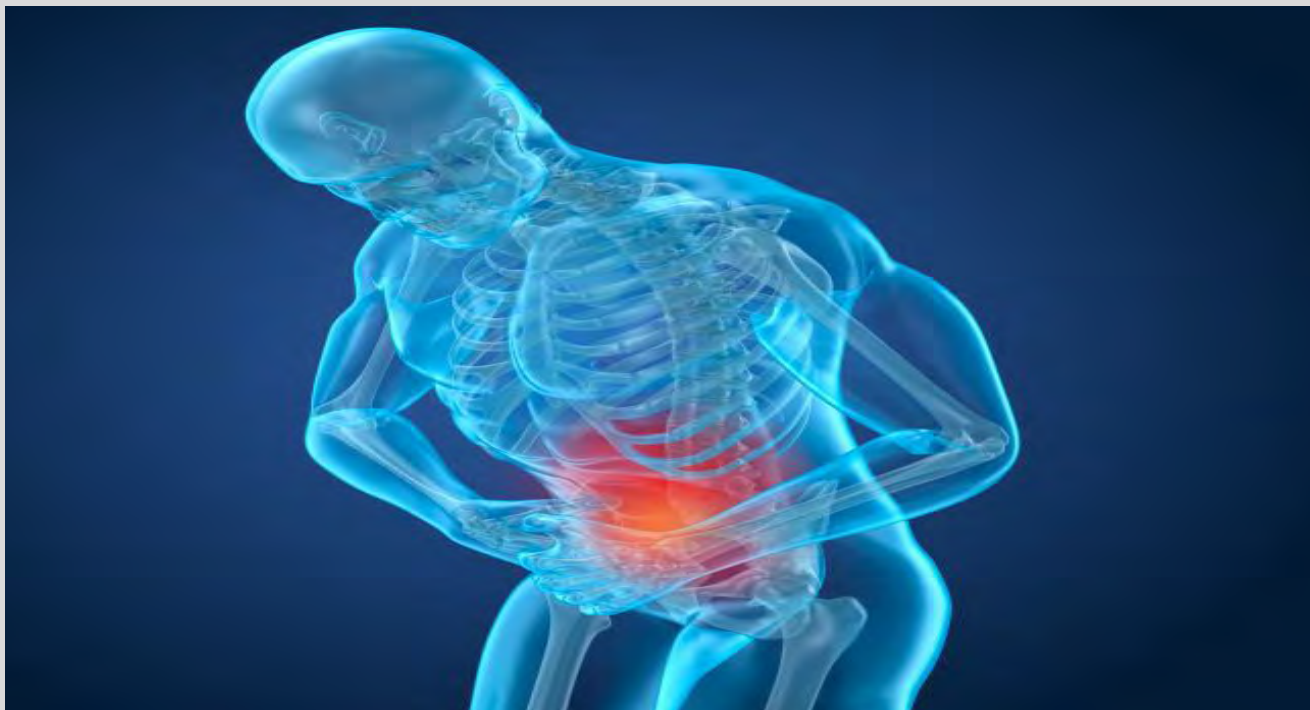


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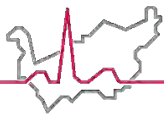
# LIVER TRAUMA

Dr Méd. Fournier Ian

Spécialiste chirurgie générale, spéc. chirurgie viscérale membre FMH

Médecin adjoint service de chirurgie générale - unité viscérale de l'HVS

Médecin consultant service de chirurgie viscérale et transplantation des HUG



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# HISTORY

- **1975: First presentation at The American Association for the Surgery of Trauma**
  - Charles/Lucas/Ledgerwood
    - JTrauma 1976; 16:442-451: Prospective evaluation of hemostatic technique for liver injuries
- **1979: liver bleeding management**
  - Calne/McMasther/Pentlow
    - Br J Surg 1979; 66:338-339: The treatment of major liver trauma by packing with transfert of the patient for definitive treatment
- **1981-1986: liver bleeding Management**
  - Feliciano/Mattox
    - J Trauma 1981; 21:285-290: Intra abdominal packing for control of hepatic hemorrhage: a reappraisal



**James Hogarth Pringle**  
**1863-1941**

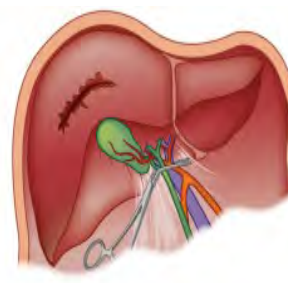
NOTES ON THE ARREST OF HEPATIC  
HEMORRHAGE DUE TO TRAUMA. BY J. HOGARTH  
PRINGLE, F.R.C.S., OF GLASGOW, Lecturer on Surgery  
in Queen Margaret College,



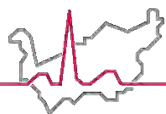
Push



Pack

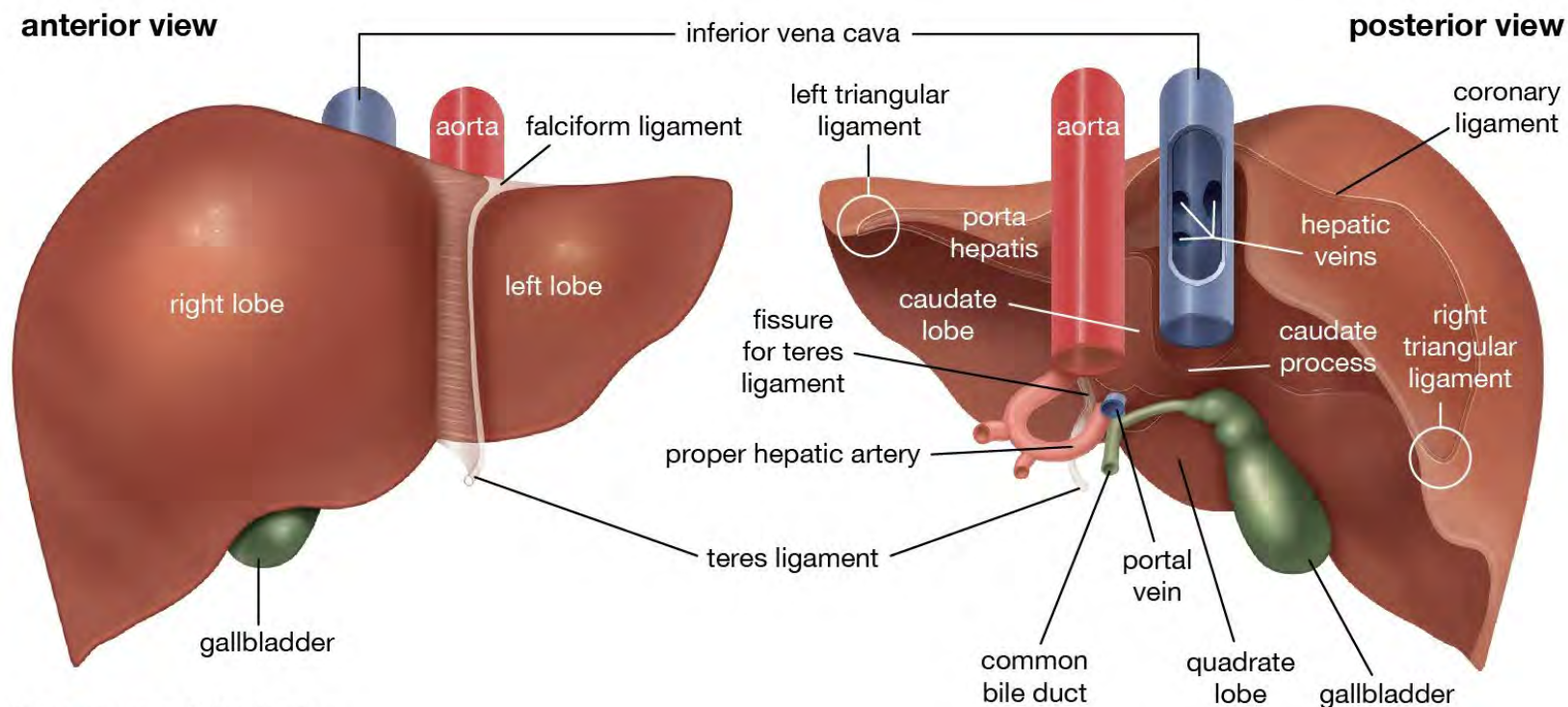


Pringle

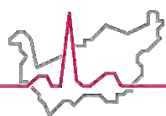


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# ANATOMY

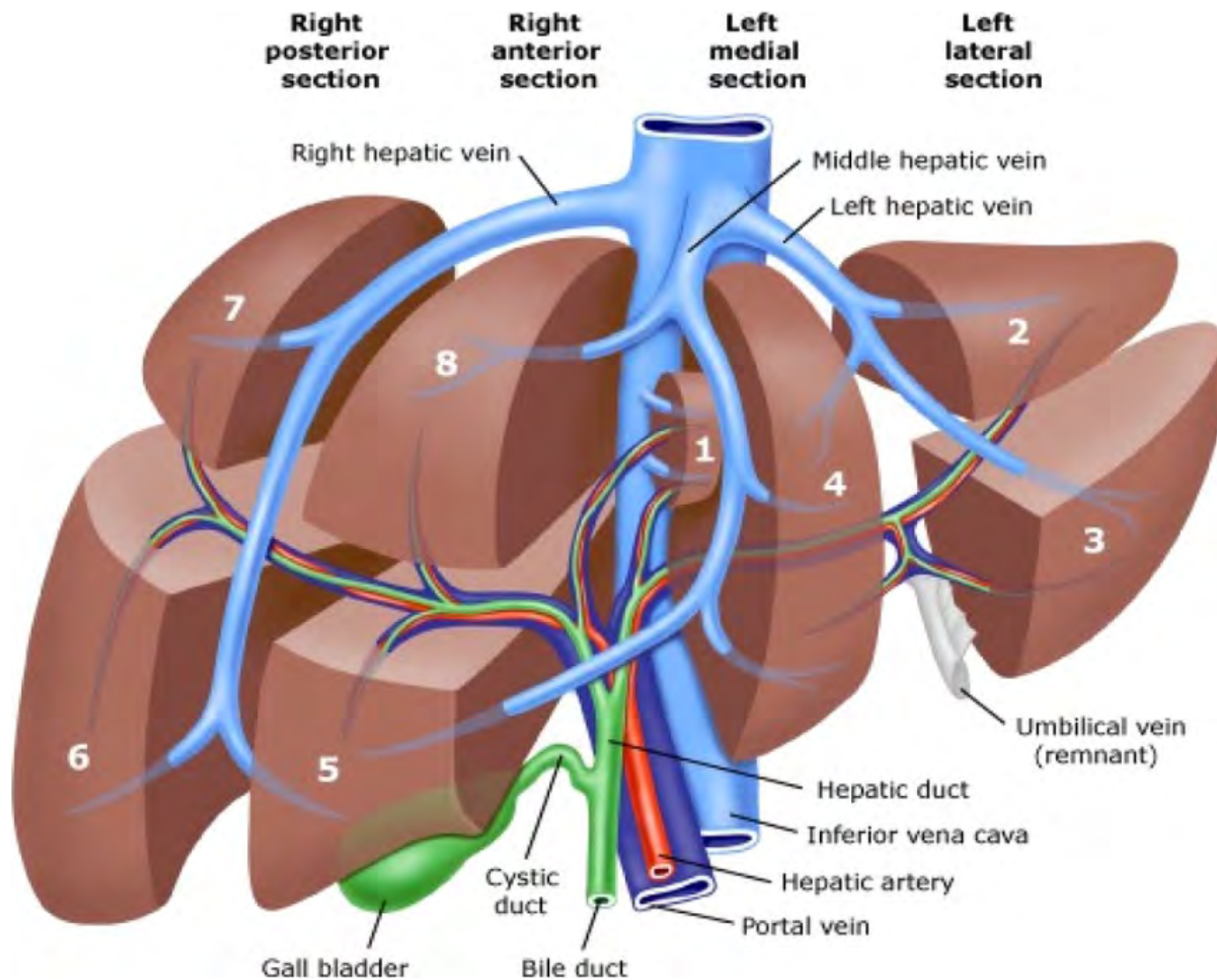


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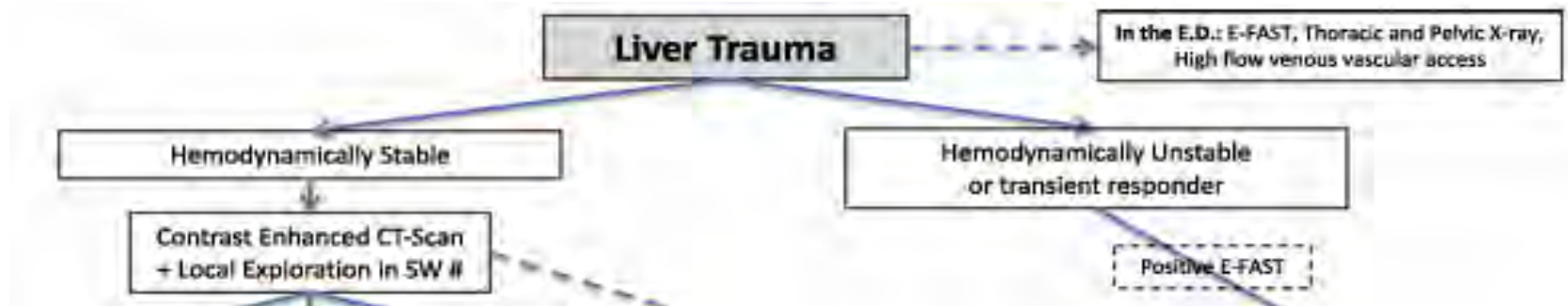
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# ANATOMY





# When suspect Liver trauma?



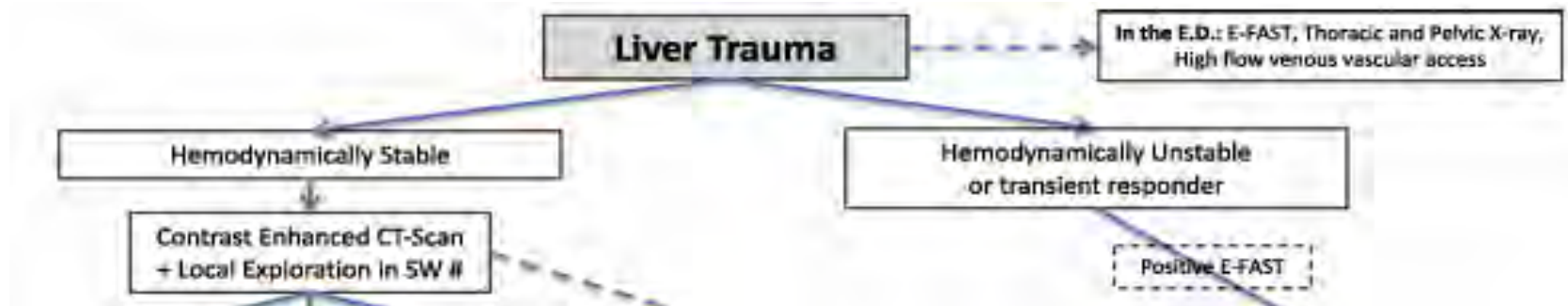
## • Injury Mechanism:

- Penetrating
  - All thoraco-Abdominal Gunshot wounds
  - All High Velocity penetrating trauma
  - Right torso/back/flanc or upper abdominal quadrant
- Blunt
  - High deceleration
  - Crush
  - Direct shock
- Blast
  - All

## • ATLS10th edition:

- Penetrating
  - Gunshot: small bowel (50%) Colon (40%) Liver (30 %)
  - Stab wound: Liver(40%) Small Bowel (30%) Diaphragm/lung (20%)
- Blunt: Spleen (40-55%) Liver (35-45%)

# When suspect Liver trauma?

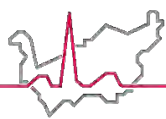


- **Work out:**

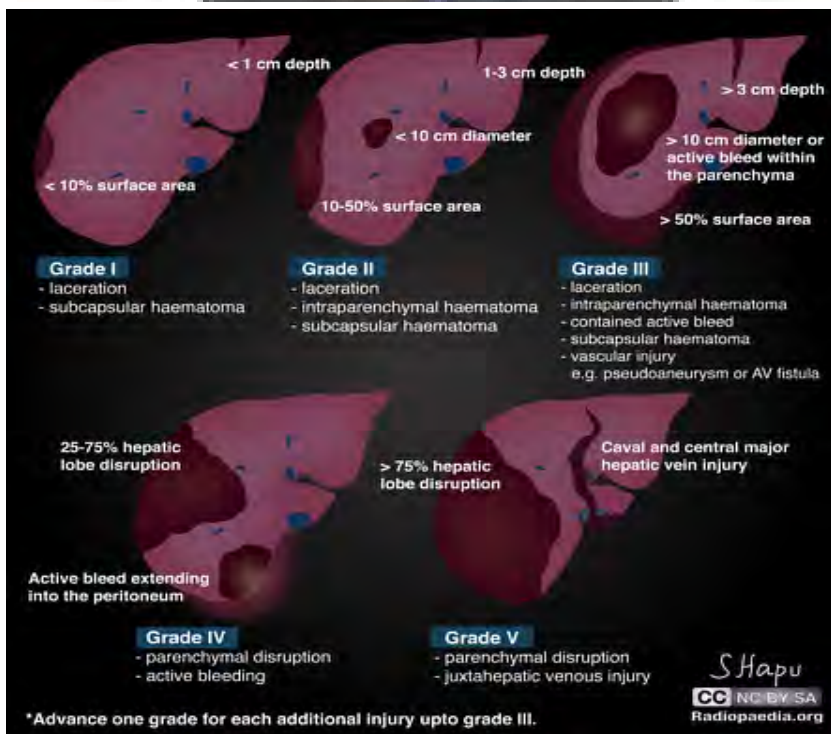
- Clinical finding
- Role of liver enzyme
  - Patients with ALT >57 U/l and AST >113 U/l are strongly associated with liver injury and require further imaging studies and close management.
  - None of the laboratory tests were related to the severity of the liver injuries

Tian Z, Liu H, Su X, Fang Z, Dong Z, Yu C, Luo K. Role of elevated liver transaminase levels in the diagnosis of liver injury after blunt abdominal trauma. *Exp Ther Med.* 2012 Aug;4(2):255-260. doi: 10.3892/etm.2012.575. Epub 2012 May 15. PMID: 23139714; PMCID: PMC3460295.

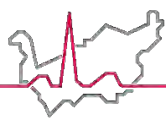
- Contrast Cat-scann



# IDENTIFY & CLASSIFY



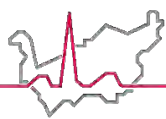
Grade	Injury Type	Description
I	Hematoma	subcapsular, <10% surface area
	Laceration	capsular tear, <1 cm parenchymal depth
II	Hematoma	subcapsular, 10–50% surface area
	Laceration	capsular tear 1–3 cm parenchymal depth, <10 cm length
III	Hematoma	subcapsular, >50% surface area of ruptured subcapsular or parenchymal hematoma
	Hematoma	intraparenchymal >10 cm
	Laceration	capsular tear >3 cm parenchymal depth
IV	Vascular	injury with active bleeding contained within liver parenchyma
	Laceration	parenchymal disruption involving 25–75% hepatic lobe or involving 1–3 Couinaud segments
	Vascular	injury with active bleeding breaching the liver parenchyma into the peritoneum
V	Laceration	parenchymal disruption involving >75% of hepatic lobe
	Vascular	juxtahepatic venous injuries (retrohepatic vena cava / central major hepatic veins)



# IDENTIFY & CLASSIFY







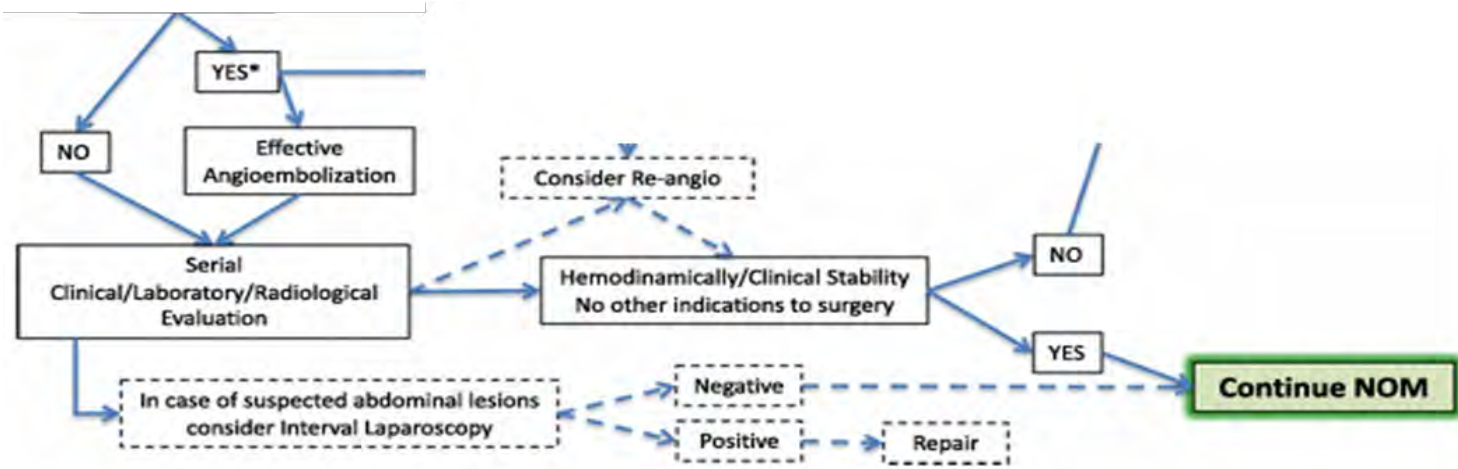
# IDENTIFY & CLASSIFY



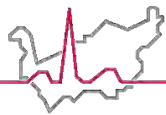
**Table 2** WSES Liver Trauma Classification

	WSES grade	Blunt/Penetrating (Stab/Guns)	AAST	Haemodynamic	CT-scan	First-line Treatment
MINOR	WSES grade I	B/P SW/GSW	I-II	Stable		
MODERATE	WSES grade II	B/P SW/GSW	III	Stable	Yes + Local Exploration in SW#	NOM* + Serial Clinical/Laboratory/ Radiological Evaluation
SEVERE	WSES grade III	B/P SW/GSW	IV-V	Stable		
	WSES grade IV	B/P SW/GSW	I-VI	Unstable	No	OM

# MANAGEMENT



- Organ-specific operative rates increased with increasing grade
- Grade alone is not predictor for need of surgery
- **Isolated liver injuries NOM Success**
  - 91.5% of grade I and II injuries,
  - 79% of grade III,
  - 72.8% of grade IV,
  - 62.6% of grade V



# FOLLOW-UP AFTER NOM

- Text Book recommendation

- Ct –scan only with symptoms or clinic-biological signs of deterioration
  - Definitive data are scares few series report only.
  - grade III–V injuries.
  - Cuff et al <sup>38</sup> reported that of the 31 patients who had follow-up CT scans 3 to 8 days after injury, only three scans changed management.
  - Cox et al <sup>39</sup> concluded from their follow-up of 530 patients, including 89 with grade IV or V injuries, that follow-up CT scans are not indicated as part of the non- operative management of blunt hepatic injuries.

- Reality

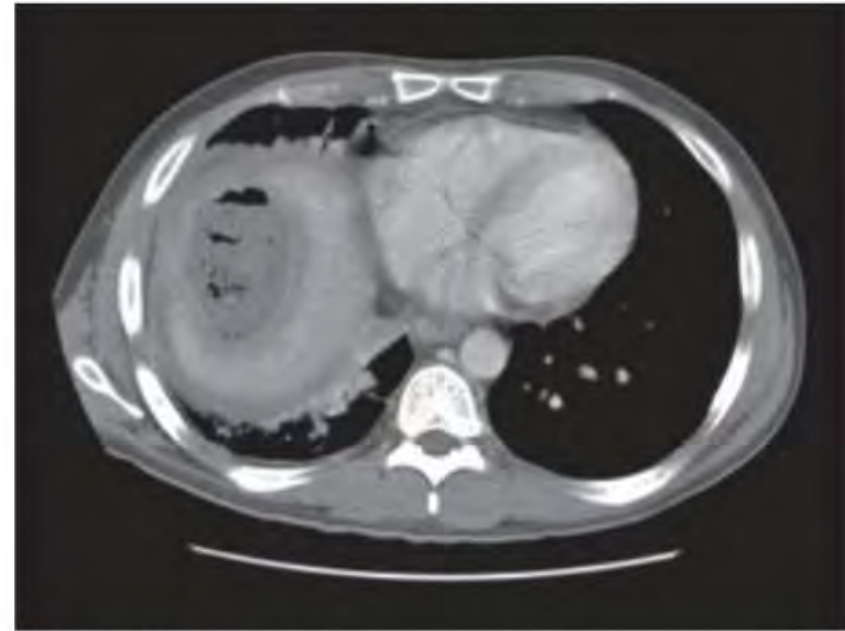
- Ct-scan are widely use during follow-up for grade III-V
- Contrast Cat-scan offers early detection of vascular complication (pseudanevrisma)
- Liver dedicated Us can offer good compromise for grade I-II-III (mild) as screening for bilioma 1-2 month after trauma
- MRI with specific excretion cholangiography protocol help decision making for biliary complication management

**R:** [38]Cuff RF, Cogbill TH, Lambert PJ. [Nonoperative management of blunt liver trauma: the value of follow-up abdominal computed tomography scans.](#) Am Surg. 2000;66:332..

[39] Cox JC, Fabian TC, Maish GO III, et al. [Routine follow-up imaging is unnecessary in the management of blunt hepatic injury.](#) J Trauma. 2005;59:1175.

# COMPLICATION OF NOM

- In a retrospective multi-institutional study of 553 patients with grade III to V hepatic injury, 12.6% developed hepatic complications. Significant coagulopathy and grade V injury were found to be predictors of a complication. <sup>25</sup>
  - Bile leaks 30%
  - Perihepatic abscess
  - Hepatic necrosis
  - Hemobilia



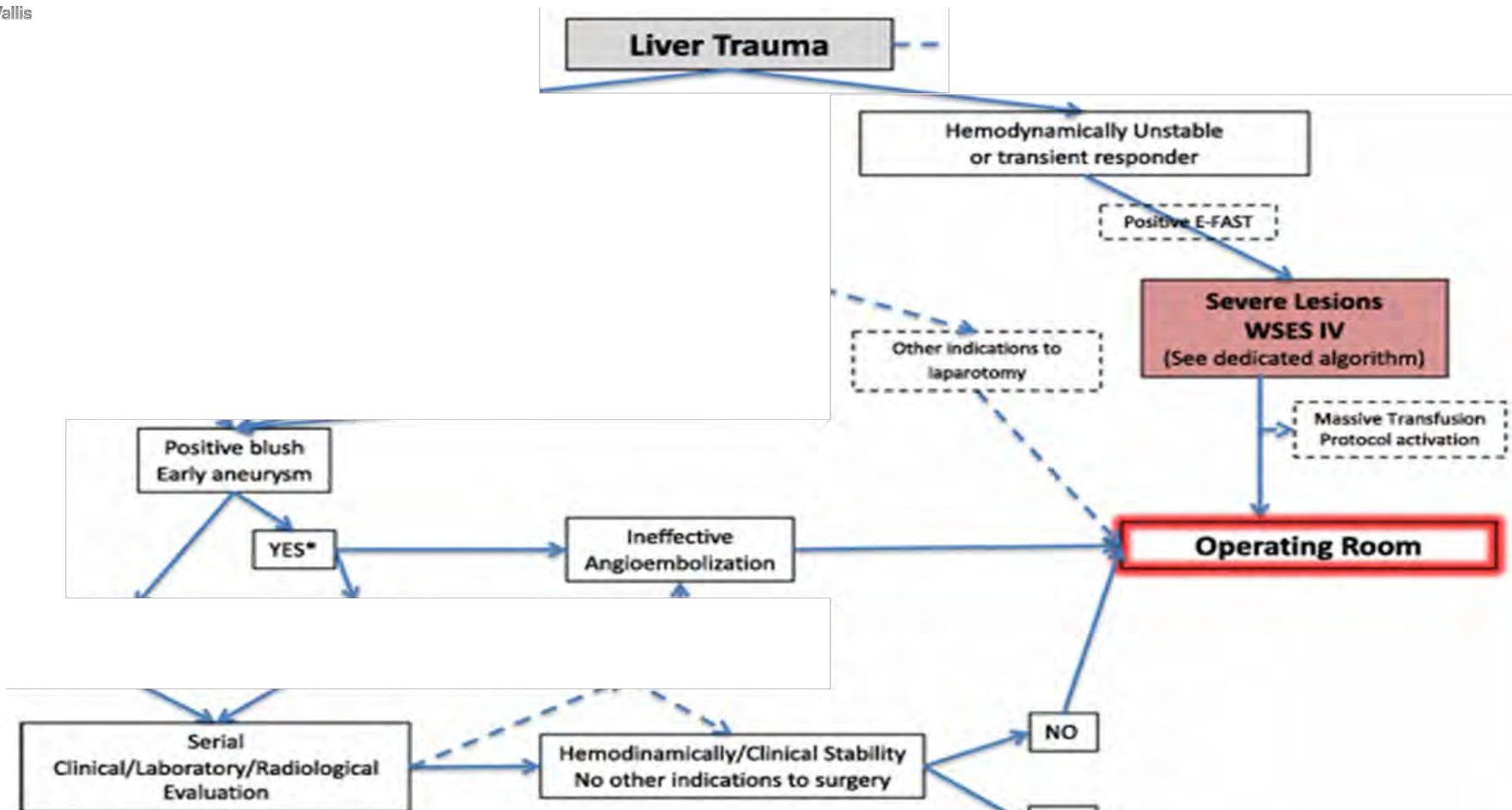
**FIGURE 33-7** Computed tomography scan demonstrating a hepatic abscess from a patient who had sustained a blunt hepatic injury.

**R:** [25]. Kozar RA, Moore FA, Cothren CC, et al. [Risk factors for hepatic morbidity following nonoperative management: multicenter study.](#)

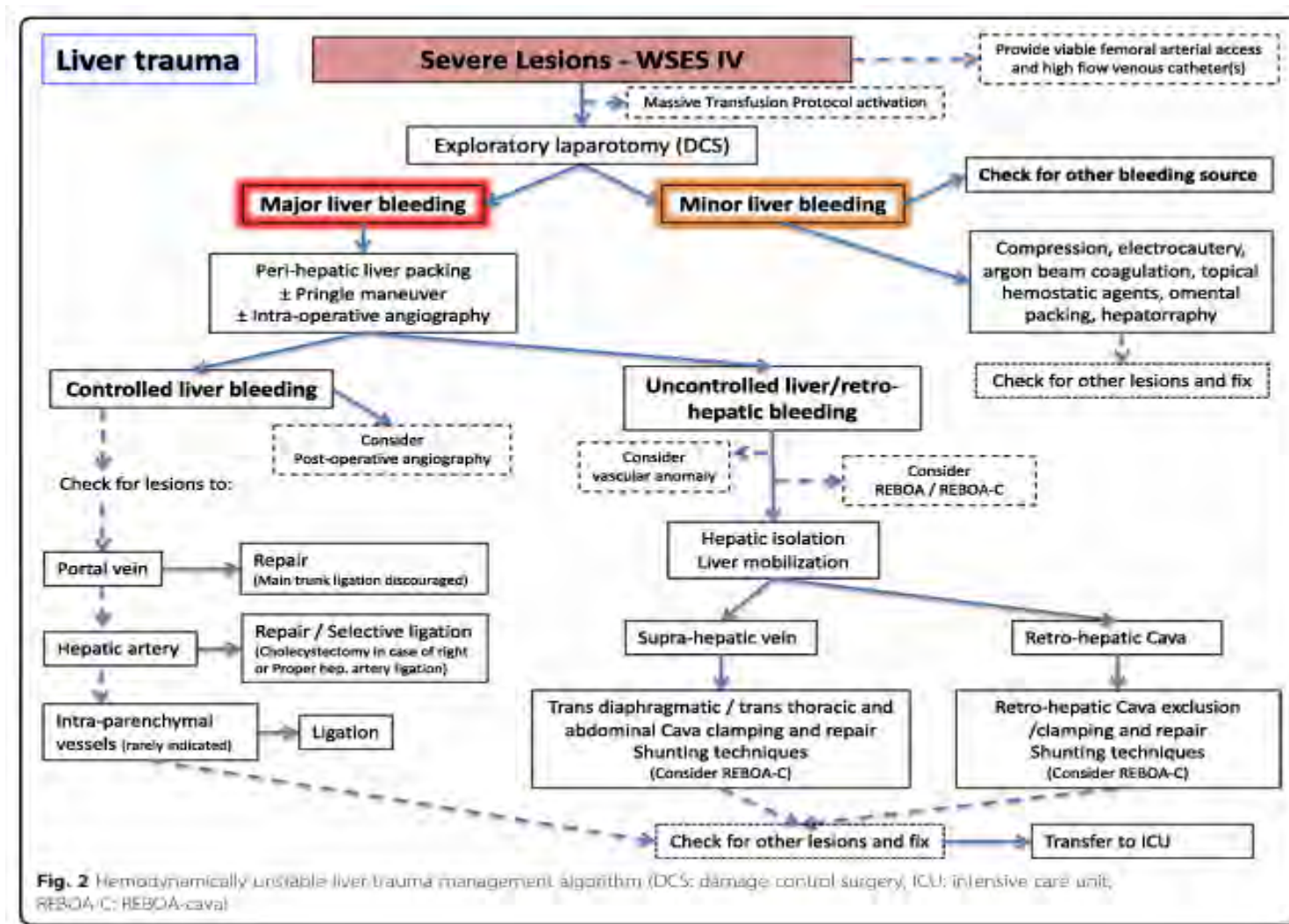
Arch Surg. 2006;141(5):451.

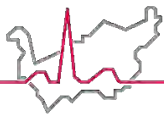


# MANAGEMENT



# Surgical Management

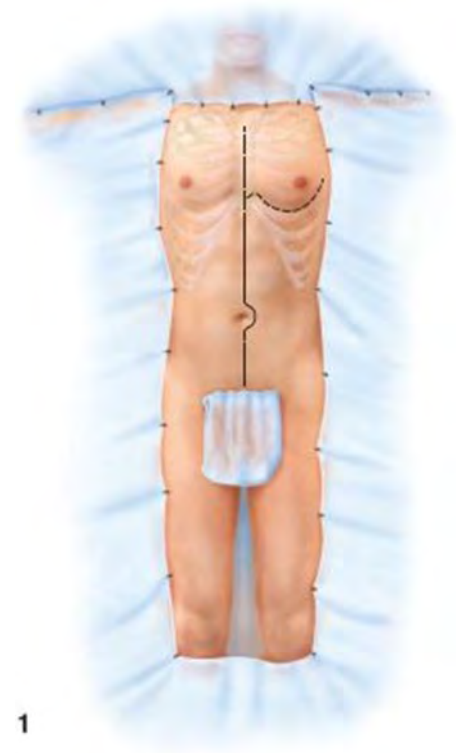


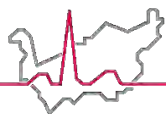


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# Surgical Statement in Unstable patient

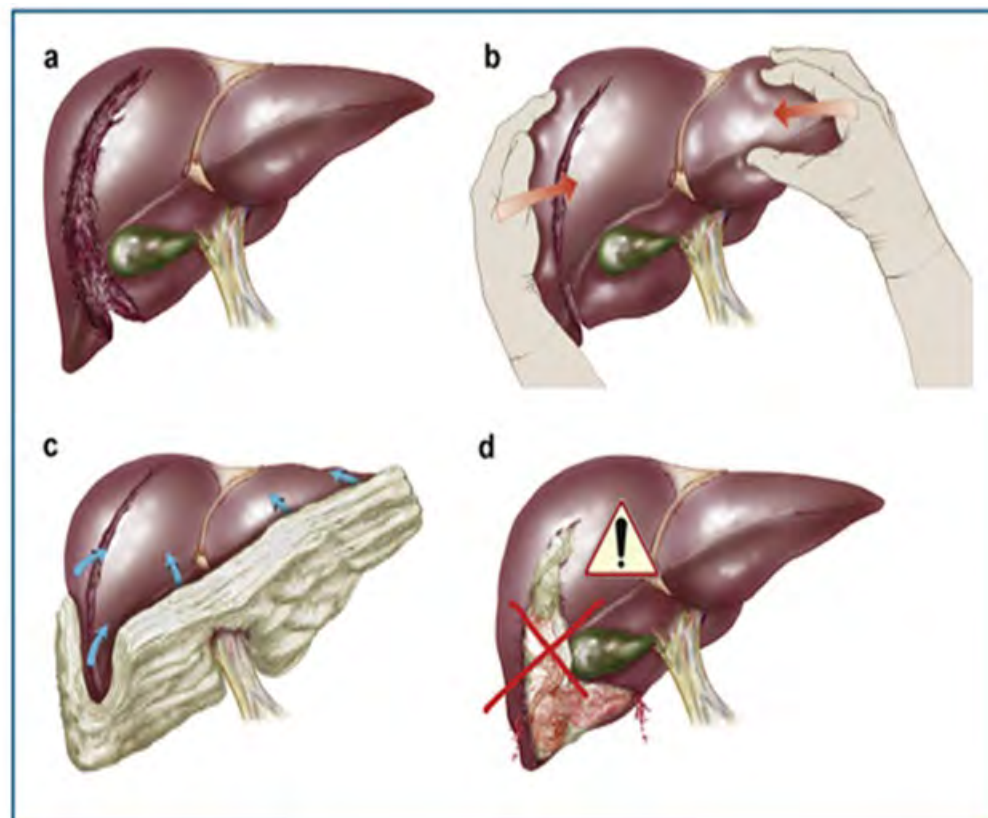
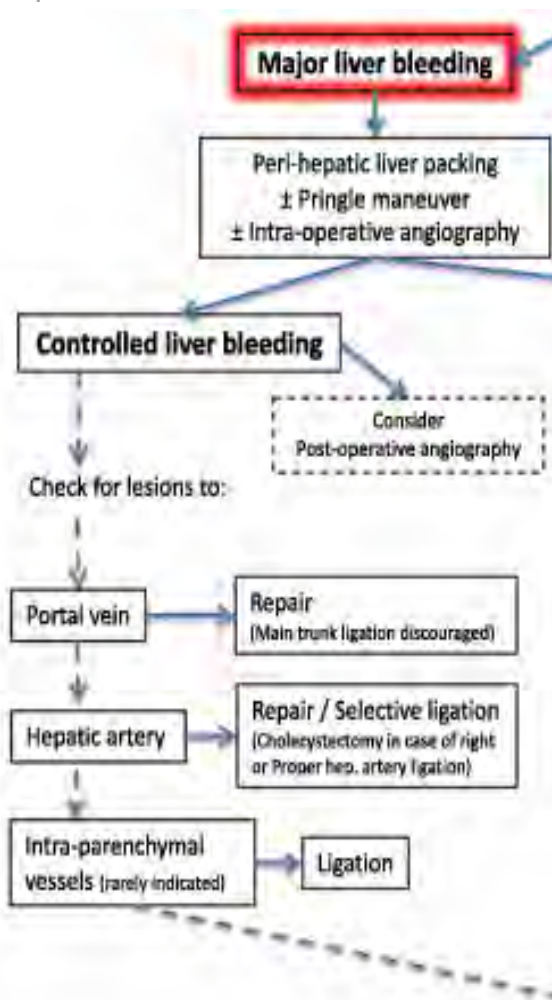
- **Goals**
  - Stop the Bleeding
  - Clean
  - Minimize CIVD
  - Fight against Hypothermia
- **Setting:**
  - Radiological modalities
  - Cell/saver
    - Can not be used with sever contamination
  - Team work
  - High Vs Low technological needs
- **Large draping/ Anticipate other site access**
  - Groin
  - thorax
- **Large laparotomy access**





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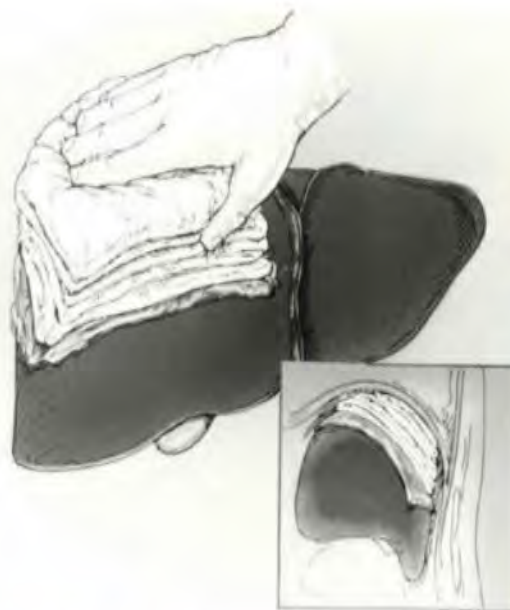
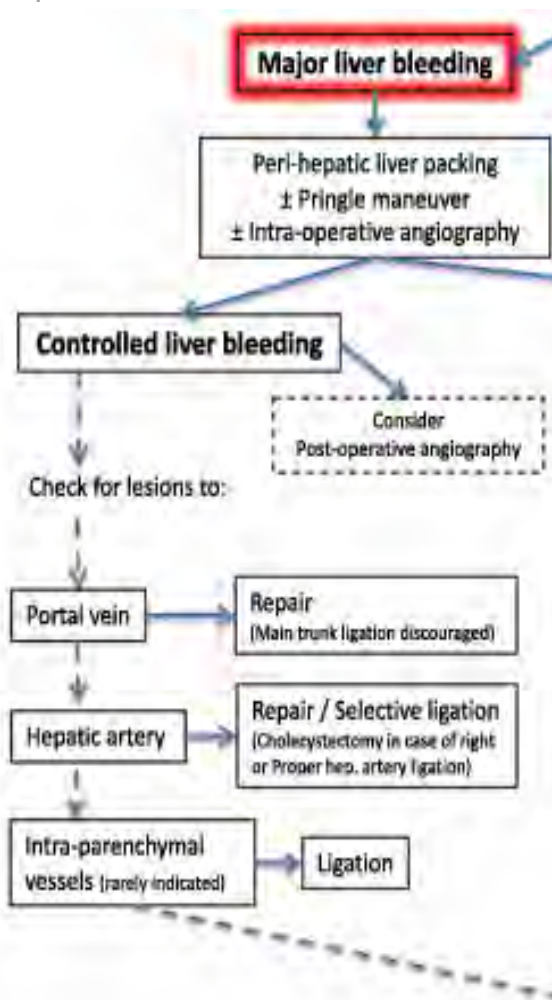
# Surgical Management



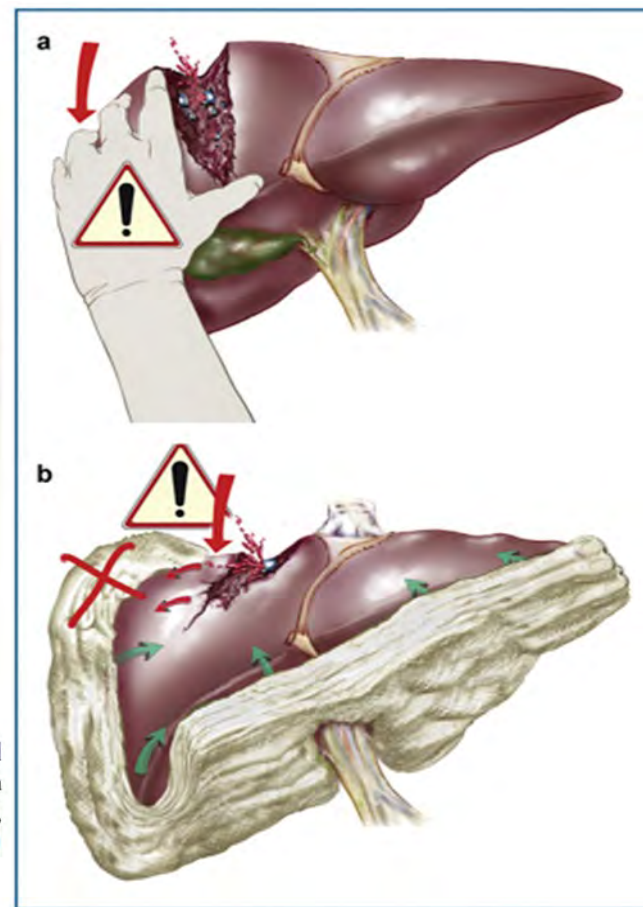
C. Letoublon, A. Amariutei, N. Taton, L. Lacaze, J. Abba, O. Risse, C. Arvieux, [Traumatismes fermés du foie : prise en charge](#), Journal de Chirurgie Viscérale, Volume 153, Issue 4, Supplement, 2016, Pages 35-45, ISSN 1878-786X, <https://doi.org/10.1016/j.jchirv.2016.07.002>.



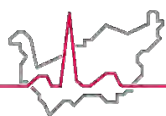
# Surgical Management



**FIGURE 33-10** Manual compression of a hepatic injury. Sagittal view (inset) of packs placed above the liver to assist with compression of hepatic bleeding. (Reproduced with permission from Feliciano DV, Pachter HL. Hepatic trauma revisited. *Curr Probl Surg*. 1989;26:453.)

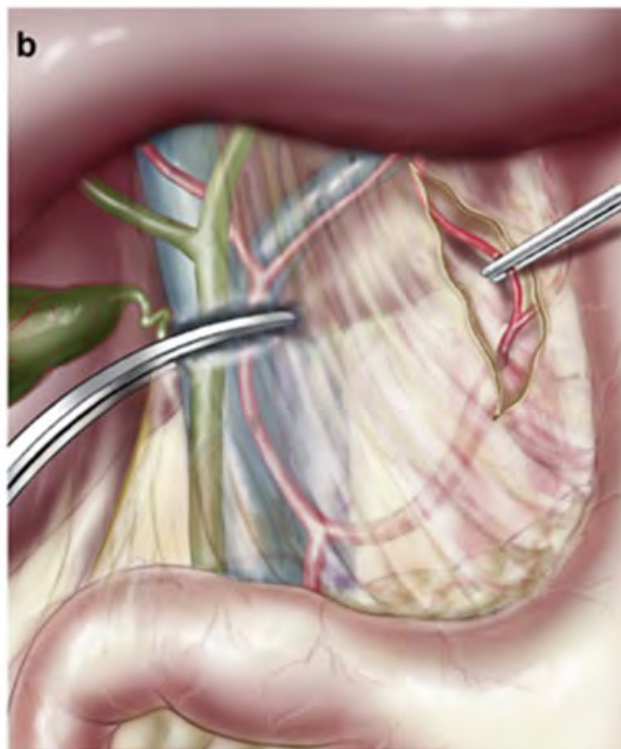
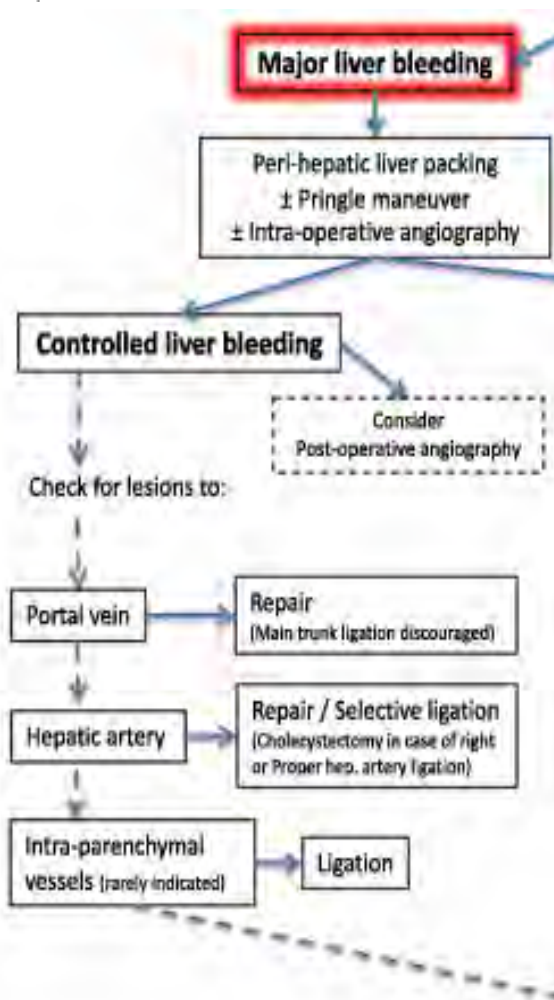


C. Letoublon, A. Amariutei, N. Taton, L. Lacaze, J. Abba, O. Risse, C. Arvieux, **Traumatismes fermés du foie : prise en charge**, Journal de Chirurgie Viscérale, Volume 153, Issue 4, Supplement, 2016, Pages 35-45, ISSN 1878-786X, <https://doi.org/10.1016/j.jchirv.2016.07.002>.



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# Surgical Management



....and in each case the hepatic and portal vessels were grasped between fingers and thumb as soon as the abdomen was opened, while blood clot, etc., was cleared out of the abdominal cavity and the necessary manipulations were being carried out on the liver.

In both cases the method acted admirably, perfect control of the bleeding areas of the liver was obtained and a clear field for operating.

- **Ann Surg 1908**

C. Letoublon, A. Amariutei, N. Taton, L. Lacaze, J. Abba, O. Risse, C. Arvieux, [Traumatismes fermés du foie : prise en charge](#), Journal de Chirurgie Viscérale, Volume 153, Issue 4, Supplement, 2016, Pages 35-45, ISSN 1878-786X, <https://doi.org/10.1016/j.jchirv.2016.07.002>.

02.

# Surgical Management

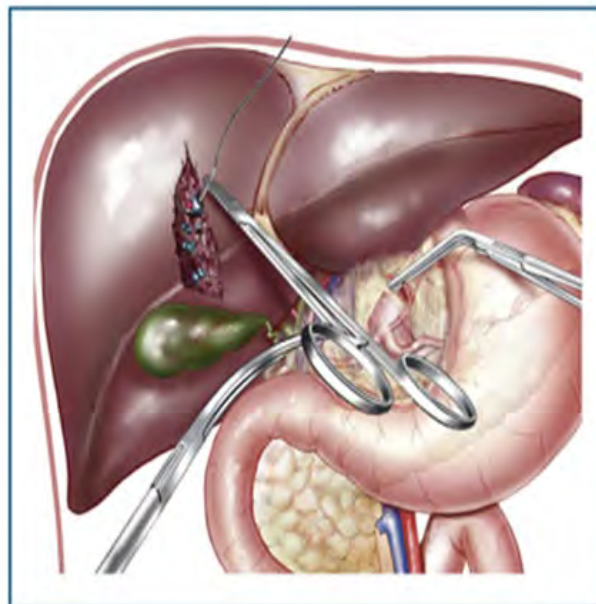
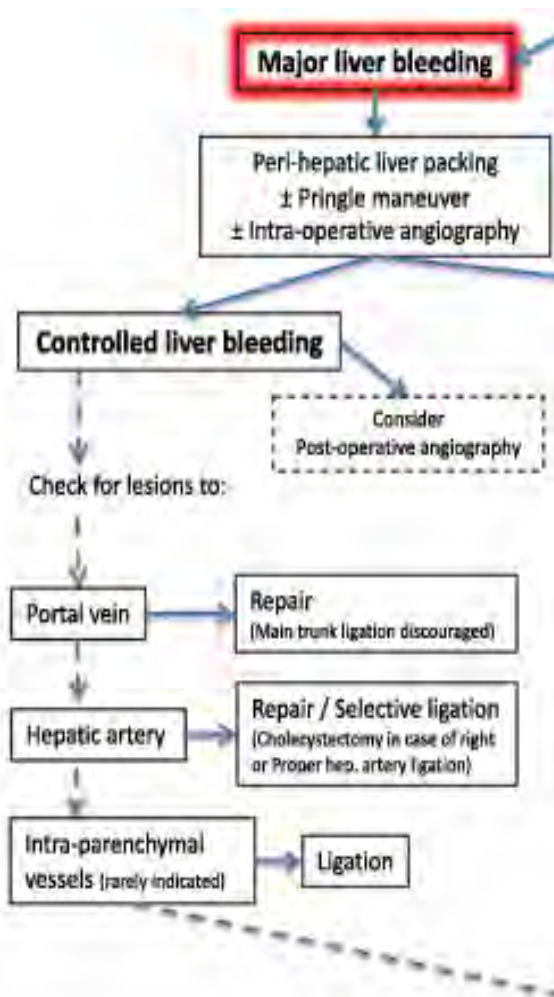


Figure 6. Individual ligation of bleeding vessels during pedicular clamping.

C. Letoublon, A. Amariutei, N. Taton, L. Lacaze, J. Abba, O. Risse, C. Arvieux, Traumatismes fermés du foie : prise en charge, Journal de Chirurgie Viscérale, Volume 153, Issue 4, Supplement, 2016, Pages 35-45, ISSN 1878-786X, <https://doi.org/10.1016/j.jchirv.2016.07.002>.

April 1981

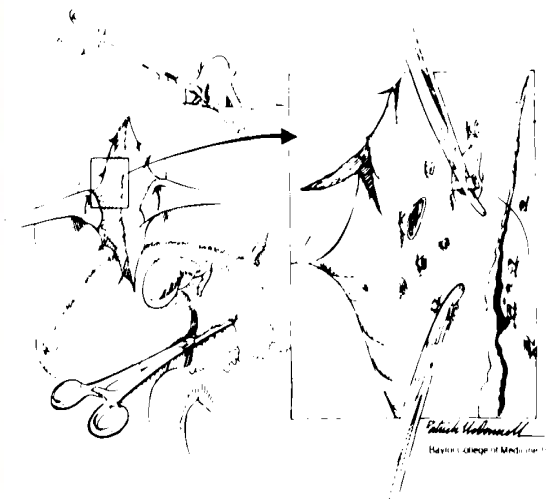


FIG. 2. Hepatotomy with selective vascular ligation.

0022-5292/81/2104-0202\$02.00/0  
THE JOURNAL OF TRAUMA  
Copyright © 1981 by The Williams & Wilkins Co.

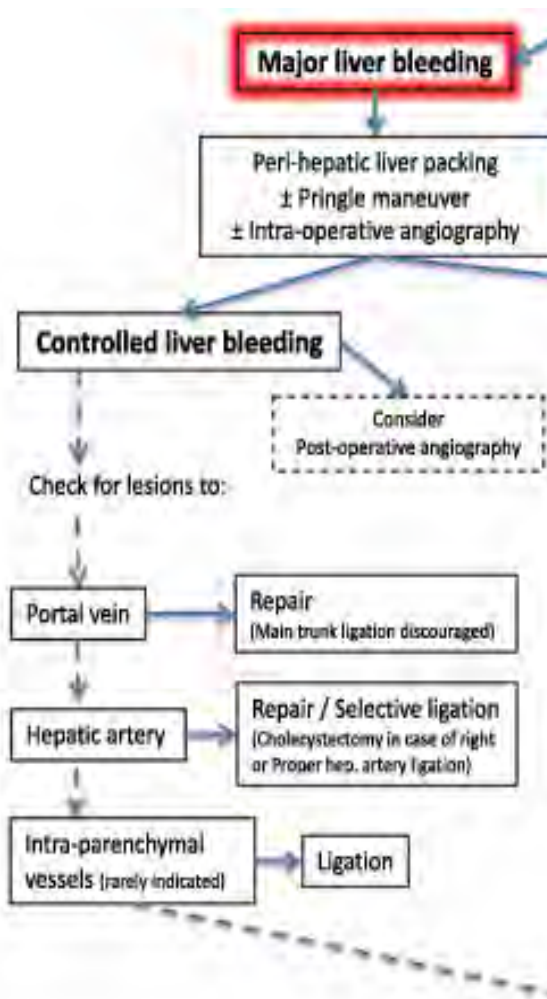
Vol. 21, No. 4  
Printed in U.S.A.

## Intra-abdominal Packing for Control of Hepatic Hemorrhage: A Reappraisal

DAVID V. FELICIANO, M.D., KENNETH L. MATTOX, M.D., and GEORGE L. JORDAN, JR., M.D.

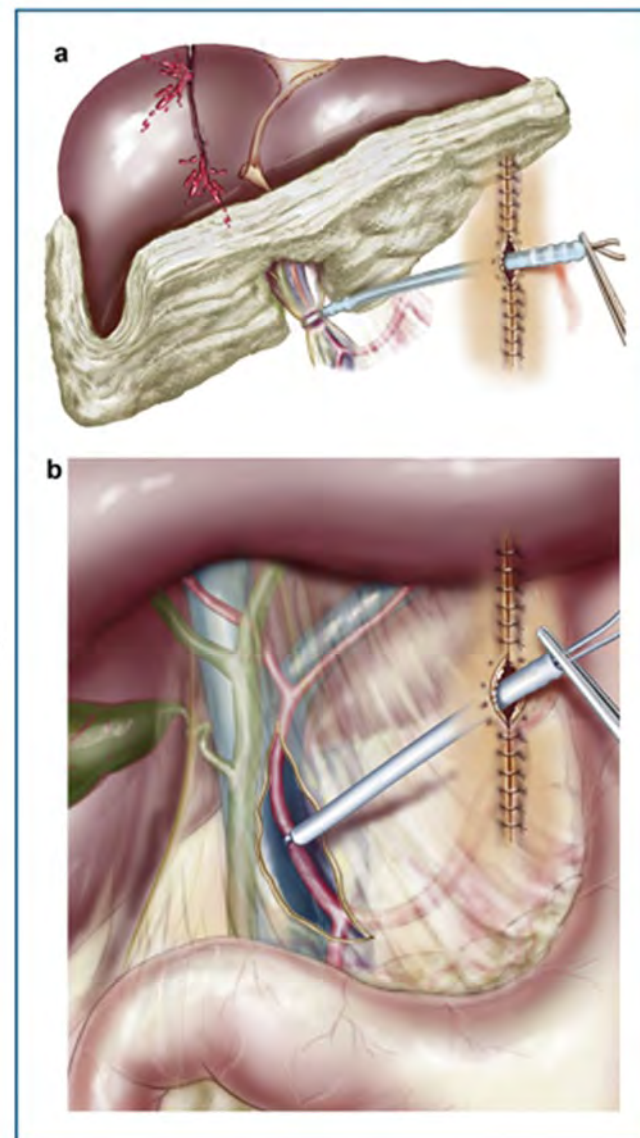


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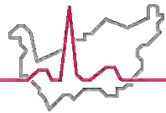


**Figure 4.** "Internal packing" with a glove finger filled with saline.

C. Letoublon, A. Amariutei, N. Taton, L. Lacaze, J. Abba, O. Risse, C. Arvieux, Traumatismes fermés du foie : prise en charge, Journal de Chirurgie Viscérale, Volume 153, Issue 4, Supplement, 2016, Pages 35-45, ISSN 1878-786X, <https://doi.org/10.1016/j.jchirv.2016.07.002>.

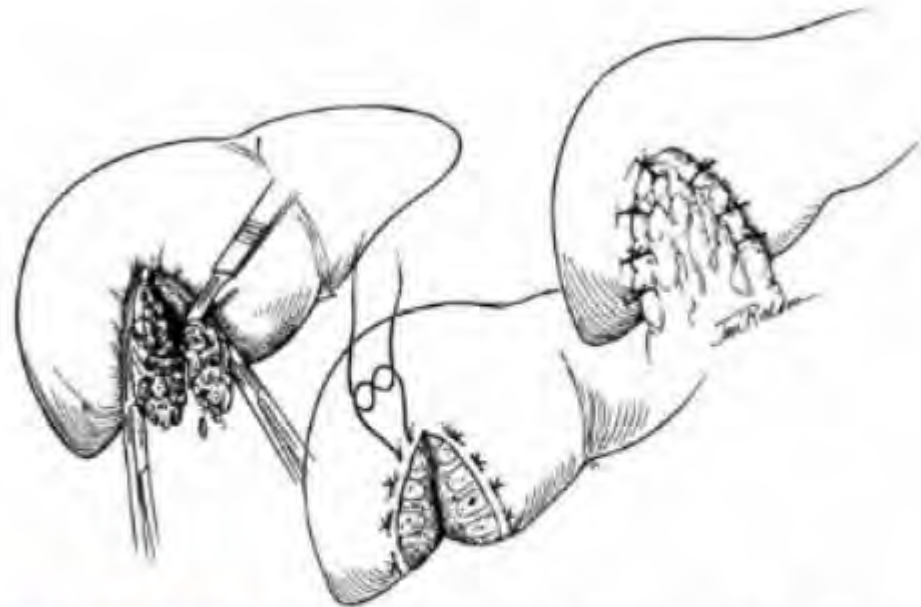
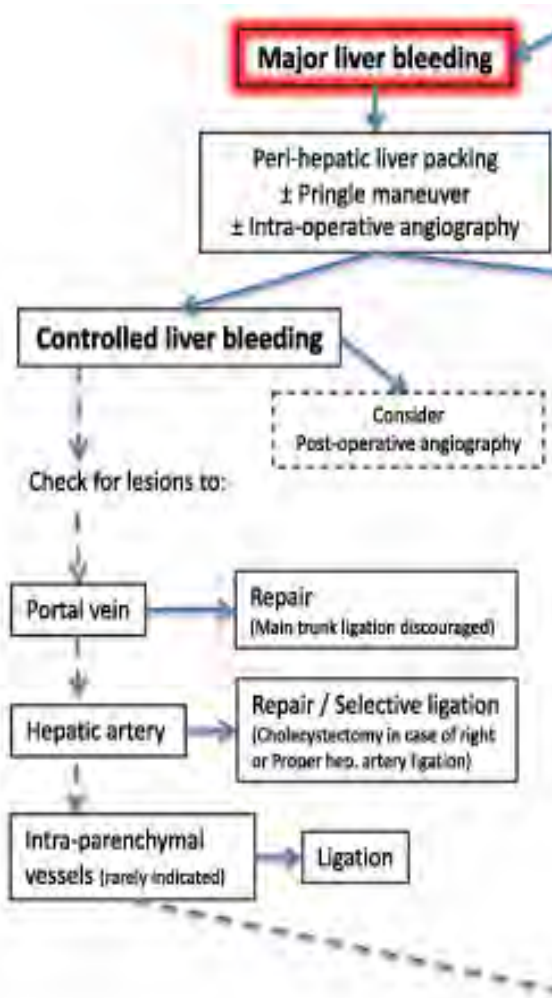




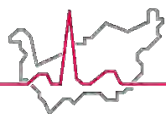


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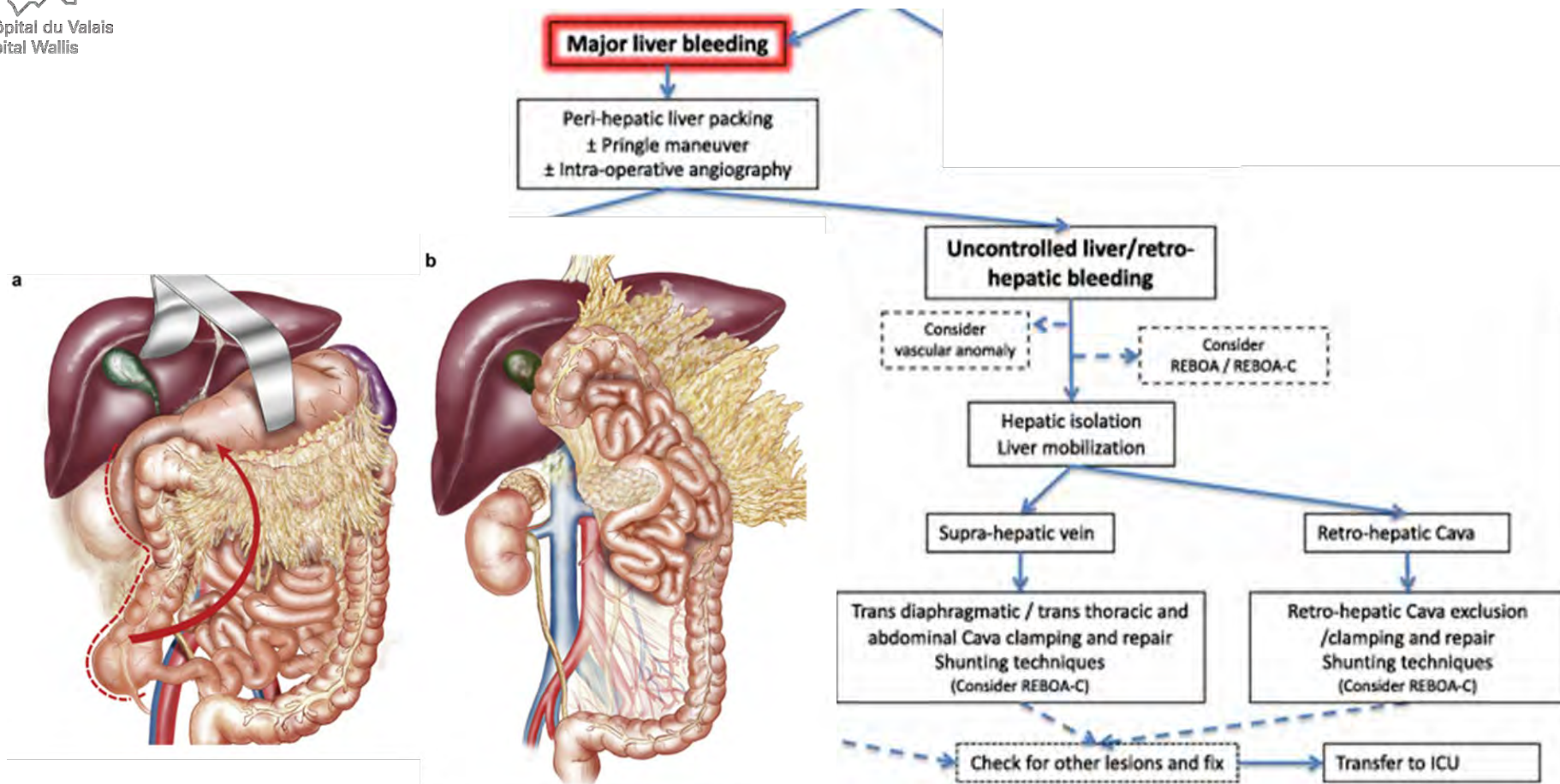


**FIGURE 33-14** Major hepatic laceration controlled with clamps and sharply debrided. The edges of the laceration are oversewn with heavy silk or chromic suture to obtain some degree of hemostasis. A well-vascularized pedicle of omentum is mobilized and secured to the denuded section of liver. (Reproduced with permission from Feliciano DV, Pachter HL. Hepatic trauma revisited. *Curr Probl Surg.* 1989;26:453.)



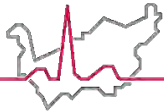
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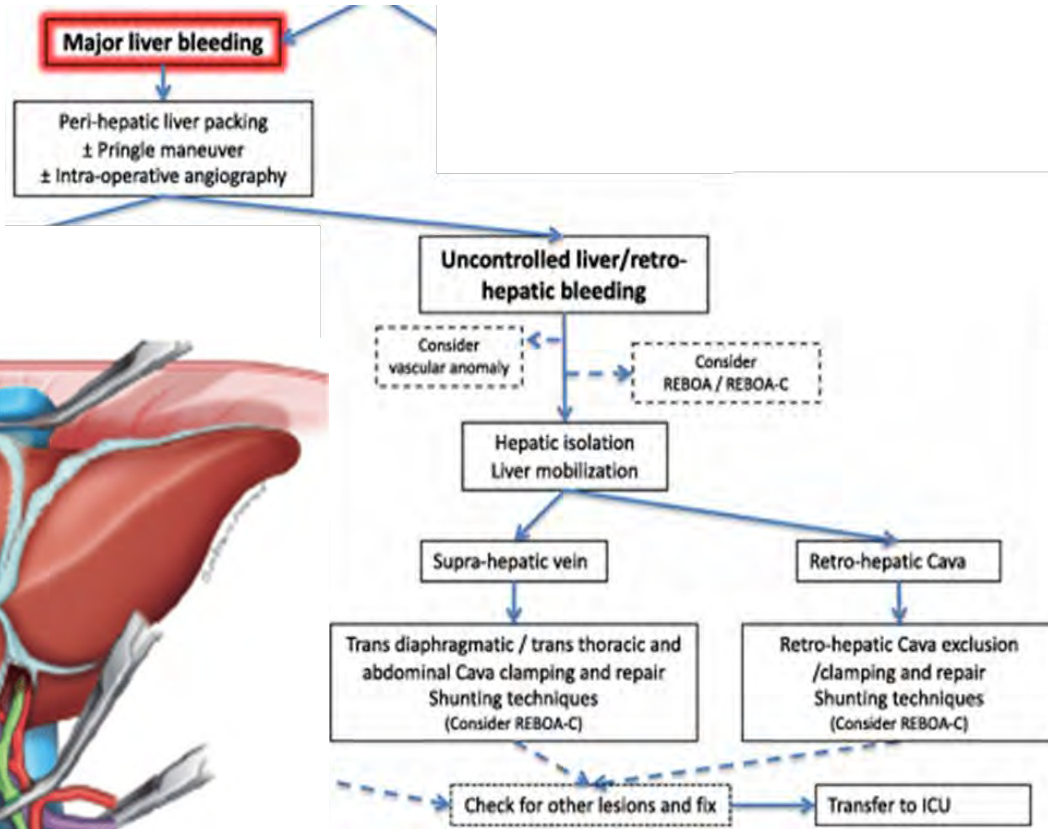
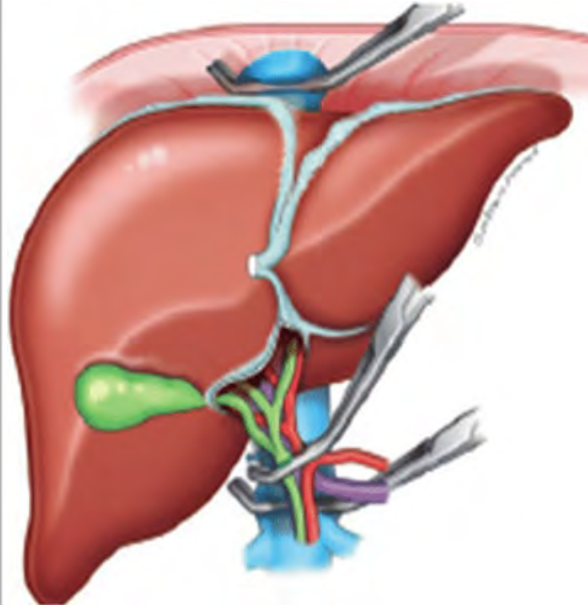
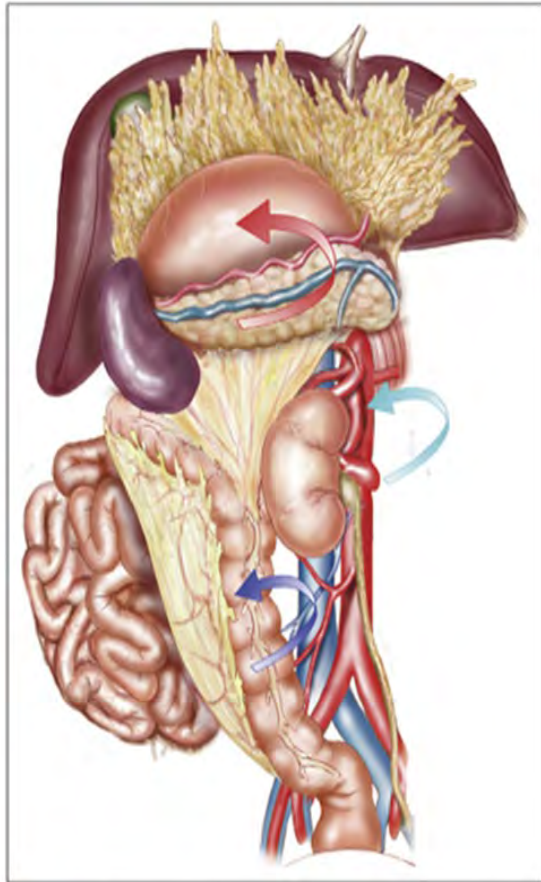


**Figure 2.** Cattell and Braasch's maneuver: right visceral rotation with extended duodenopancreatic mobilization followed by dissection of the mesenteric root.

# Surgical Management

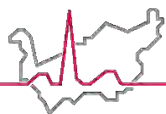


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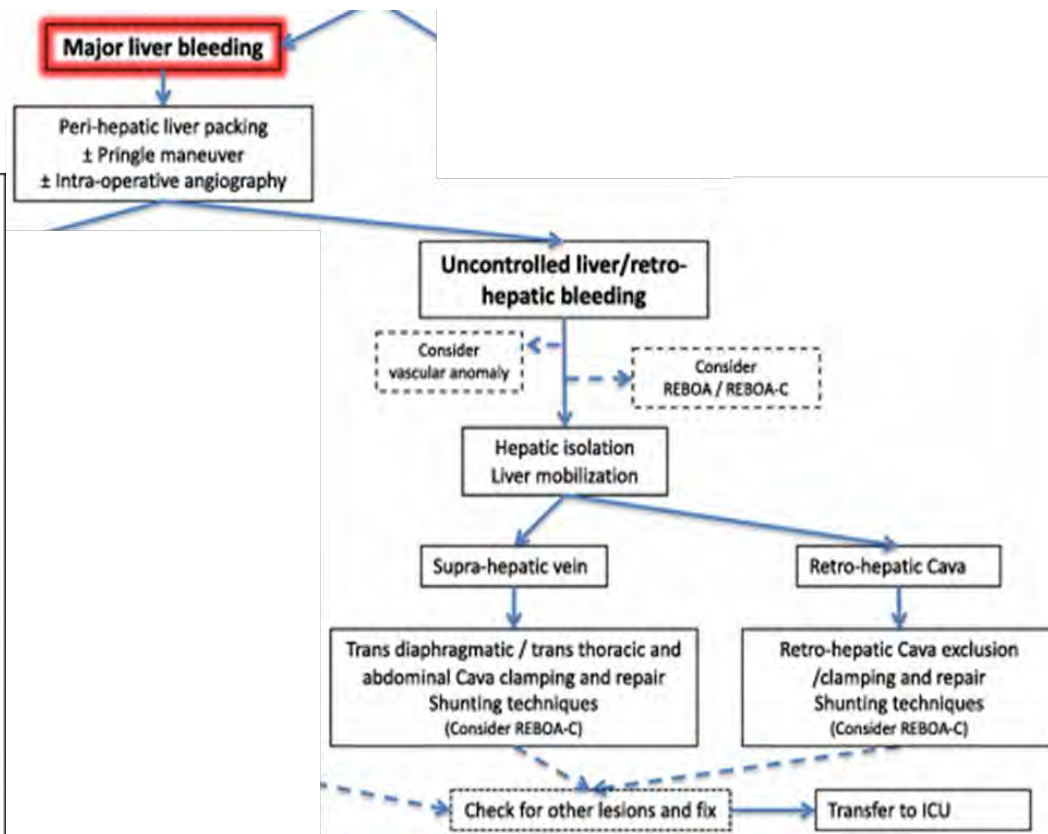
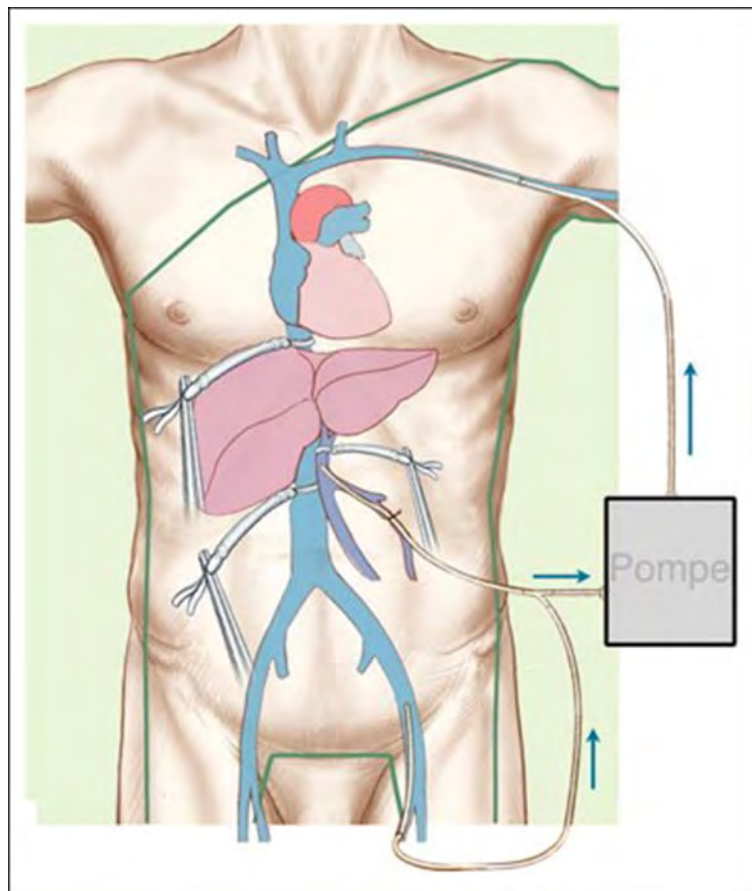
**Figure 3.** Mattox' maneuver: left visceral rotation with mesogastic dissection and medialization of the spleen and pancreas.

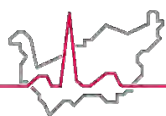




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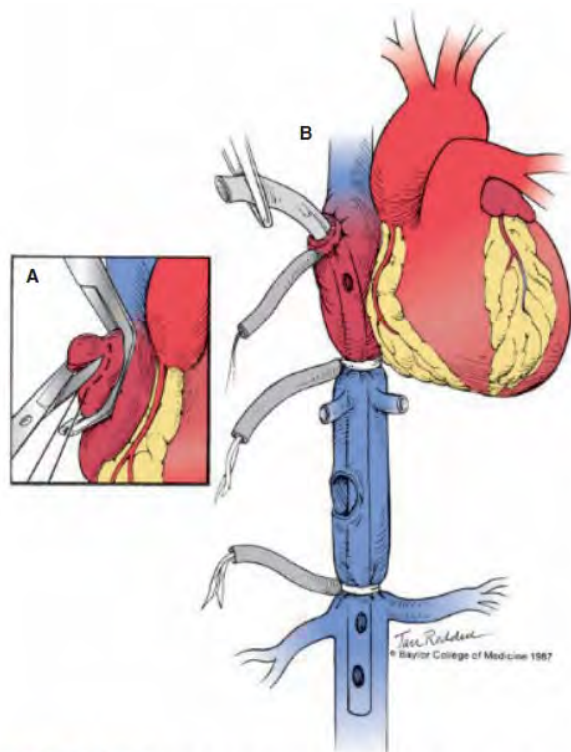
# Surgical Management



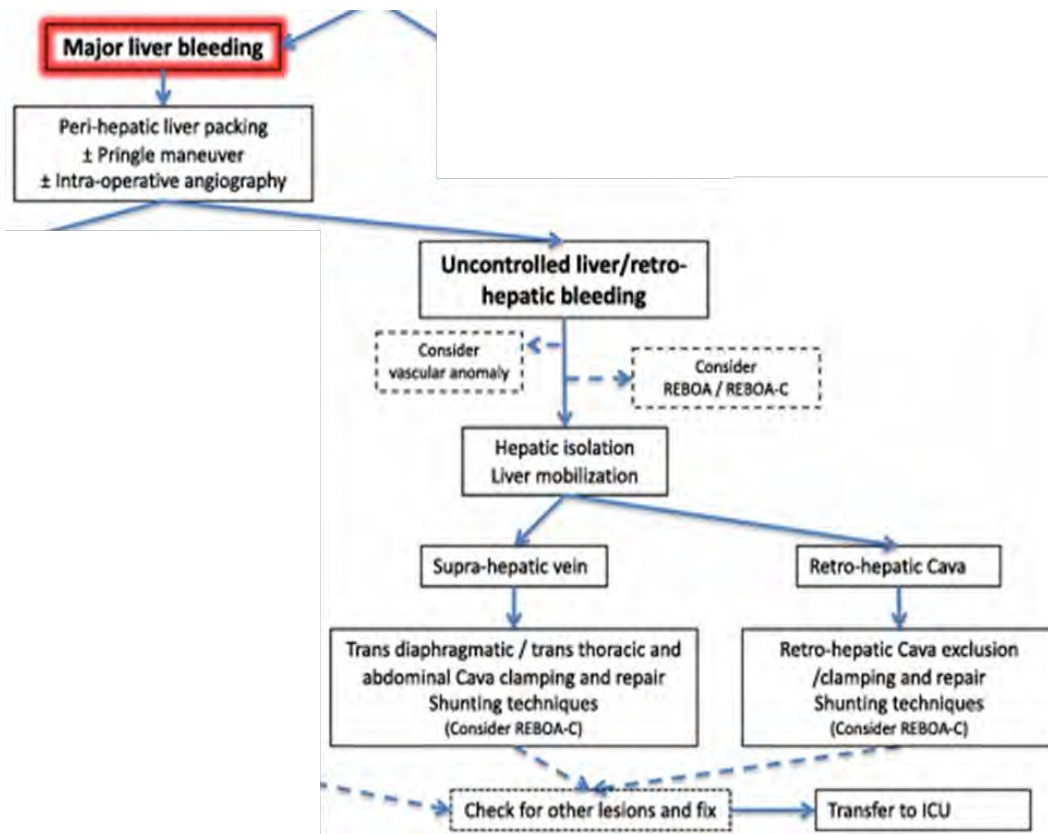


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# Surgical Management



**FIGURE 33-17** (A) A hole is cut in the right atrial appendage above a 2-0 silk pursestring suture. A Satinsky clamp maintains vascular control. (B) Final position of No. 36 chest tube acting as an atriocaval shunt. Note the extra hole cut in the chest tube at the level of the right atrium. All holes in the chest tube are outside the umbilical tapes, thereby forcing blood from the lower half of the body and the kidneys through the shunt. (Reproduced with permission from Feliciano DV, Pachter HL. Hepatic trauma revisited. *Curr Probl Surg.* 1989;26:499.)





# REBOA in the cava /REBOA total liver exclusion

RESEARCH ARTICLE

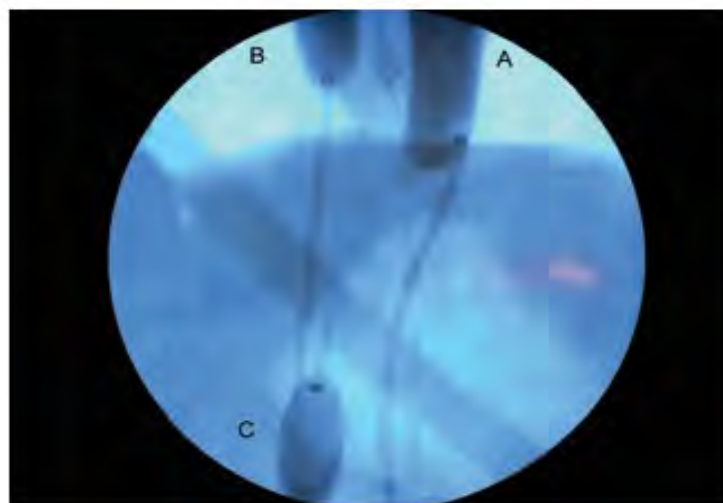
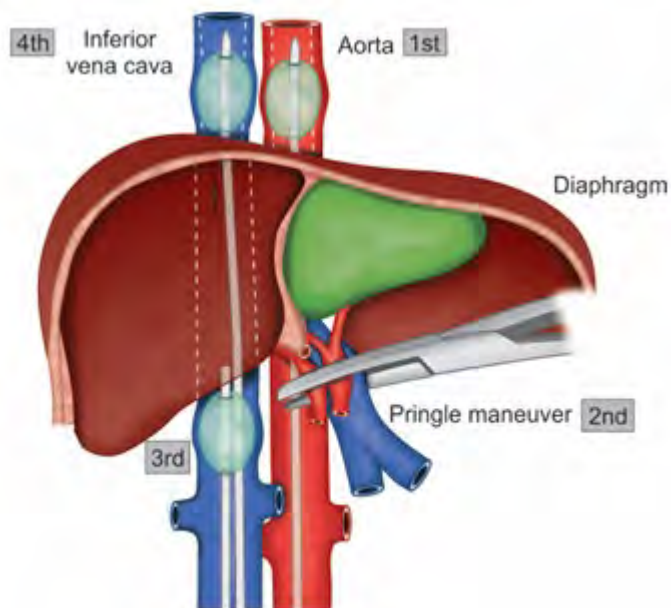
10.5005/jp-journals-10030-1214

## Three Sequential Balloon Catheters for Vascular Exclusion of the Liver and Aortic Control (one REBOA and two REBOVCs): A Hemorrhage Control Strategy in Suprahepatic Vena Cava Injuries

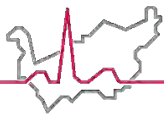
<sup>1</sup>Joao B Rezende-Neto, <sup>2</sup>Ghassan Al-Kefeiri, <sup>3</sup>Matt Strickland, <sup>4</sup>Vikram Prabhudesai, <sup>5</sup>Sandro B Rizoli, <sup>6</sup>Ori Rotstein

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RESULTS BY YEAR



**Fig. 1:** Fluoroscopic image of the endovascular balloons inflated within the aorta (A) in the suprahepatic IVC; (B) and the infrahepatic IVC; (C) IVC, inferior vena cava.



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# Surgical Management

- **Temporary closure:**

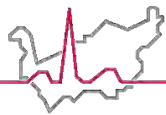
- Not for time sparring
- Abdominal Compartment Syndrome
  - Def: Sustained IAP >20mmhg + organ failure
- Red Duke Trauma Institute Austin Tx
  - 39%->17%



- **Complication:**

- Up to 70% hernia
- 50% wound infection
- Enteral fistula

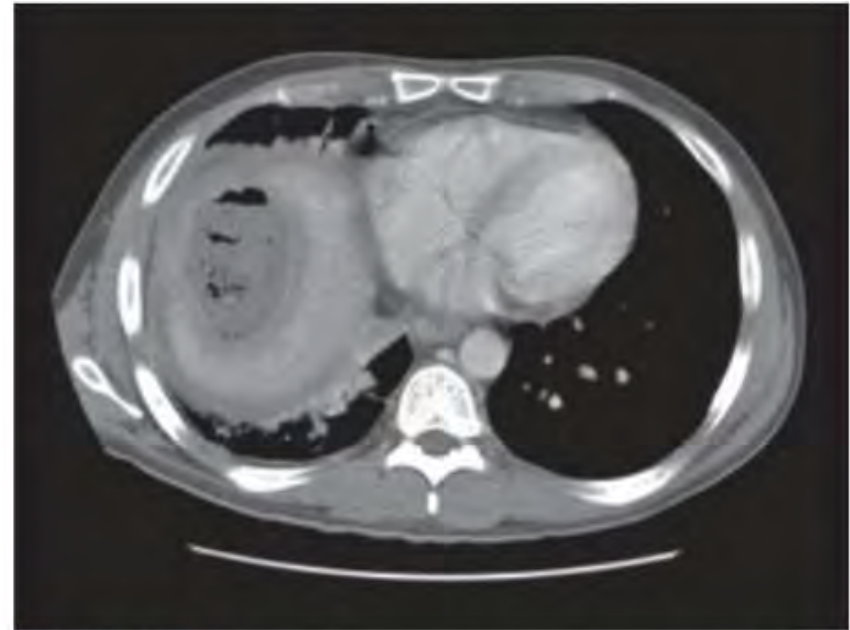




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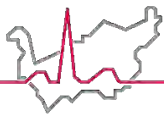
# COMPLICATION AFTER SURGERY

- Bleeding 2%-10%
- Bile leaks 40%-25% (Grade IV-V)<sup>114;115</sup>
- Perihepatic abscess 25%<sup>115</sup>
- Hepatic necrosis
  - Dabbs et al <sup>116</sup> found that 29 of 30 Grade IV-V DCS+embolization (70%)
  - Secondary surgery
- Hemobilia
- Liver Failure
- Abdominal Compartment Syndrome



**FIGURE 33-7** Computed tomography scan demonstrating a hepatic abscess from a patient who had sustained a blunt hepatic injury.

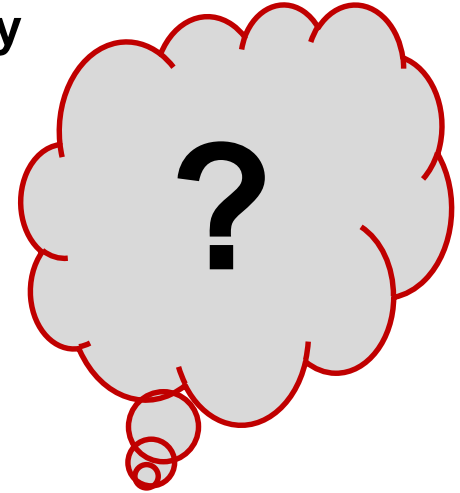
R: [114]. Bala M, Gazalla SA, Faroja M, et al. [Complications of high-grade liver injuries: management and outcome with a focus on bile leaks](#). Scand J Trauma Resusc Emerg Med. 2012;20:20. [115]. Asensio JA, Demetriades D, Chahwan S, et al. [Approach to the management of complex hepatic injuries](#). J Trauma. 2000;48:66. [116]. Dabbs DN, Stein DM, Scalea TM. [Major hepatic necrosis: a common complication after angioembolization for treatment of high-grade liver injuries](#). J Trauma. 2009;66:621.

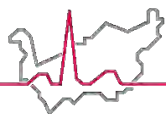


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# Thank you for your Attention

- **Multimodal and Pluri disciplinary management necessary**
- **Management Guided by Organ severity score**
- **Non Operative Management**
  - Standard treatment for majority of liver trauma
- **Operative Management**
  - Simple Maneuvers can help deal with dramatic lesion
  - Some lesion will remain untreatable

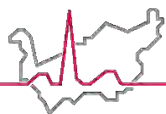




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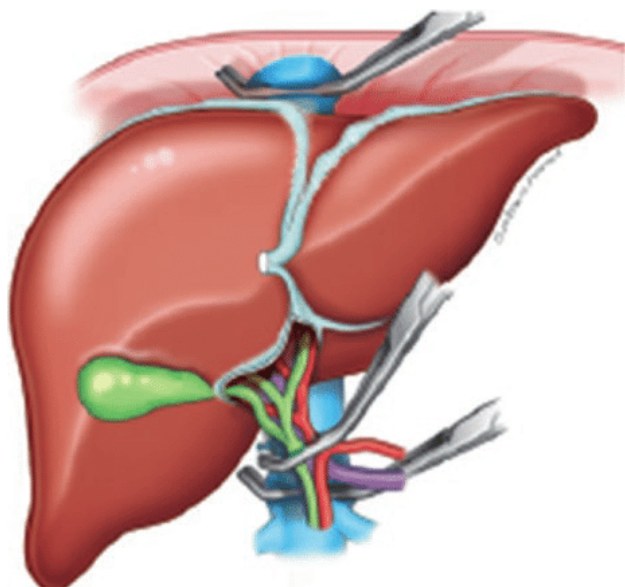
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# Thank you for your Attention

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Surgical Management

## 2. REBOA in the cava /reboa total liver exclusion



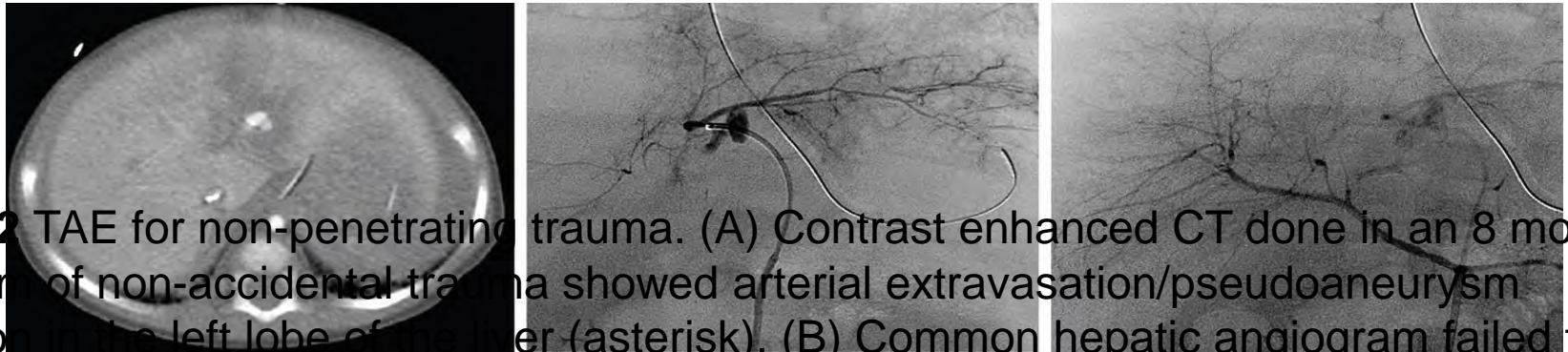
- **Fundamental principal laparoscopic ventral hernia repair**
  - Hernia reduction
  - Fascia defect closure
    - Direct intraperitoneal suture
    - Percutaneous
  - Mesh placement/sizing
    - Intraperitoneal (I-PoM)
  - Mesh fixation
    - Tacker fixation

RESEARCH ARTICLE

10.5005/jp-journals-10030-1214

**Three Sequential Balloon Catheters for Vascular Exclusion of the Liver and Aortic Control (one REBOA and two REBOVCs): A Hemorrhage Control Strategy in Suprahepatic Vena Cava Injuries**

<sup>1</sup>Joao B Rezende-Neto, <sup>2</sup>Ghassan Al-Kefeiri, <sup>3</sup>Matt Strickland, <sup>4</sup>Vikram Prabhudesai, <sup>5</sup>Sandro B Rizoli, <sup>6</sup>Ori Rotstein



**Figure 2** TAE for non-penetrating trauma. (A) Contrast enhanced CT done in an 8 month old victim of non-accidental trauma showed arterial extravasation/pseudoaneurysm formation in the left lobe of the liver (asterisk). (B) Common hepatic angiogram failed to show the extravasation/pseudoaneurysm. (C) Selective left hepatic artery injection via cannulation of an accessory left hepatic artery arising from the left gastric artery showed the site of extravasation(asterisk). This was treated with gelatin sponge slurry embolization to good angiographic effect (not shown). Care was withdrawn due to significant intracranial injuries and the patient unfortunately passed shortly thereafter. Images courtesy of Dr. Keith Quencer. TAE, transarterial embolization.