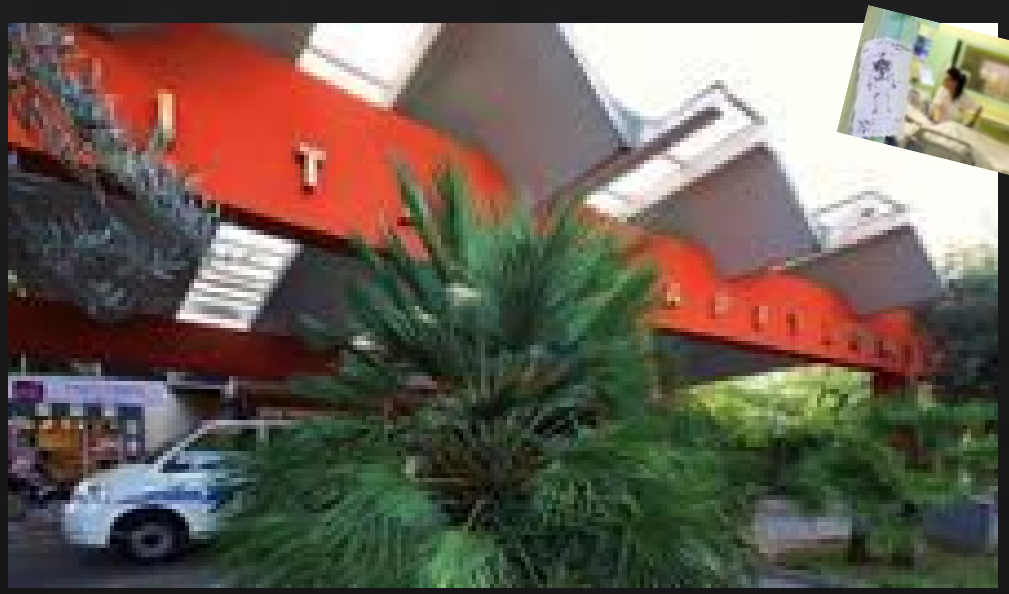
L'abdomen : l'oublié



Jonathan CHARBIT

Centre Régional d'Accueil des Patients Traumatisés Sévères - CHU Lapeyronie - Montpellier

Conflits d'intérêt

- LFB : Projet Trauma sim
- Johnson & Johnson : Hôtel et transports
- Nestlé : Congrès, hôtel et transports
- Astellas Pharma : Congrès, hôtel et transports

L’abdomen, pas si oublié….

L'abdomen, pas si oublié….

- 30% des trauma sévères par AVP

  Huber-Wagner et al. *Lancet* 09

- La plupart associée à des scores ISS élevés

  Tinkoff et al. *J Am Coll Surg* 2008

- Lésions abdominales multi-organes dans 40% des cas

  Mc Anena et al. *Surg Clin North Am* 1990

- Mortalité élevée 6-50% selon les séries et selon l'organe

Complications

- Précoces
  - Choc hémorragique
  - Péritonite stercorale
  - Ischémie mésentérique
- Retardées :
  - Resaignement, rupture d'organe plein en 2 temps
  - Péritonite secondaire, abcès péritonéal
  - Péritonite biliaire, biliome
  - Syndrome du compartiment abdo
  - Iléus fonctionnel, occlusion
  - Pancréatite aigue, …
  - Urinome et urinopéritoine
  - Déhiscence pariétale , insuf respi

American Association for the Surgery of Trauma Organ Injury Scale I: Spleen, Liver, and Kidney, Validation Based on the National Trauma Data Bank

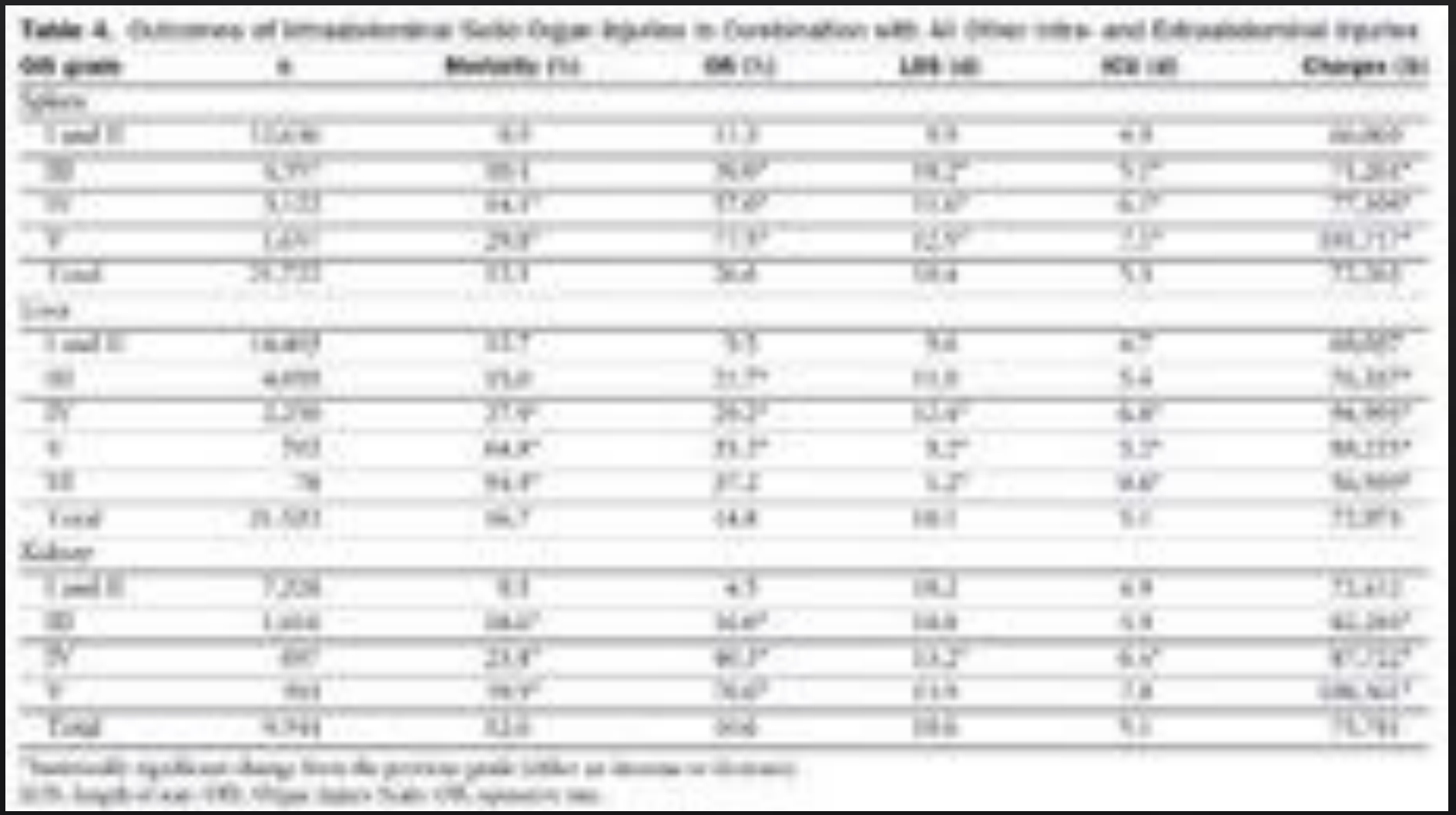


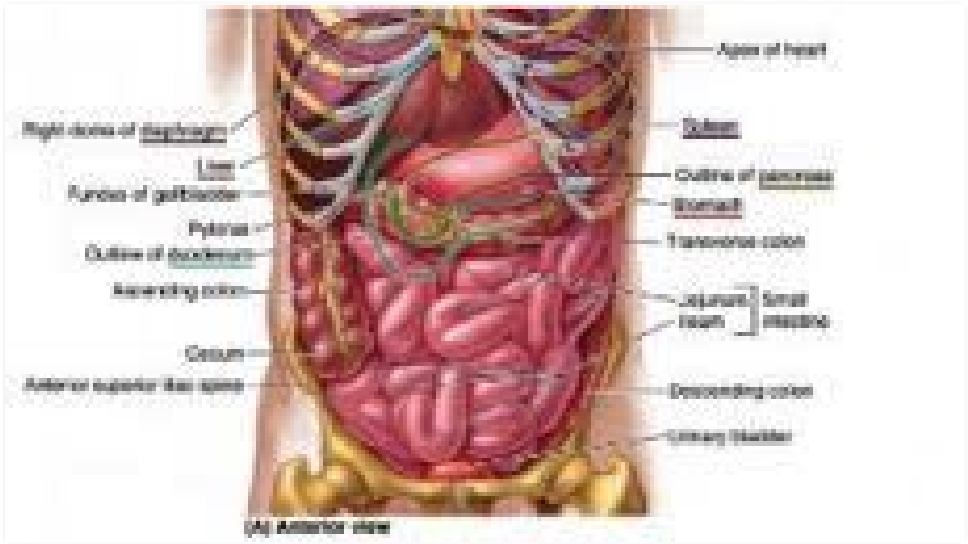
Table 4. Outcomes of Intraabdominal Solid Organ Injuries in Combination with All Other Intra- and Extraabdominal Injuries

OIS grade	n	Mortality (%)	OR (%)	LOS (d)	ICU (d)	Charges ($)
Spleen						
I and II	11,616	6.5	11.3	9.9	4.9	66,065*
III	5,757	10.1	36.0*	19.2*	5.1*	71,204*
IV	3,122	14.1*	37.0*	11.6*	6.7*	77,604*
V	1,451	29.8*	71.9*	12.9*	7.1*	101,717*
Total	21,722	11.1	26.6	10.4	5.3	72,263
Liver						
I and II	16,403	11.7	5.5	9.6	6.7	68,025*
III	4,055	15.0	21.7*	11.0	5.4	76,387*
IV	2,256	27.9*	29.2*	12.4*	6.8*	94,993*
V	703	64.8*	33.2*	9.2*	5.2*	88,235*
III	76	94.4*	37.2	1.2*	0.6*	56,969*
Total	21,523	16.7	14.8	10.1	5.1	72,874
Kidney						
I and II	7,226	9.5	4.5	19.2	6.9	73,612
III	1,616	18.0*	16.0*	18.8	5.9	82,289*
IV	497	23.8*	40.3*	13.2*	6.6*	87,722*
V	404	39.9*	76.0*	11.9	7.8	106,463*
Total	9,744	12.6	10.6	10.6	5.1	75,794

*Statistically significant change from the previous grade (either an increase or decrease).
LOS, length of stay; OR, Organ Injury Scale; OR, [illegible]

Tinkoff et al. *J Am Coll Surg* 2008

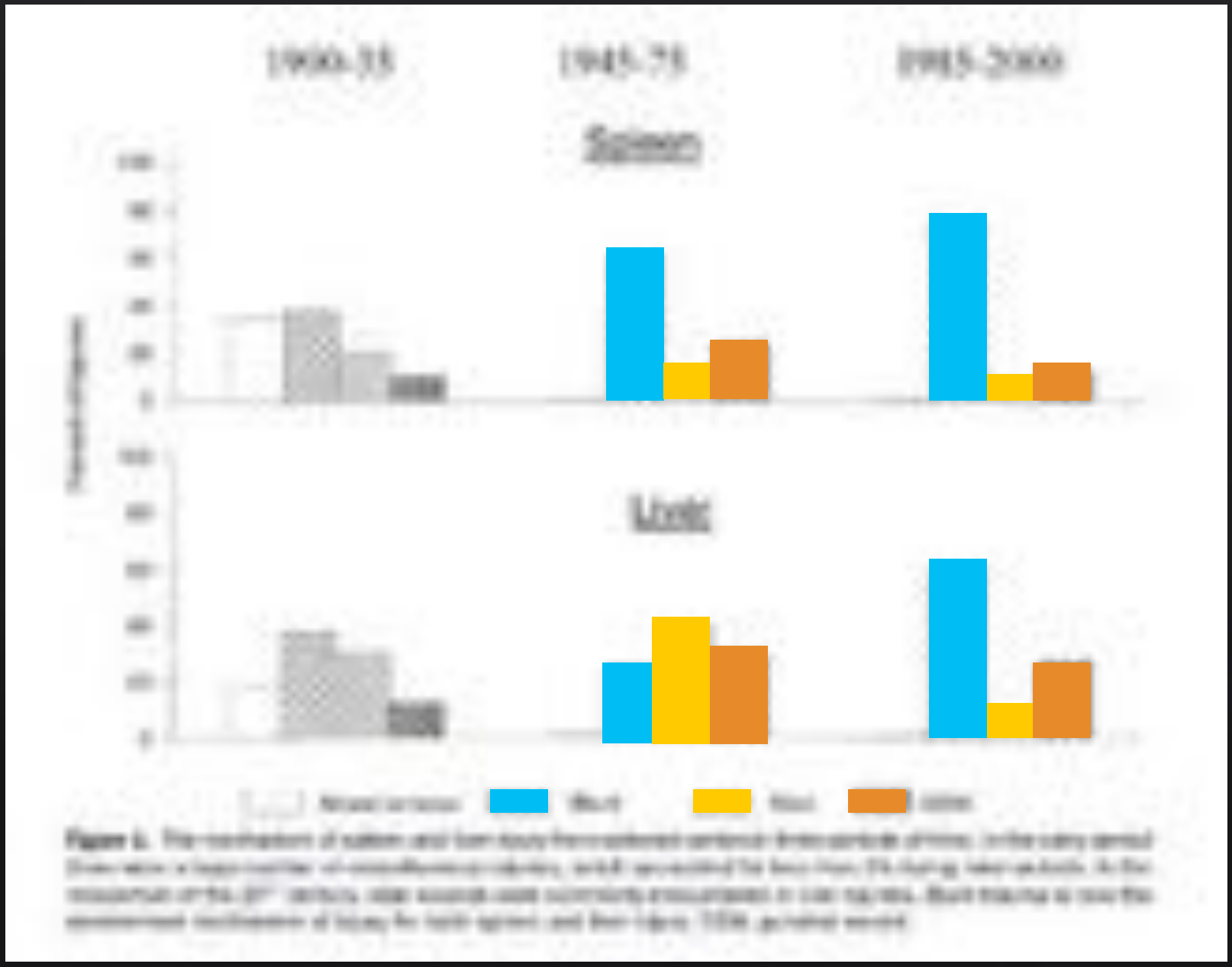
L’abdomen, pas si oublié….



Epidémiologie

Organe	Fréquence
Rate	46 %
Foie	33 %
Mésentère	10 %
Reins-vessie	9 %
Intestin grêle	8 %
Colon	7 %
Duodénum-pancréas	5 %
Vaisseaux	4 %
Estomac	2 %
Vésicule	2 %

Mc Anena et al. *Surg Clin North Am* 1990



Richardson et al. *J Am Coll Surg* 2005

EAST Multi-institutional Hollow Viscus Injury Study

Michael D. Williams, MD, Dorraine Watts, RN, PhD, and Samir Fakhry, MD

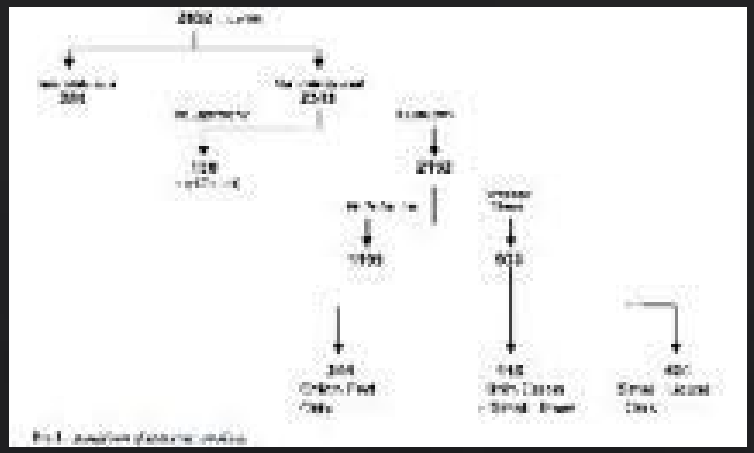


Table 1 Incidence of Injuries Found at Lap

Organ	Incidence (%)
Spleen	52.8
Liver	36.7
Mesentery	13.8
Colon/rectum	13.1
Pancreas	13.0
Diaphragm	12.3
Vascular	9.2
Bladder	5.6
Kidney	5.0

J Trauma. 2003;55:906–912.

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Mc Anena et al. *Surg Clin North Am* 1990

Mécanismes lésionnels

- **Contondant / Fermé**
  - Coup direct, collision
  - Ecrasement bref (ceinture, projection) ou prolongé (ensevelissement)
  - Décélération soudaine : AVP, chute, projection
- **Pénétrant :**
  - Arme blanche
  - Arme à feu
  - Projectile …
- **Blast**

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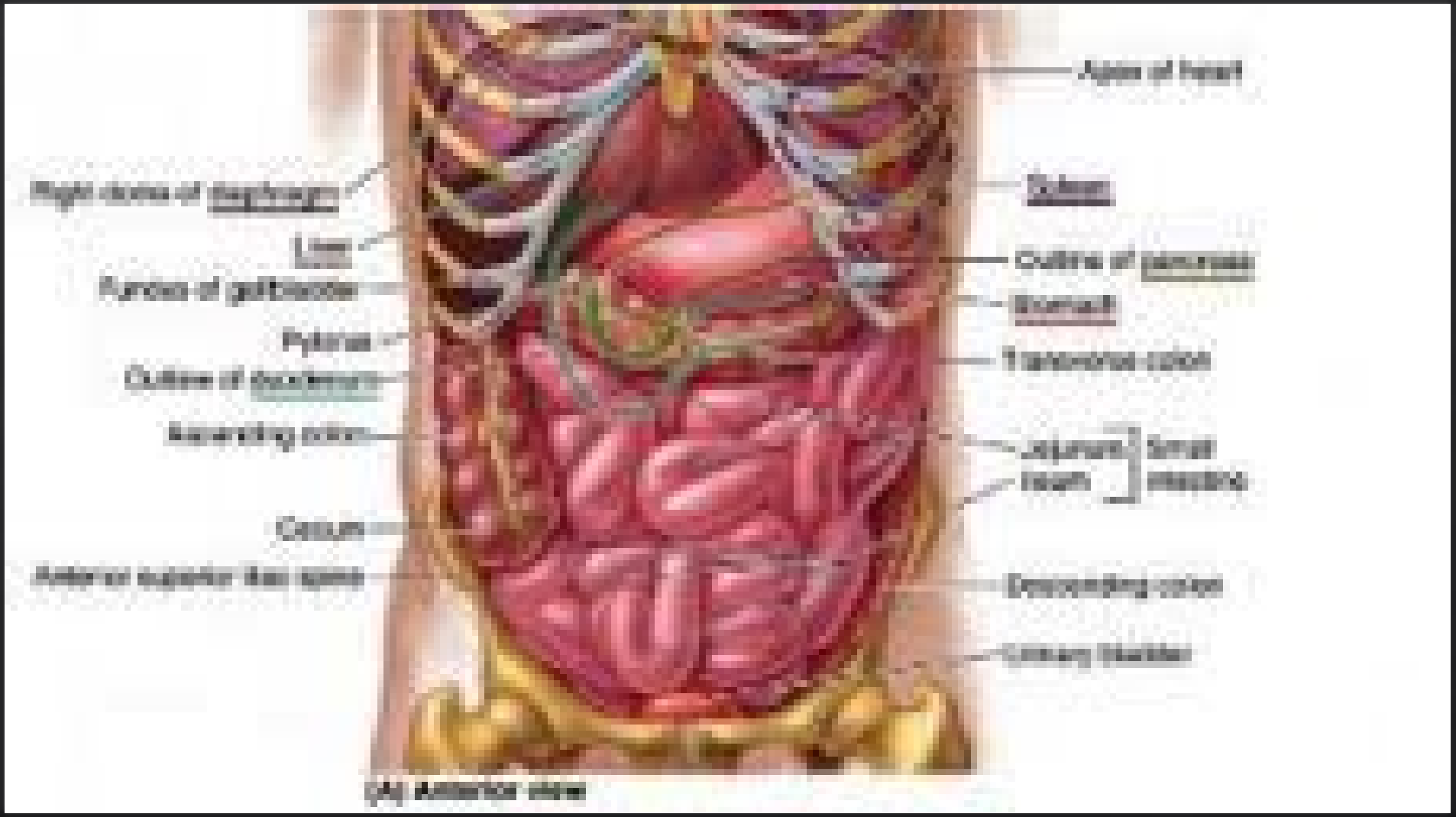
Mécanismes lésionnels



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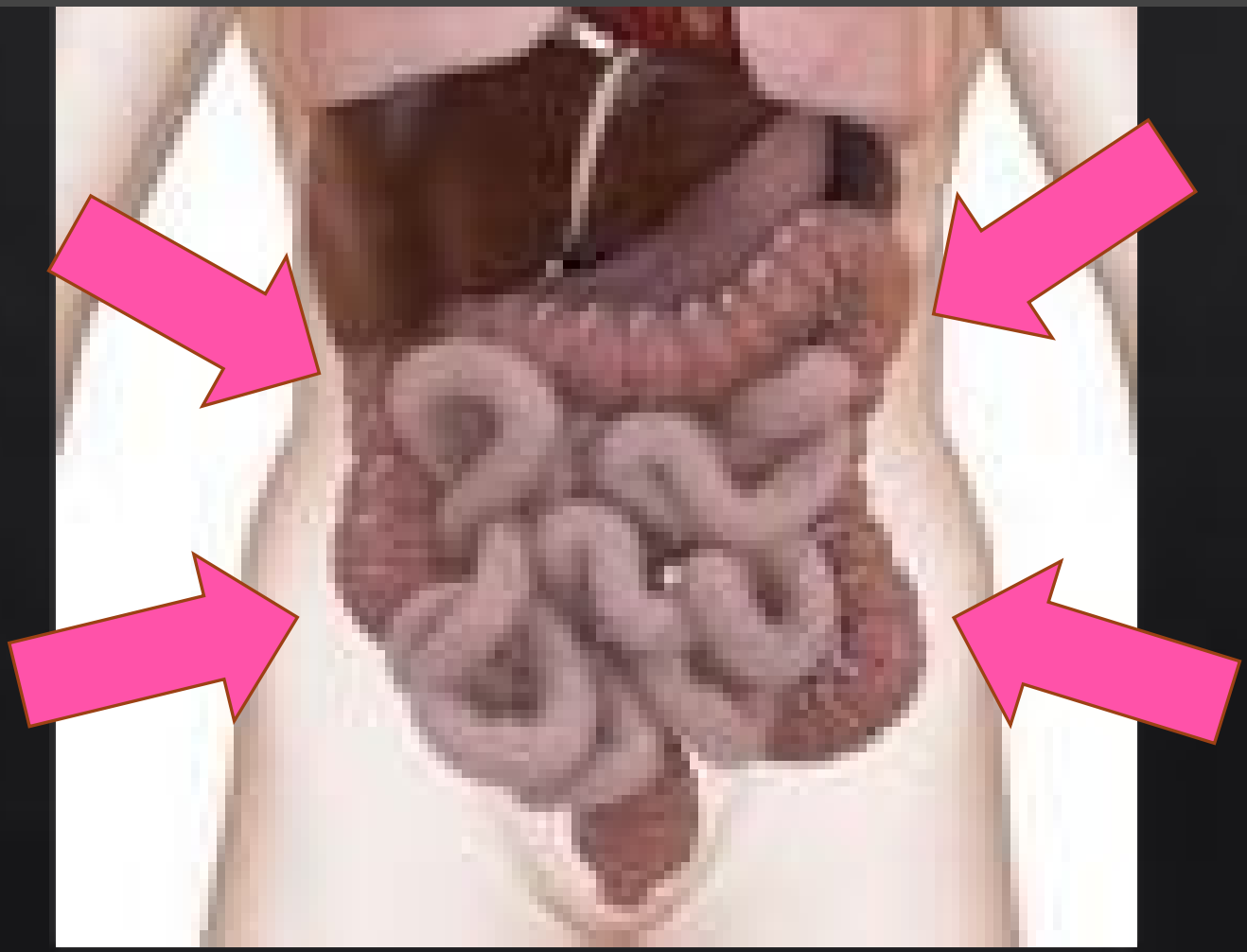
Mécanismes lésionnels



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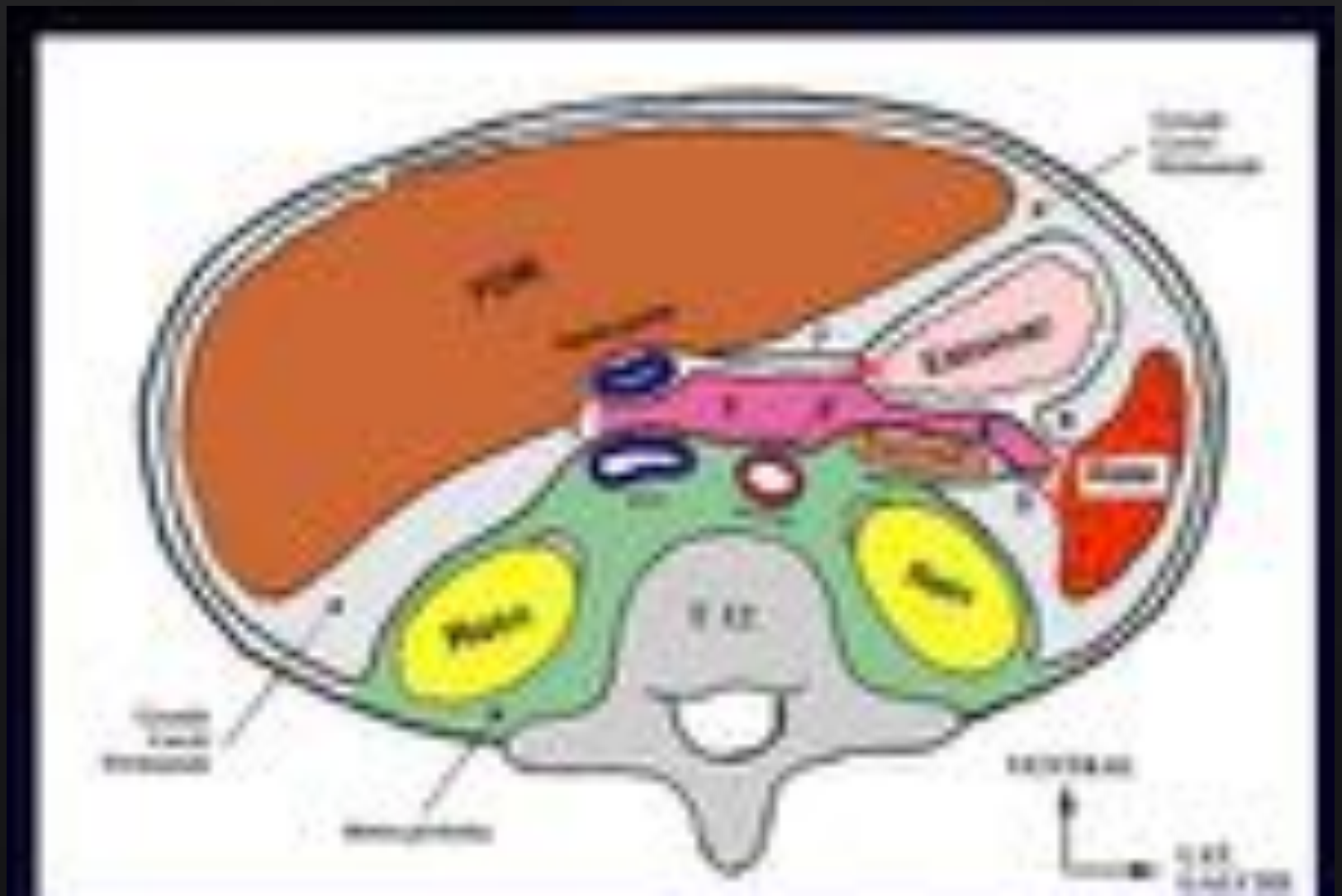
Polytraumatisme et décélération

Polytraumatisme et décélération

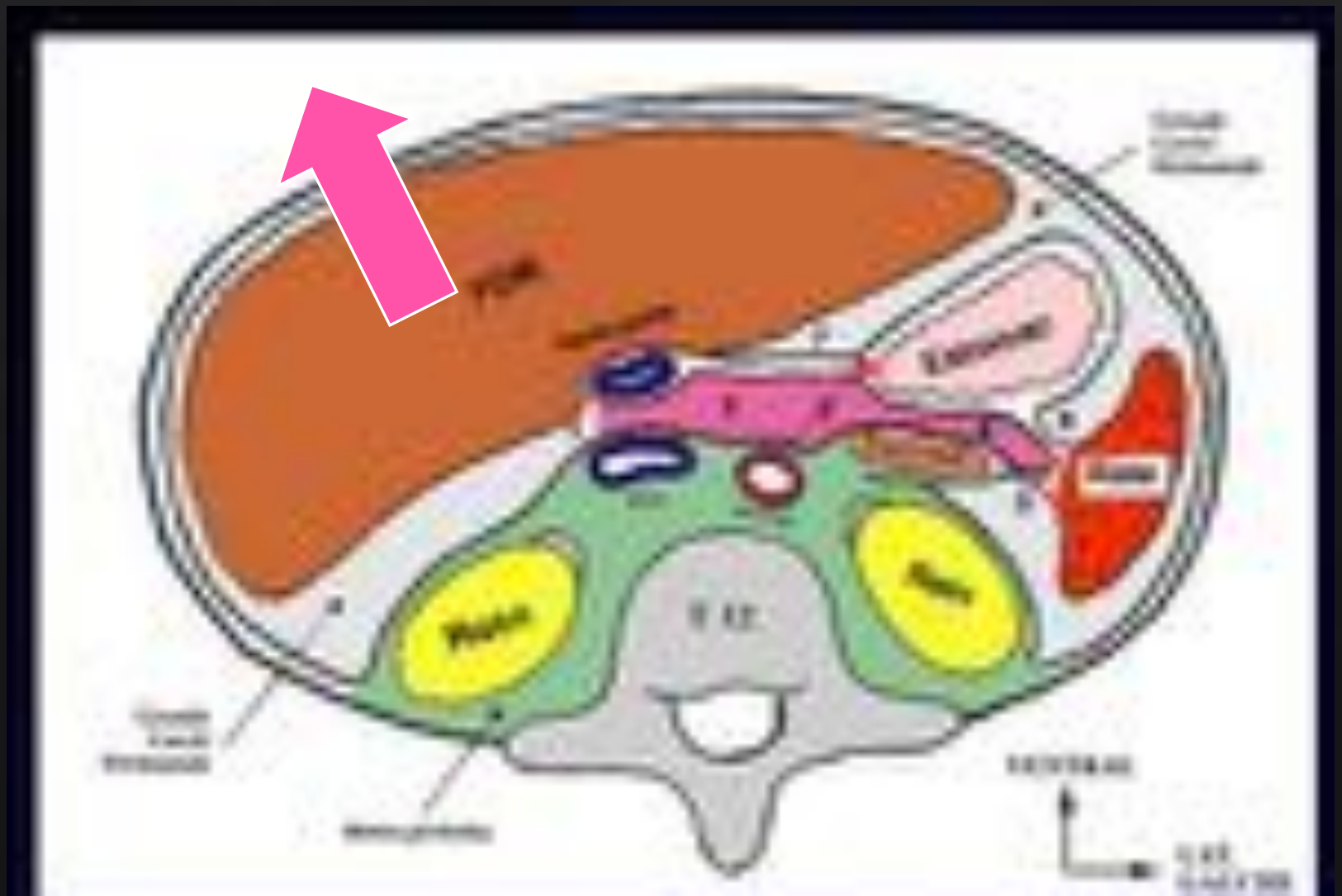
D'après Parr et Grande (##)

Organe	Poids réel (kg)	Poids apparent (kg)		
Vitesse(km/h)	0	36	72	108
Rate	0,25	2,5	10	22,5
Coeur	0,35	2,5	14	31,5
Encéphale	1,5	15	60	135
Foie	1,8	18	72	162
Sang	5	50	200	450
Corps entier	70	700	2800	6300
	1	x 10	x 40	x 90

Mécanismes lésionnels



Mécanismes lésionnels



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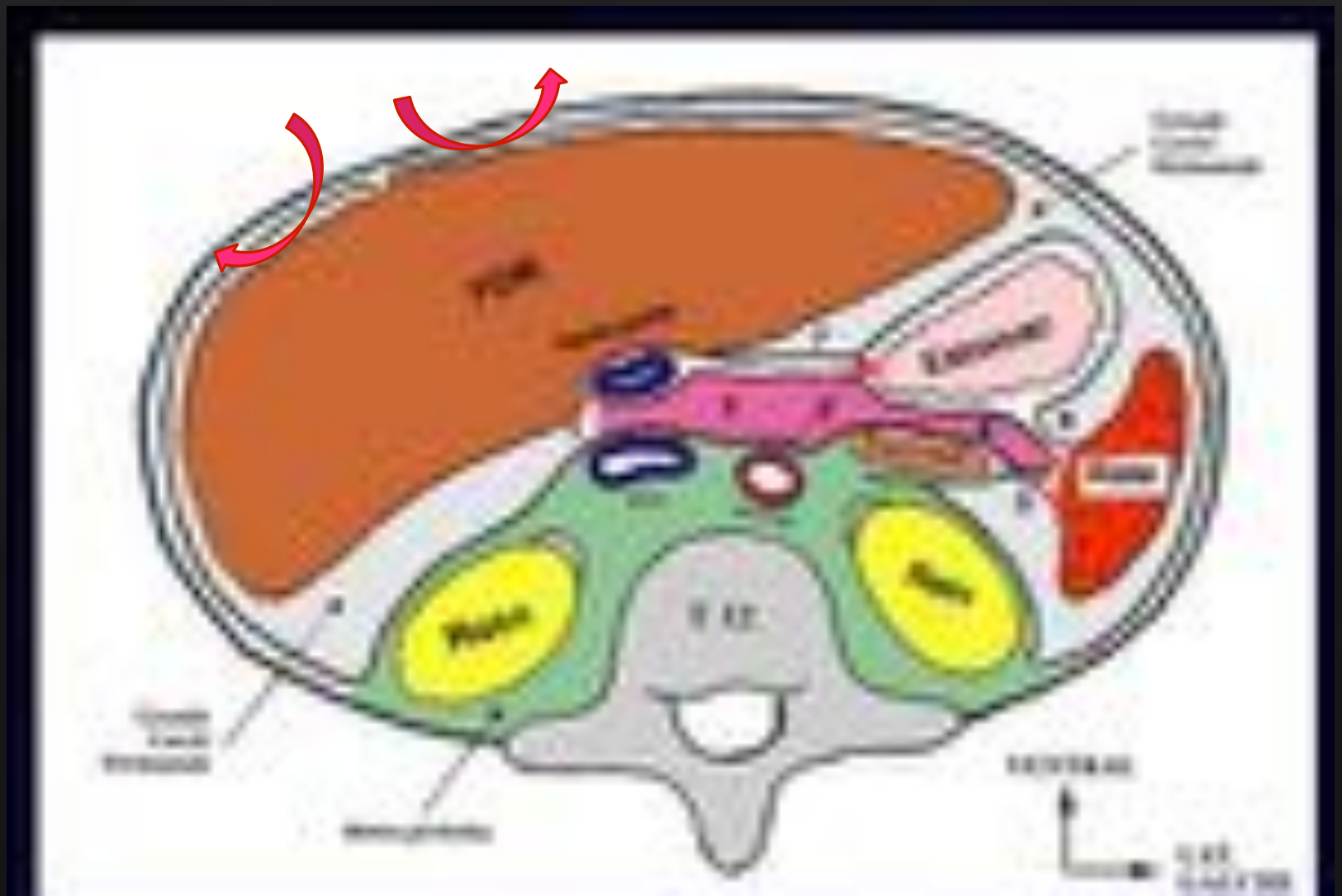

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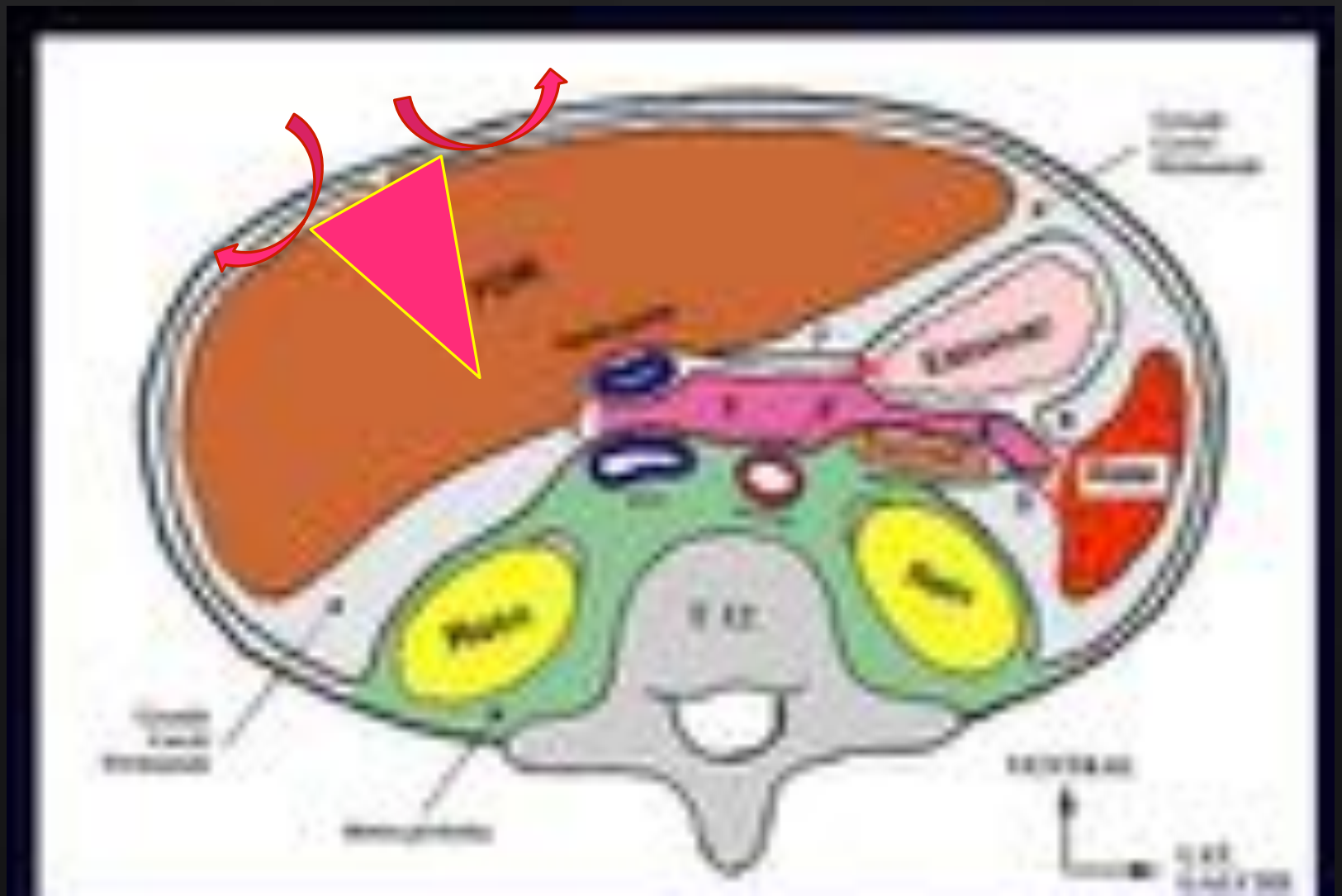
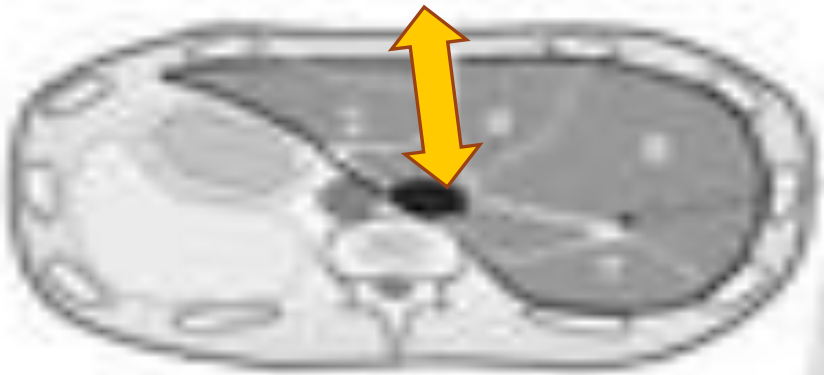
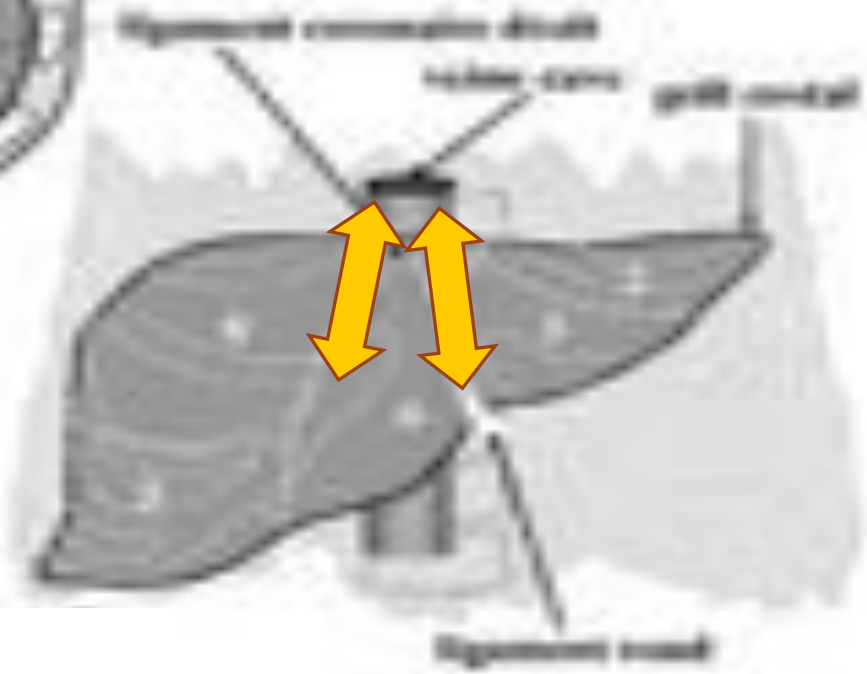
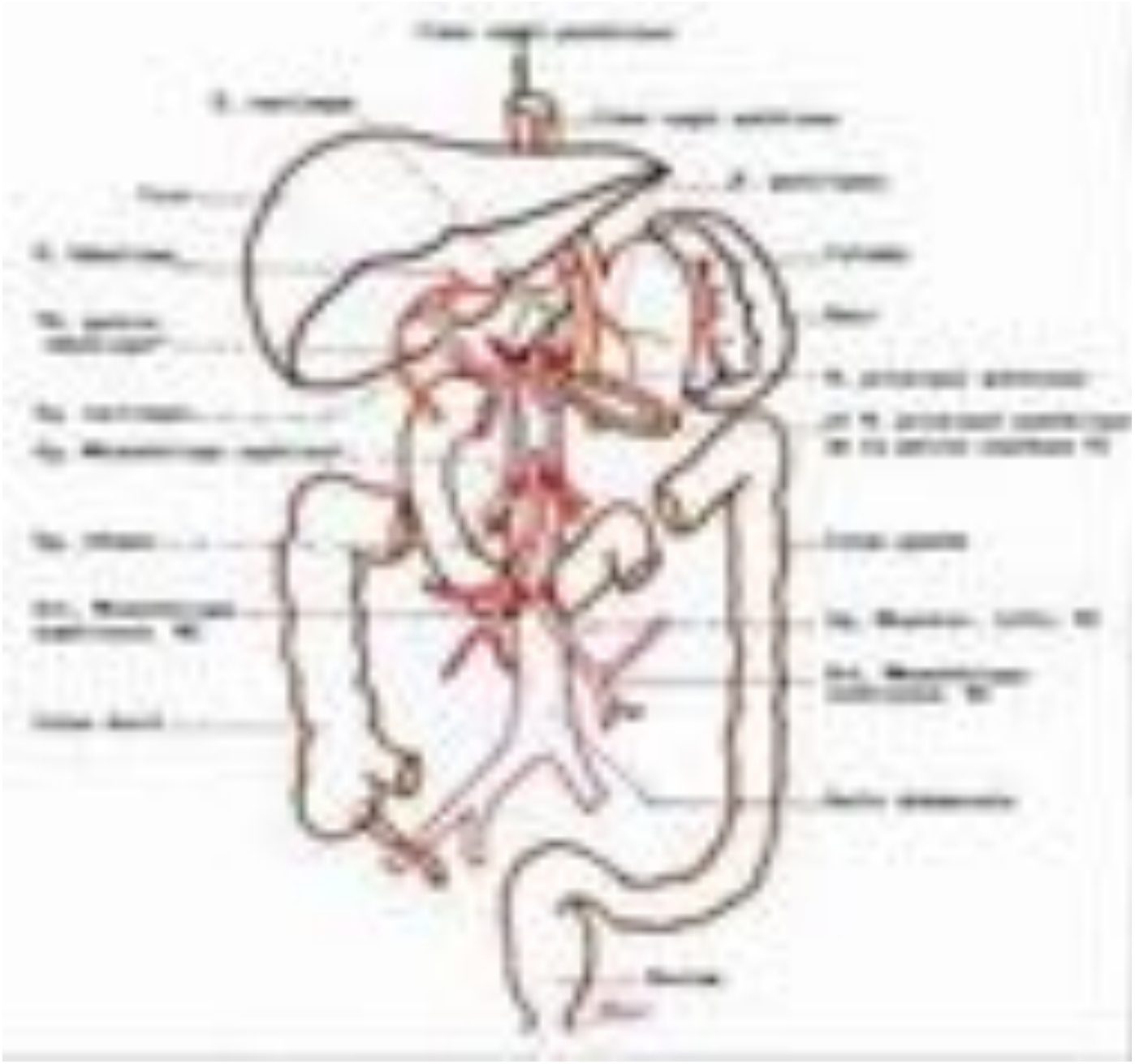


Mécanismes lésionnels







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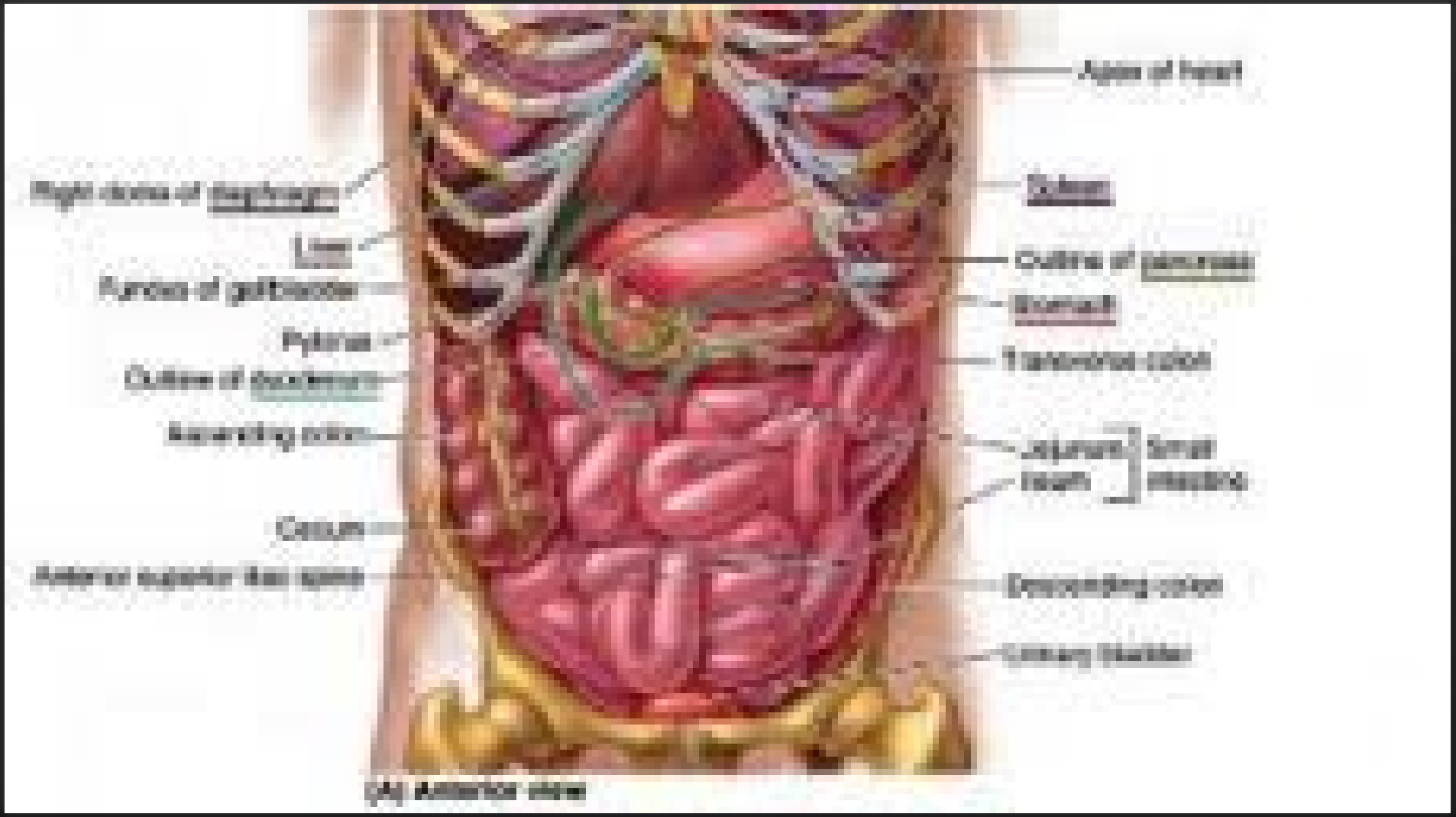

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  - Pancréatite aigue, coulées nécrosantes/surinfectés
  - Urinome et urinopéritoine
  - Déhiscence pariétale , insuf respi

Evaluation clinique

⇒ *Douleur, empâtement, défense……*

Evaluation clinique

⇒ *Douleur, empâtement, défense……*

- Frustre voir occulte
- Très peu sensible
- Non-spécifique
- Non rentable chez le patient comateux
- Piégeux sur le trauma pénétrant
  - Organes digestifs intra-thoraciques
  - Aire cardiaque
  - Profondeur ??

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Evaluation clinique

Nishijima et al. *JAMA* 2012

Evaluation clinique

Exploration diagnostique

?

Exploration diagnostique

Stable

Instable

STRATEGIE de PEC

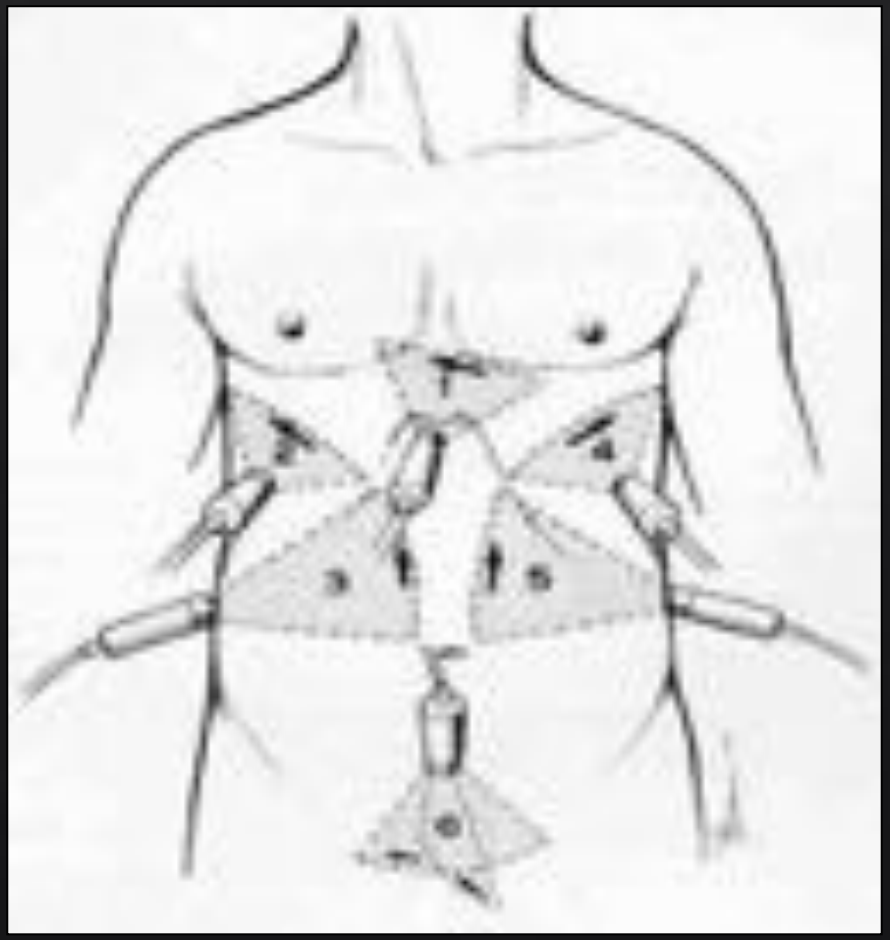
STRATEGIE de PEC

FAST –

Focused Assessment Sonography for Trauma

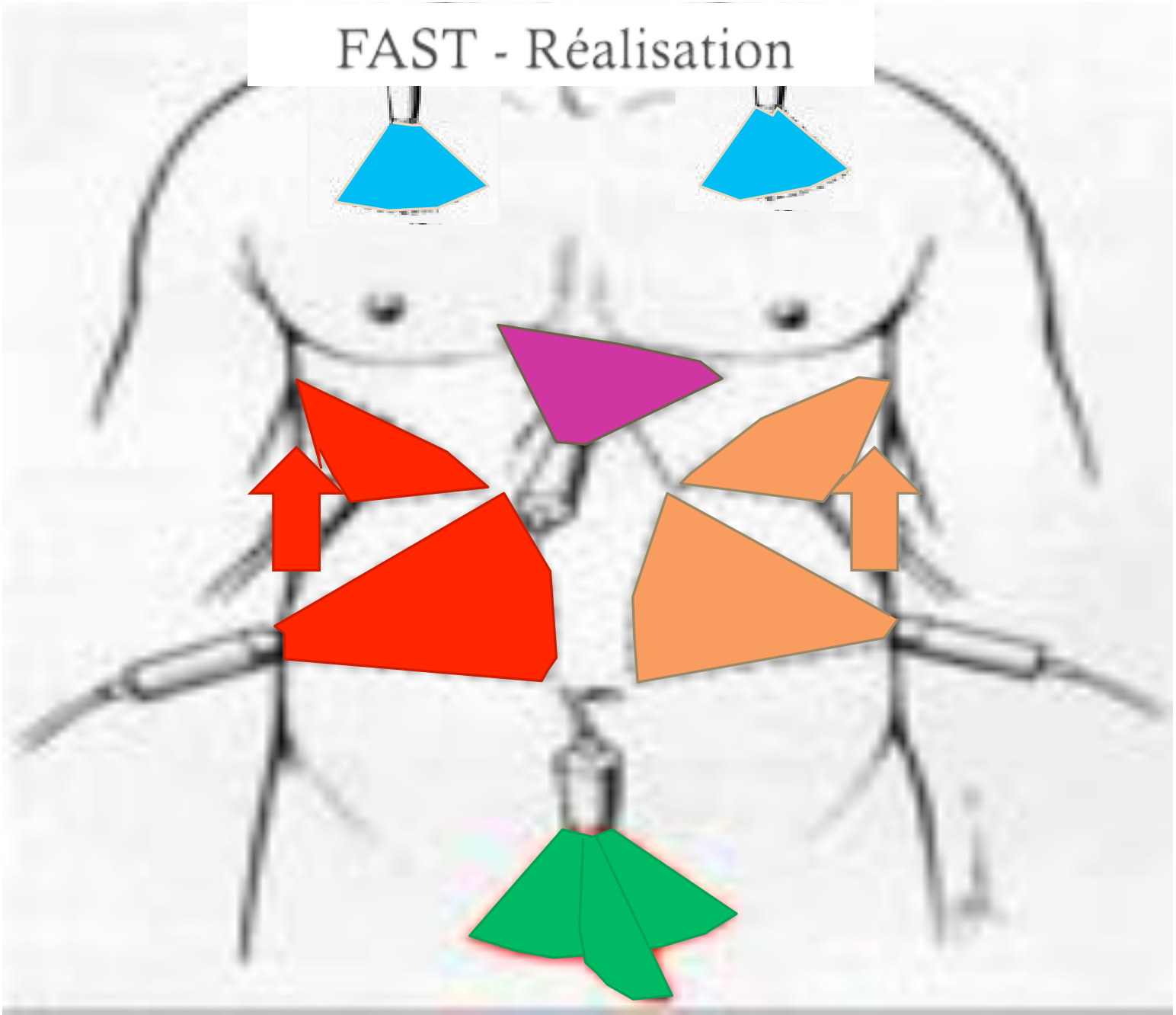
Prospective Analysis of a Rapid Trauma Ultrasound Examination Performed by Emergency Physicians

O. John Ma MD Mateer, James R. MD; Ogata, Masaaki MD; Kefer, Michael P. MD; Wittmann, Dietmar MD; Aprahamian, Charles MD



J Trauma. 38(6):879-885, June 1995.

FAST - Réalisation



A haemoperitoneum does not indicate active bleeding in the peritoneum in 50% of hypotensive blunt trauma patients: a stu of 110 severe trauma patients

J. Charbit[a,*], I. Millet[d], K. Lakhal[a], G. Brault-Noble[a], F. Guillon[b,c], P. Taourel[d], X. Capdevila[a,e]

False Positives

Critères d'inclusion

Patients Hémodynamiquement **Instables** (PAS< 90 mmHg)

+ Hémopéritoine **modéré ou abondant** (Score Federle ou laparotomie)

Paramètres d'étude

=> Nécessité d'hémostase : *laparotomie / angiographie*

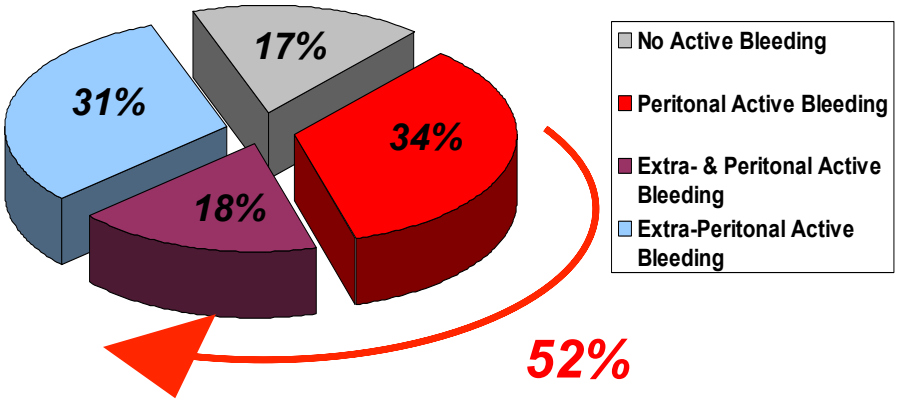


Figure 1. Presence and site of Active bleeding

Injury 2014;45:88-94

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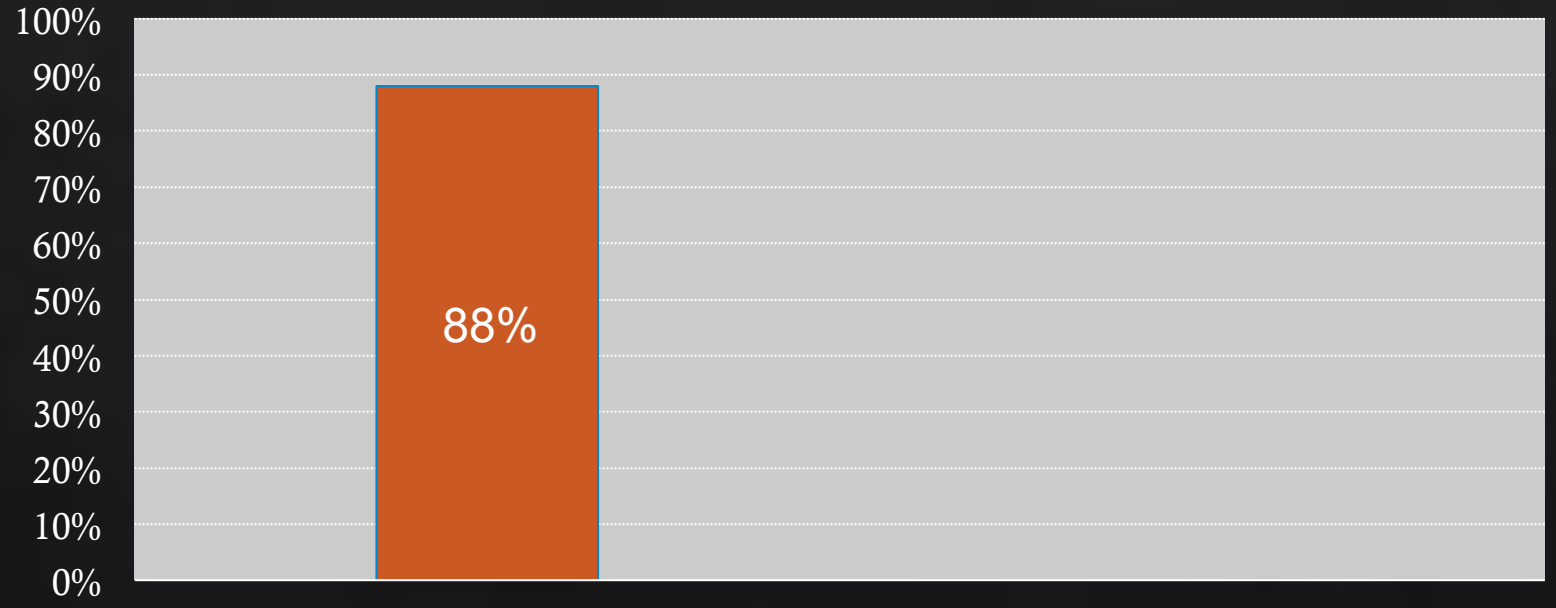
False Positives

Prédiction d'une lésion péritonéale



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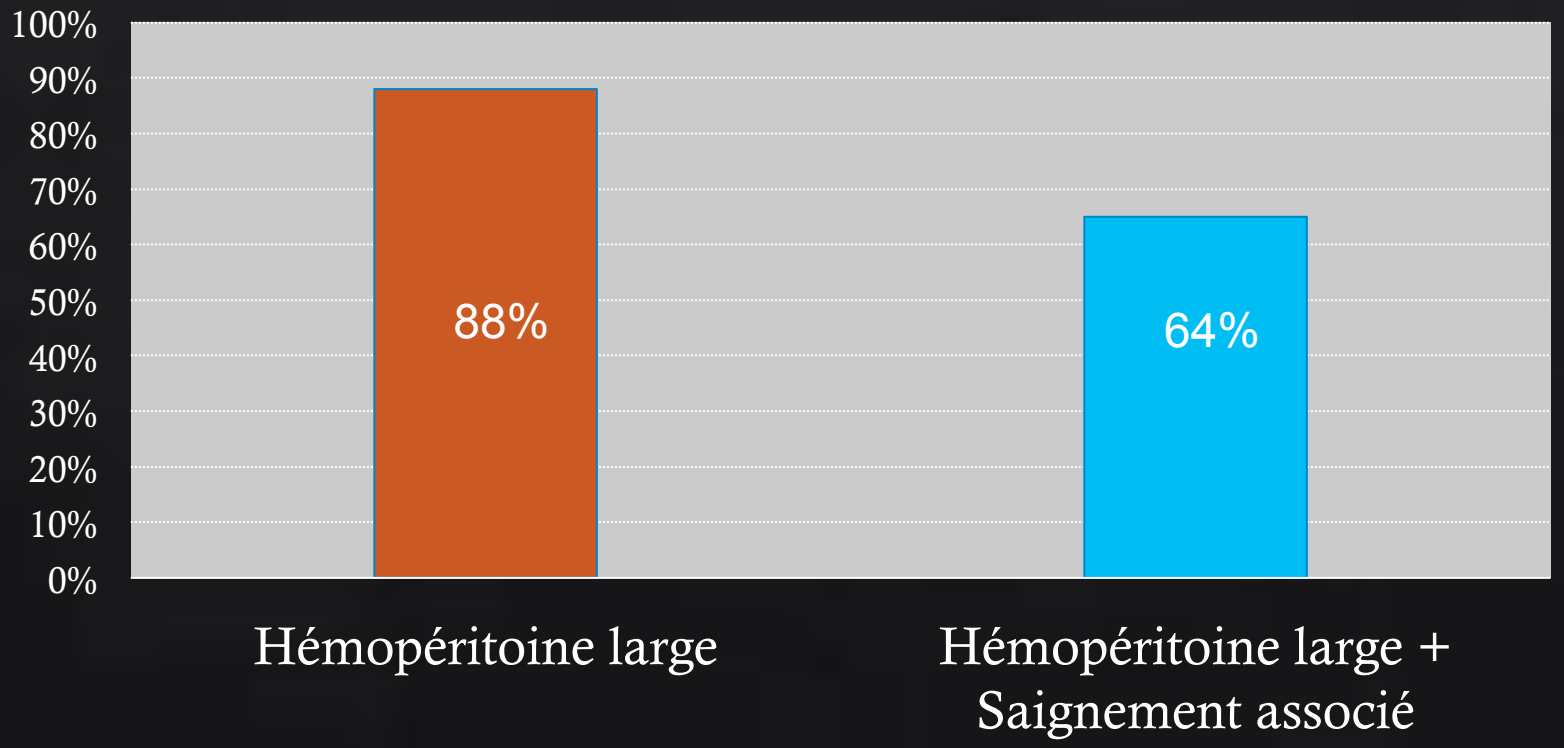


Injury 2014;45:88-94

Does the size of the hemoperitoneum help to discriminate the bleeding source and guide therapeutic decisions in blunt trauma patients with pelvic ring fracture?

Jonathan Charbit, MD, Ingrid Millet, MD, Orianne Martinez, MD, Jean-Paul Roustan, MD, Samuel Merigeaud, MD, Patrice Taourel, PhD, *and* Xavier Capdevila, MD, PhD, *Montpellier, France*

Table 1 Method of Estimating Intraperitoneal Blood

7 Intraperitoneal Spaces
Right subphrenic
Right subhepatic
Left subphrenic
Left paracolic
Right paracolic
Pelvis (paravesicular spaces)
Intramesenteric

0 – 1 space: no or minimal
2 spaces: moderate (200-500 ml)
≥ 3 spaces: large (≥ 500 ml)

TABLE 6. Predictive Value for an Intraperitoneal Hemorrhage Requiring Therapeutic Laparotomy from the Qualitative and Semiquantitative Analysis of Hemoperitoneum in Patients With Blunt Pelvic Ring Trauma (N = 185)

		Qualitative Analysis (Moderate or Large)		Semi-Quantitative Analysis (Large Only)	
Presence of Hemoperitoneum	N	PPV (%)	NPV (%)	PPV (%)	NPV (%)
Overall patients	185	39 (28–51)	98 (96–100)	62 (43–80)	92 (88–96)
According to pelvic fracture pattern					
Stable fracture	106	39 (22–56)	97 (94–100)	54 (27–81)	91 (86–97)
Unstable fracture	79	42 (26–69)	100 (100–100)	69 (44–94)	92 (86–99)
Hypotensive patients subgroup	102	45 (32–58)	100 (100–100)	70 (51–88)	86 (78–94)
Patients needed PAE subgroup	20	40 (15–65)	100 (100–100)	67 (13–100)	67 (40–93)

PAE, pelvic angioembolization.
Data are expressed as percentages with their 95% confidence interval.

J trauma 2012

STRATEGIE de PEC

Hemoperitoneum semiquantitative analysis on admission of blunt trauma patients improves the prediction of massive transfusion☆,☆☆

Jonathan Charbit[a,*], Martin Mahul[a], Jean-Paul Roustan[a], Pascal Latry[b], Ingrid Millet[c], Patrice Taourel[c,d], Xavier Capdevila[a,d,e]

The American Journal of Emergency Medicine

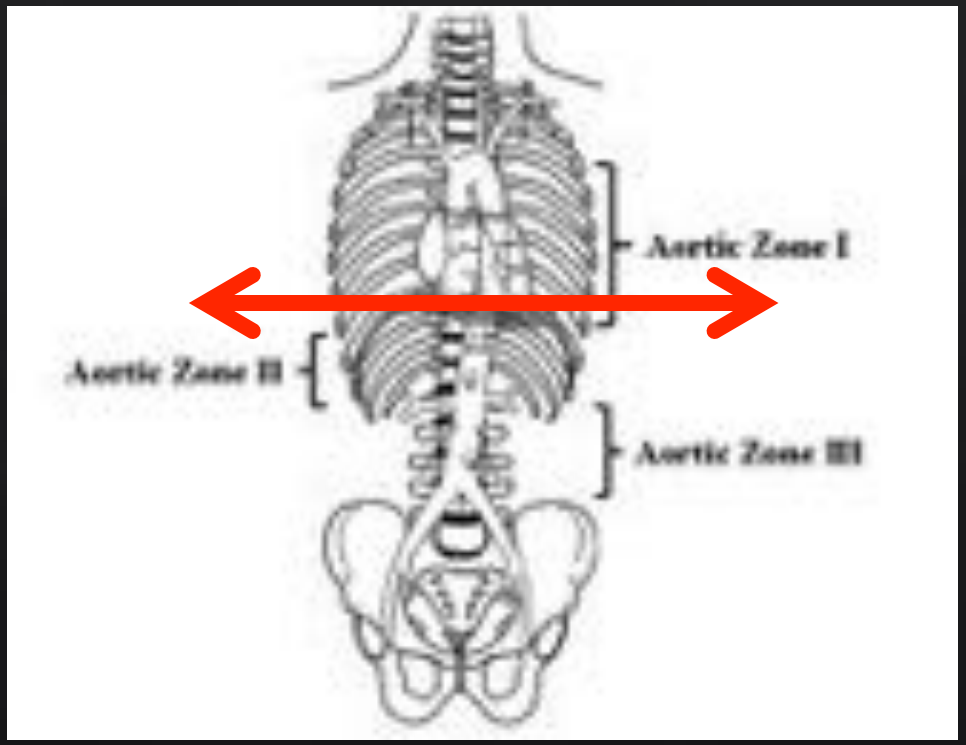
Table 3. Predictive Values for MT according to the Haemoperitoneum Size.

Size Of Haemoperitoneum	All patients (*N = 381*)		Hypotensive patients* (*n = 182*)		Non-hypotensive Patients (*n = 199*)	
	PPV	NPV	PPV	NPV	PPV	NPV
Large	41% (32-51%)	85% (81-89%)	61% (48-73%)	71% (63-79%)	8% (0-17%)	95% (92-98%)
Moderate	23% (15-31%)	79% (74-84%)	32% (21-43%)	56% (46-65%)	6% (0-13%)	94% (91-98%)
No/minimal	10% (6-15%)	68% (62-75%)	25% (12-37%)	55% (46-63%)	5% (1-8%)	93% (87-99%)

American Journal of Emergency Medicine (2013) **31**, 130–136

A clinical series of resuscitative endovascular balloon occlusion of the aorta for hemorrhage control and resuscitation

Megan L. Brenner, MD, Laura J. Moore, MD, Joseph J. DuBose, MD, George H. Tyson, MD, Michelle K. McNutt, MD, Rondel P. Albarado, MD, John B. Holcomb, MD, Thomas M. Scalea, MD, *and* Todd E. Rasmussen, MD



J Trauma. 2013;75:506-511

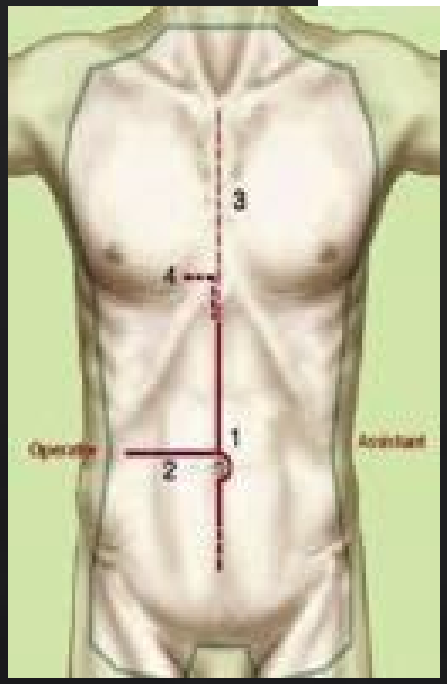
Laparotomie exploratrice

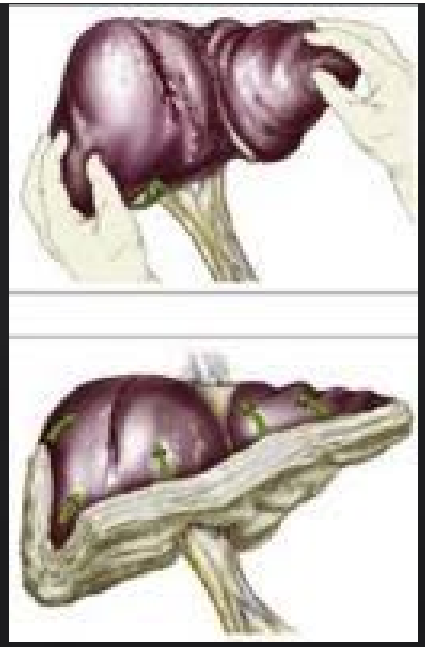
Lapa
exp

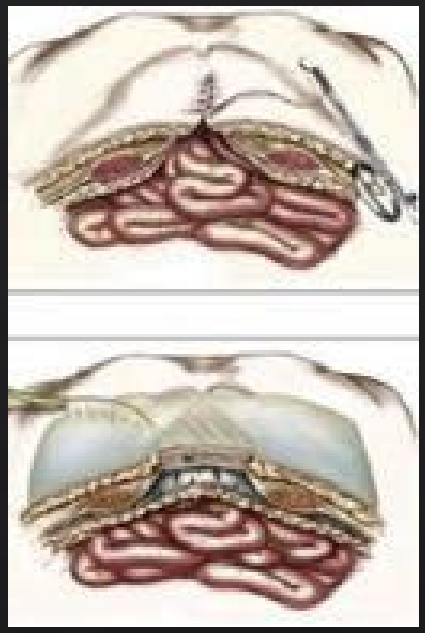
SURGICAL TECHNIQUE

Damage control laparotomy

C. Letoublon*, F. Reche, J. Abba, C. Arvieux

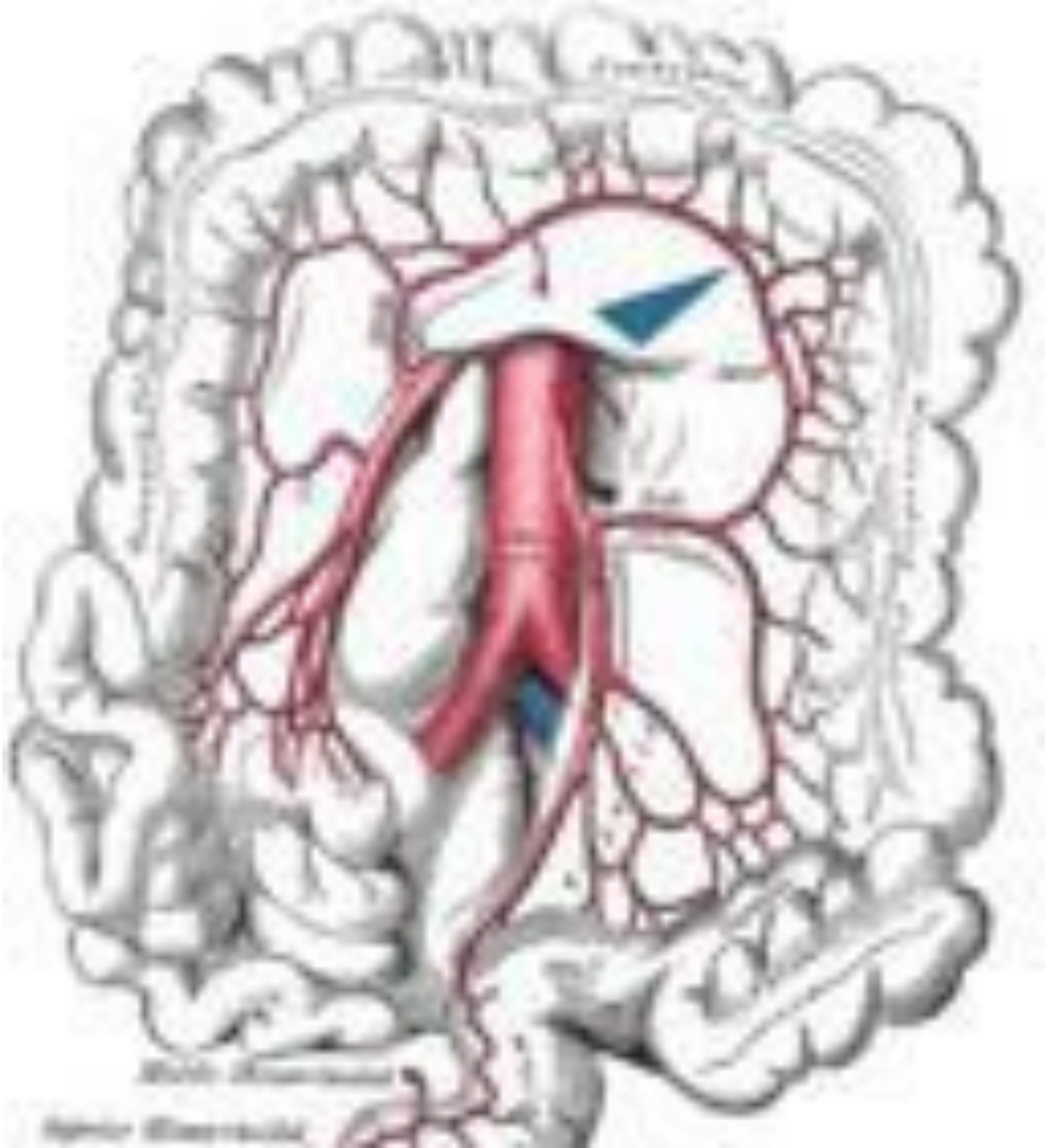


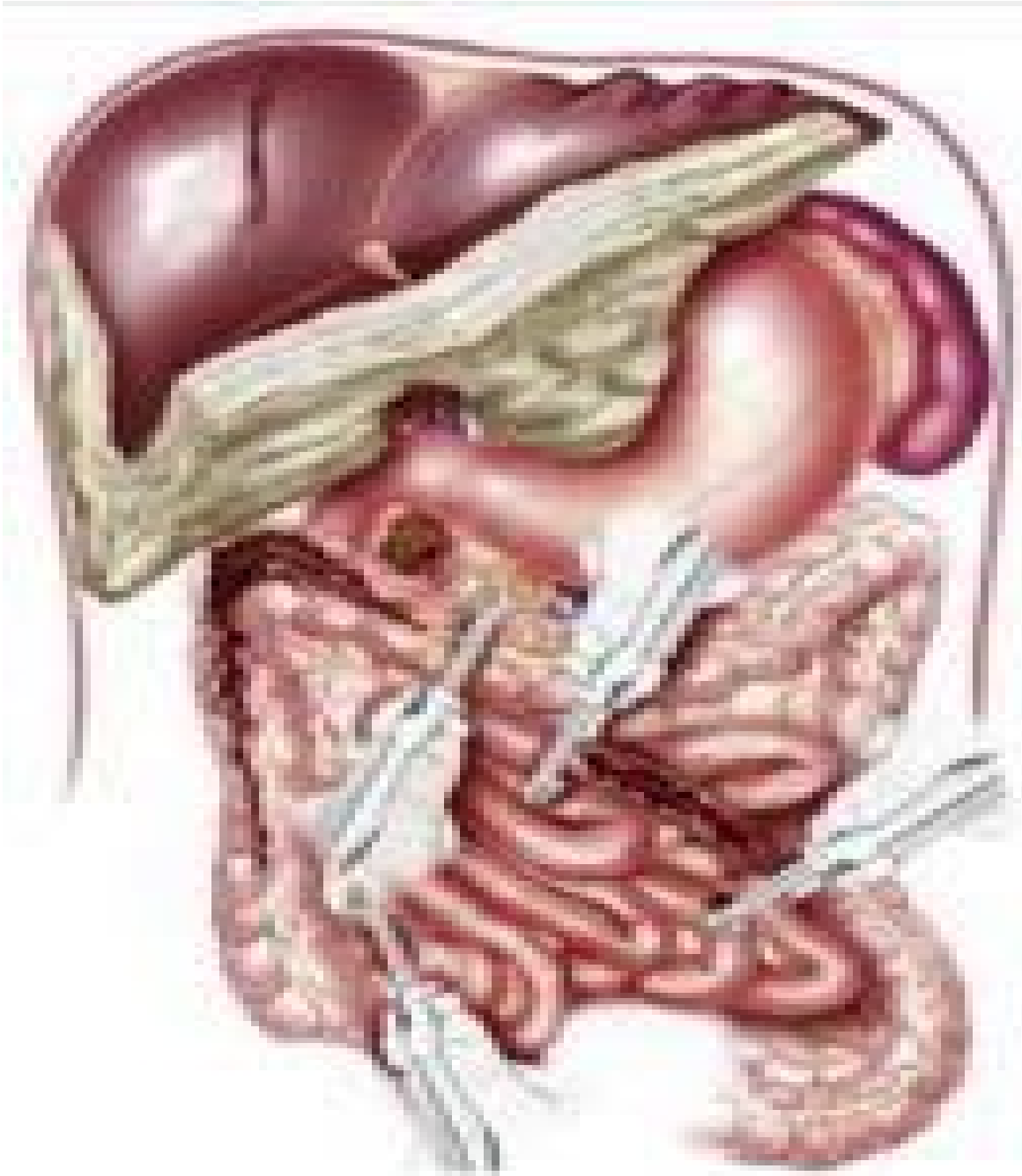


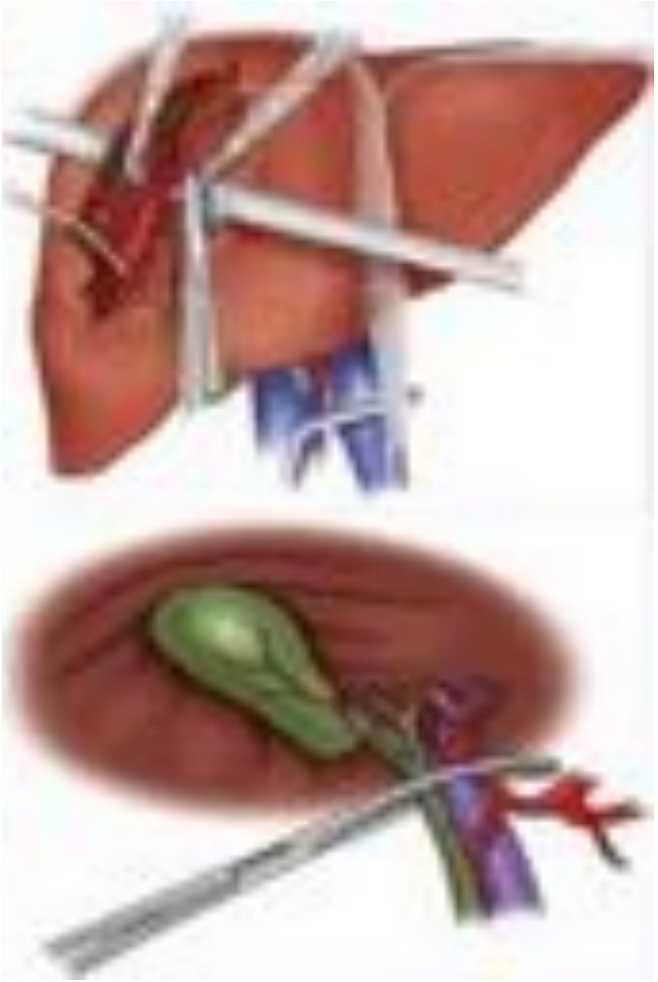


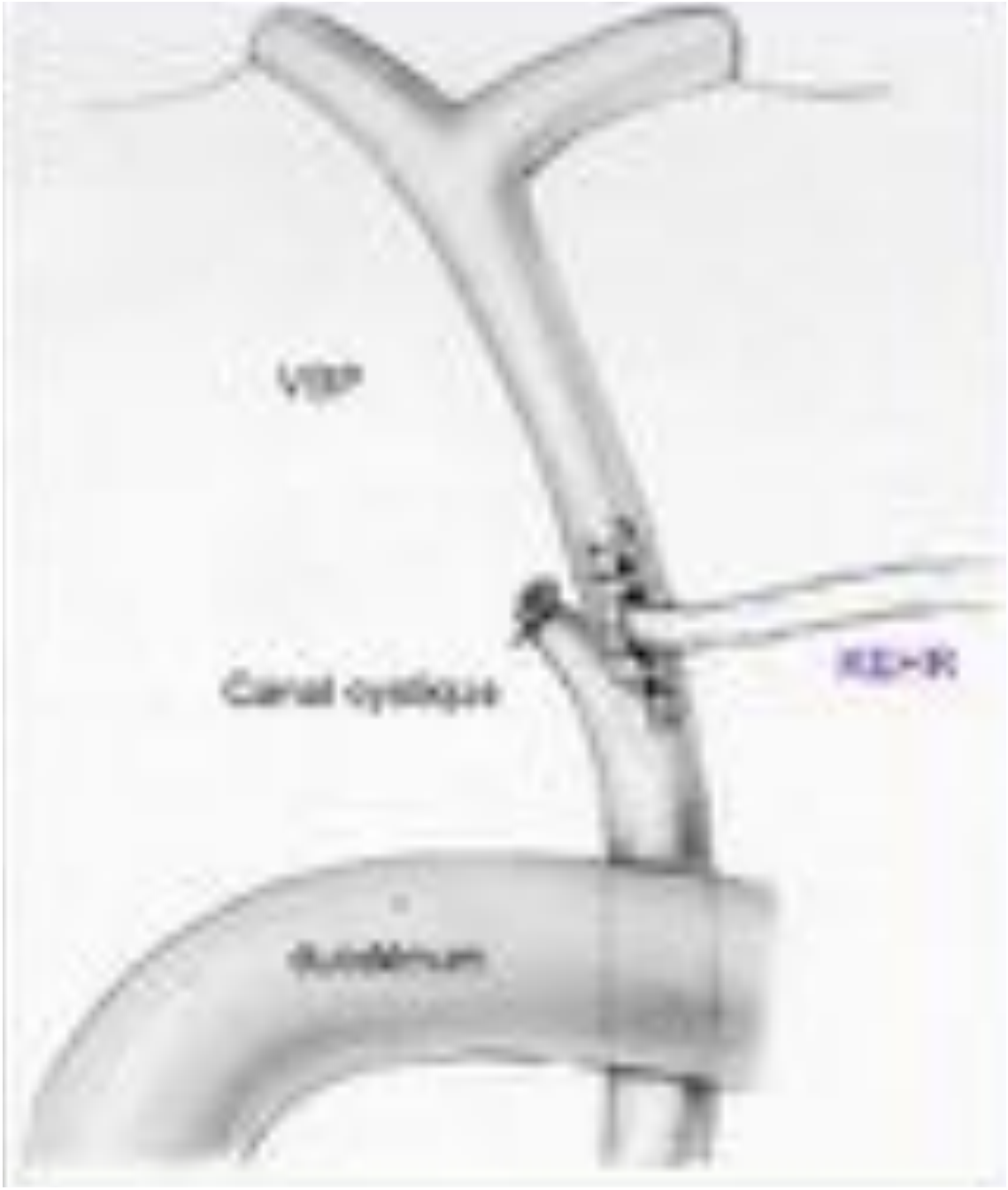
Damage control laparotomy

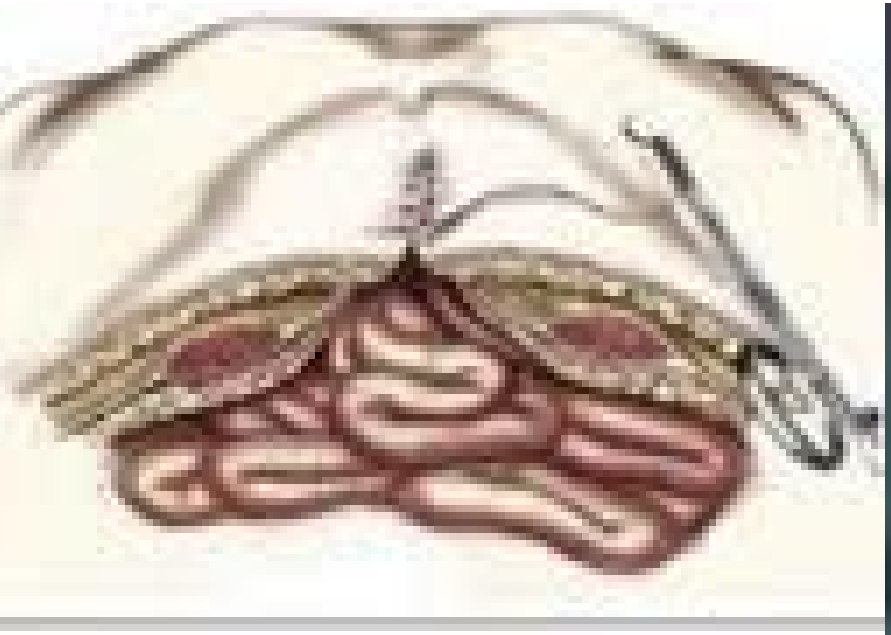
- Réservé aux patients les plus graves
- Discuter pré ou per-op
- Discuter le type de fermeture
- Envisager une procédure associée
- Suivi d'une réanimation agressive
- Programmer une réparation secondaire

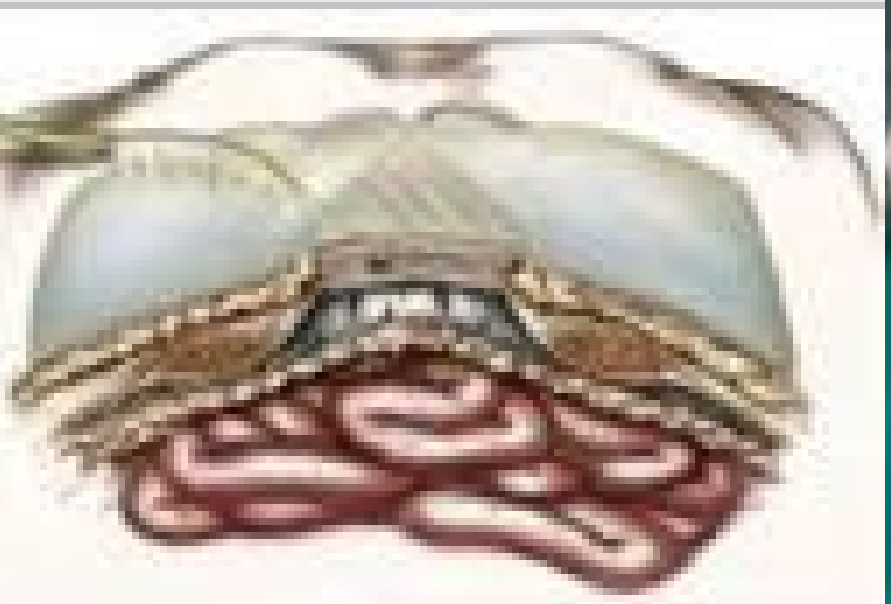







VBP
Canal cystique
Duodénum





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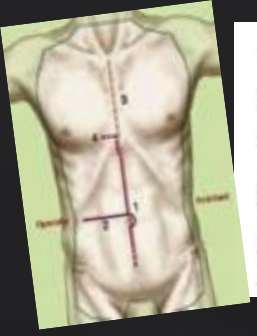


Evolution in Damage Control for Exsanguinating Penetrating Abdominal Injury

Jon W. Johnson, MD, Vicente H. Gracias, MD, C. William Schwab, MD, FACS, Patrick M. Reilly, MD, FACS, Donald R. Kauder, MD, FACS, Michael B. Shapiro, MD, FACS, G. Paul Dabrowski, MD, FACS, and Michael F. Rotondo, MD, FACS

- Patients choc hémorragique d'origine abdominale
- Comparaison Laparo damage control vs Laparo classique

Table 4 Operative Phase (DCI)

Parameters	CS (n = 21)	HS (n = 24)	*p* Value
Time (min)	174 ± 98	182 ± 66	0.742
LpH	7.18 ± 0.15	7.20 ± 0.18	0.690
$LHCO_3$	17.0 ± 4.1	18.3 ± 3.4	0.251
$LTemp_{OR}$	34.9 ± 1.4	32.9 ± 1.4	0.00002
SBP	122.2 ± 23.5	111.2 ± 27.8	0.162
Crystalloid	9.4 ± 5.3	9.2 ± 4.7	0.894
PRBCs	11.2 ± 8.3	22.7 ± 11.6	0.0005
FFP	3.5 ± 3.5	5.4 ± 3.3	0.068
Platelets	4.9 ± 5.4	7.5 ± 4.7	0.091

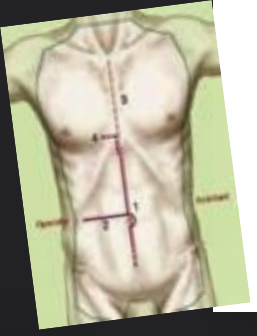
Table 6 Patient Survival

Parameter	Current Period (n = 21)	Historical Period (n = 24)	*p* Value
Survival (%)	90	58	0.02
ISS	30.4 ± 15.3	30.6 ± 9.6	0.18
PATI	33.1 ± 12.8	37.0 ± 13.9	0.335
OR—lowest temp	34.9 ± 1.4	32.9 ± 1.4	<0.001
ICU pH—on arrival	7.37 ± 0.11	7.37 ± 0.12	1.00
ICU PT—on arrival	15.2 ± 1.5	19.6 ± 9.2	0.05
ICU PTT—on arrival	36.8 ± 10.0	70.4 ± 39.5	0.001

PT, prothrombin time; PTT, partial thromboplastin time.

- Résultats :
  - Diminution des besoins transfusionnels
  - Acidose moins profonde
  - Augmentation de la survie

J Trauma. 2001;51:261–271.



Safety of Performing a Delayed Anastomosis During Damage Control Laparotomy in Patients With Destructive Colon Injuries

Carlos A. Ordoñez, MD, Luis F. Pino, MD, Marisol Badiel, MD, MSc, Alvaro I. Sánchez, MD, MS, Jhon Loaiza, BSc, Leonardo Ballestas, MD, and Juan Carlos Puyana, MD

Surgical Management Protocol

In our institution, a protocol of damage control for trauma patients has been established. At the time of the index or initial laparotomy, DCL involving control of bleeding with packing is performed if the patients presents with hypothermia (defined as temperature <35°C), base deficit >−8 mmol/L, hemoperitoneum >1,500 cm^3, and New Injury Severity Score (NISS) >35.

The patients underwent immediate DCL, which involved control of bleeding with packing. To prevent contamination, the affected colon segment was resected and the proximal and distal colonic ends were temporarily left in discontinuity. The abdominal wall was closed using the vacuum-pack technique. Patients were transferred to the ICU

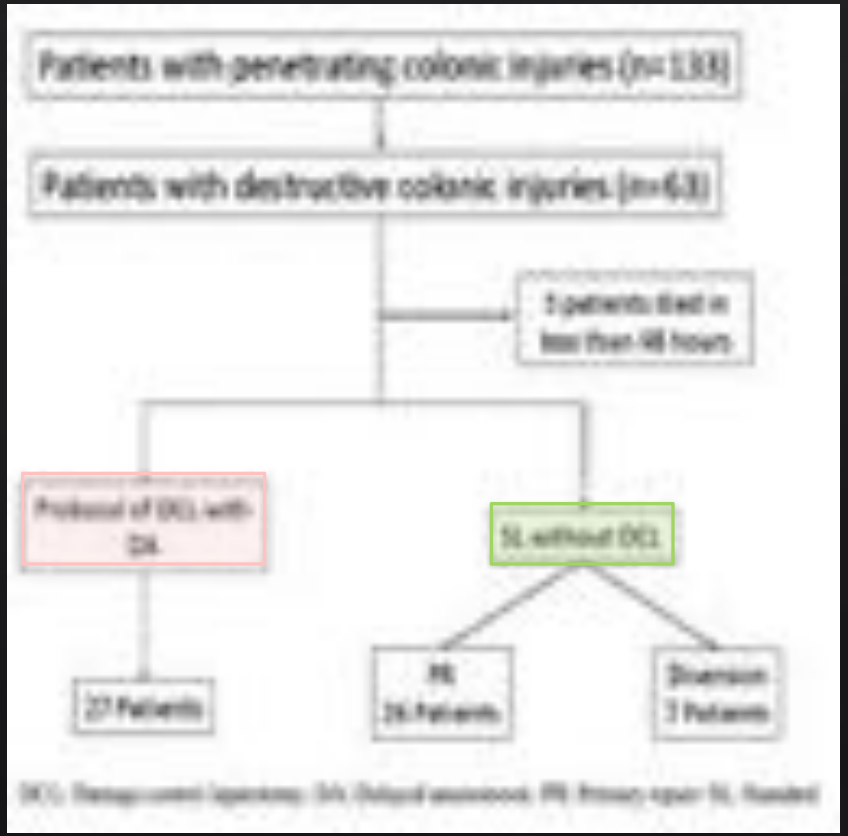


TABLE 3. Comparison of Outcomes Between Patients With DCI Who Underwent a Damage Control Laparotomy With Delayed Anastomosis and Patients With DCI Who Underwent Standard Laparotomy With Primary Repair

Outcome	DCL With DA (n = 27)	SL With Primary Repair (n = 26)	P
Complications, n (%)			
Leaks	2 (7.4)	1 (3.8)	0.157
Intra-abdominal abscess	16 (59.2)	12 (46.2)	0.34
Fasciitis	3 (11.1)	3 (11.5)	0.96
Mortality, n (%)	1 (3.7)	0 (0.0)	0.322

SL, standard laparotomy; DA, delayed anastomosis.

J Trauma. 2011;71: 1512–1518

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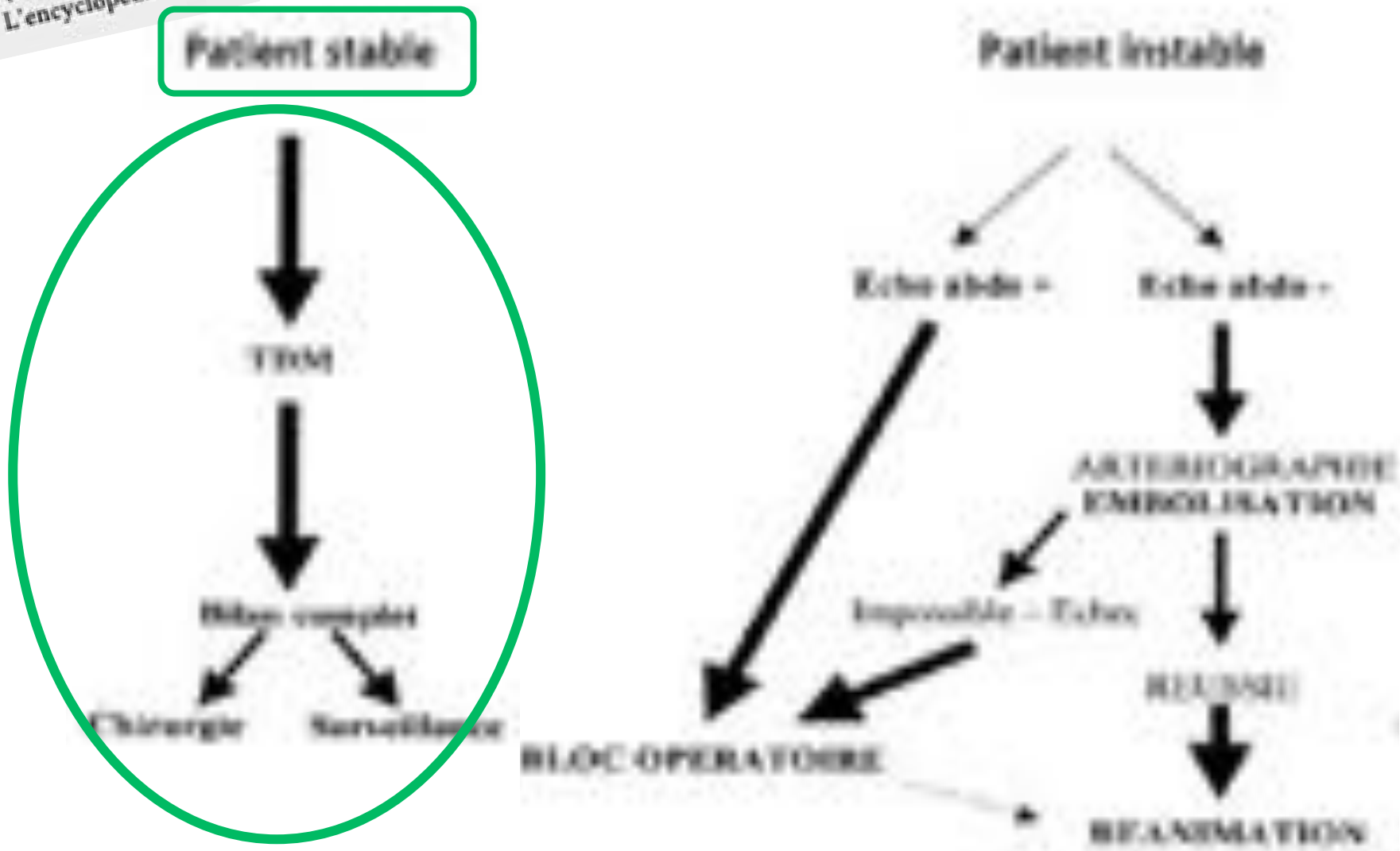
STRATEGIE de PEC



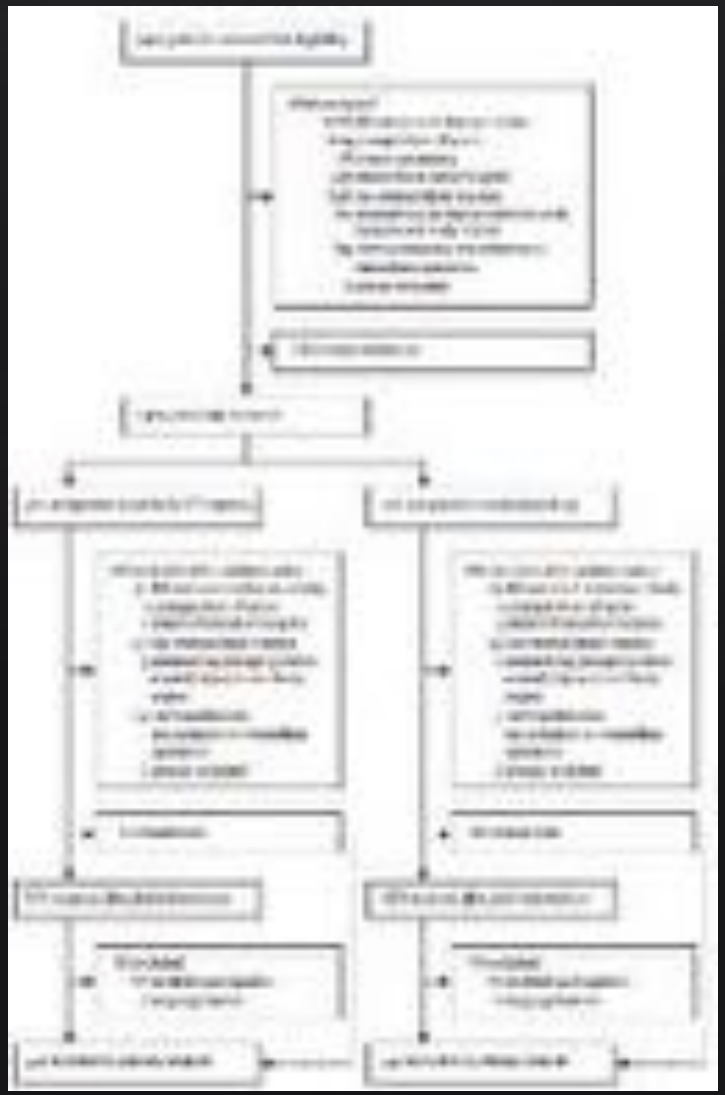
Exploration du patient stable

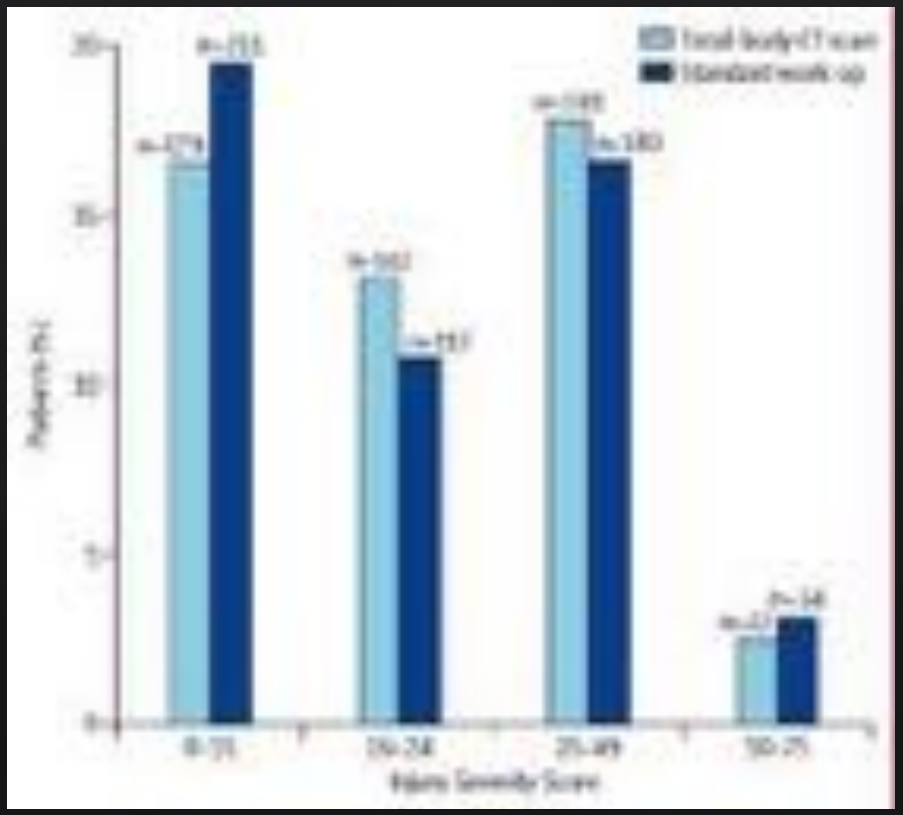
- Systématique
- Temps artériel + Portal
- ± tardif à 5’
- ± tardif à 15-20’

Huber-Wagner et al. *Lancet* 09

Immediate total-body CT scanning versus conventional imaging and selective CT scanning in patients with severe trauma (REACT-2): a randomised controlled trial

Joanne C Sierink, Kaj Treskes, Michael J R Edwards, Benn J A Beuker, Dennis den Hartog, Joachim Hohmann, Marcel G W Dijkgraaf, Jan S K Luitse, Ludo F M Beenen, Markus W Hollmann, J Carel Goslings, for the REACT-2 study group*





Lancet 2016; 388: 673–83

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	Total-body CT		Standard work-up		p value
	Number of patients	Data	Number of patients	Data	
[illegible]					
[illegible]					
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	Total-body CT		Standard work-up		p value
	Number of patients	Data	Number of patients	Data	
[illegible]					
[illegible]					
All patients, ITT	423	[illegible]	424	[illegible]	[illegible]
Patients with polytrauma	359	[illegible]	353	[illegible]	[illegible]
Patients with ISS ≥16	340	[illegible]	327	[illegible]	[illegible]
[illegible]					
All patients, ITT	423	[illegible]	424	[illegible]	[illegible]
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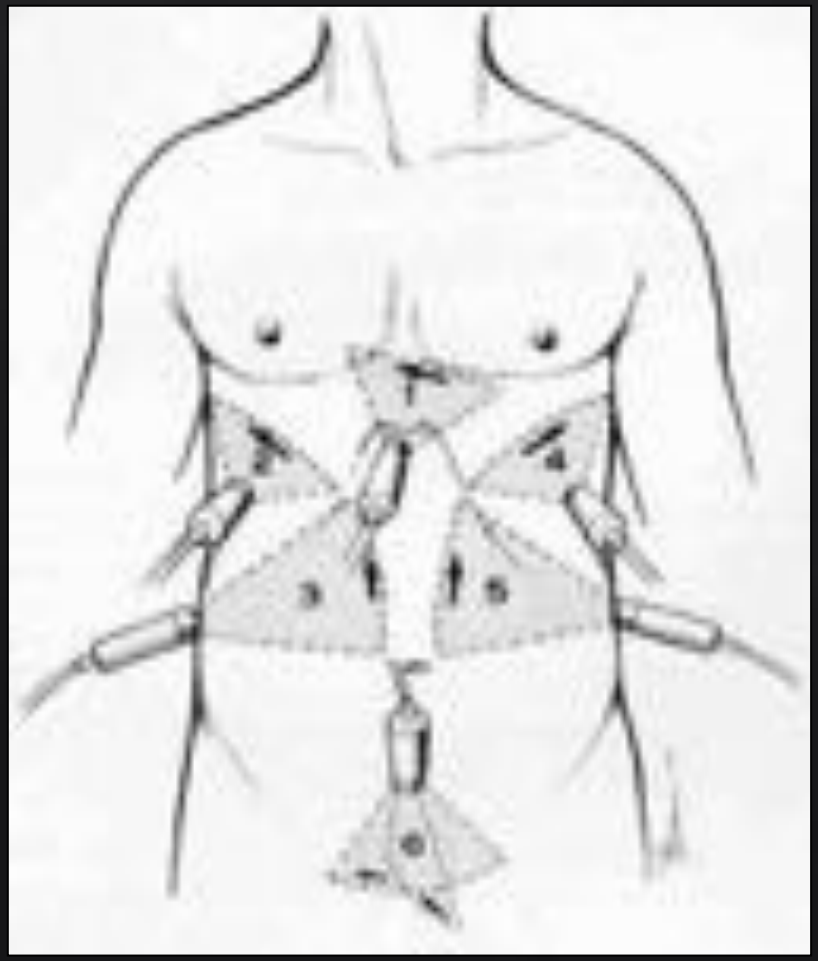
Lancet 2016; 388: 673–83

Exploration du patient stable

- Systématique
- Temps artériel + Portal
- ± tardif à 5’
- ± tardif à 15-20’

Huber-Wagner et al. *Lancet* 09

Exploration du patient stable



J Trauma 1995;38:879–885

- Détecter et quantifier l'HP
- Evaluer la gravité
- Activer la réalisation du scanner
- Anticiper la commande de sang
- Anticiper la prise en charge
- …. se bouger…..

Exploration du patient stable

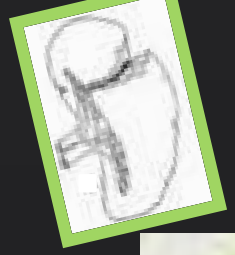
- Systématique
- Temps artériel + Portal
- ± tardif à 5’
- ± tardif à 15-20’

Huber-Wagner et al. *Lancet* 09

Exploration du patient stable

Stratégie par organe

Organe	Fréquence
Rate	46 %
Foie	33 %
Mésentère	10 %
Reins-vessie	9 %
Intestin grêle	8 %
Colon	7 %
Duodénum-pancréas	5 %
Vaisseaux	4 %
Estomac	2 %
Vésicule	2 %



Trauma splénique

OIS Rate

GRADE 3

- Hématome capsul[illegible], S° >50%
- Lacération >3cm

GRADE 1

- Hématome capsul[illegible], S° >10%
- Lacération <1cm

GRADE 4

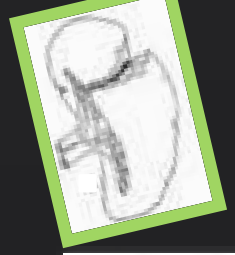
- Dévascularisation >25%
- Lacération proximale

GRADE 2

- Hématome capsul[illegible], S° >10-50% ou < 5cm
- Lacération 1 à 3 cm

GRADE 5

- Fracture avec éclatement de rate
- Lésion hilaire vasculaire

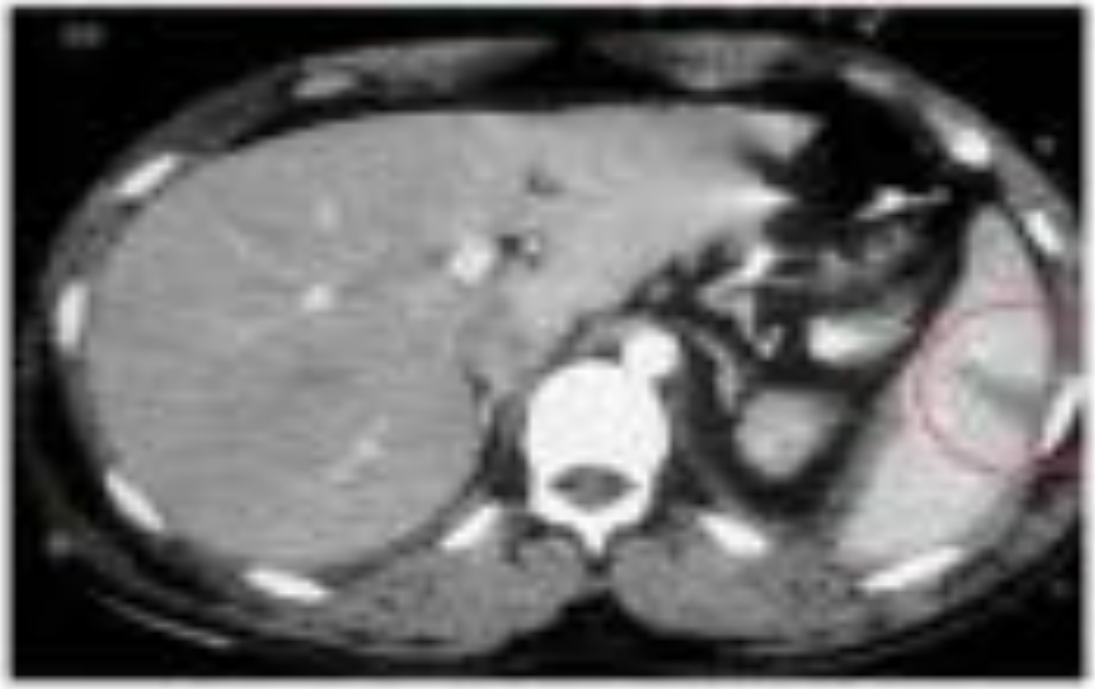


Trauma splénique

Grade I

Hématome sous-capsulaire non-expansif inférieur à 10 % de la surface splénique

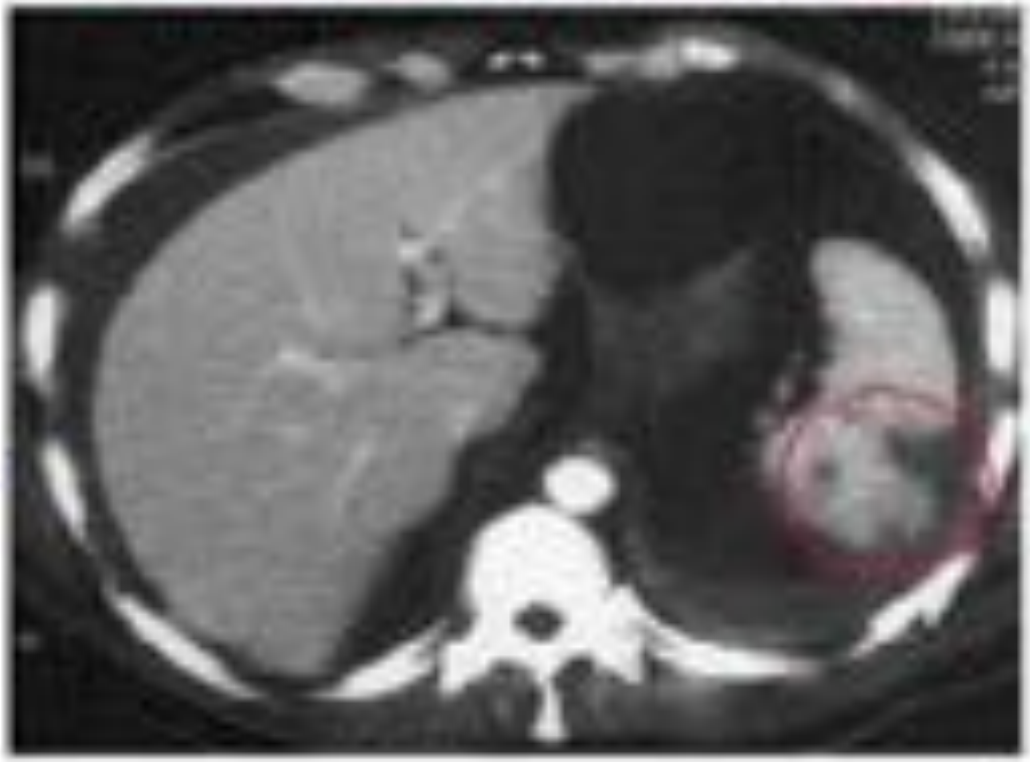
Parenchyme : lacération capsulaire non hémorragique d'une profondeur < 1 cm



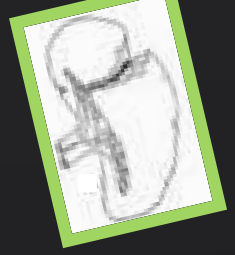
Trauma splénique

Grade II

Hématome sous-capsulaire, non expansif intéressant 10-50 % de la surface splénique



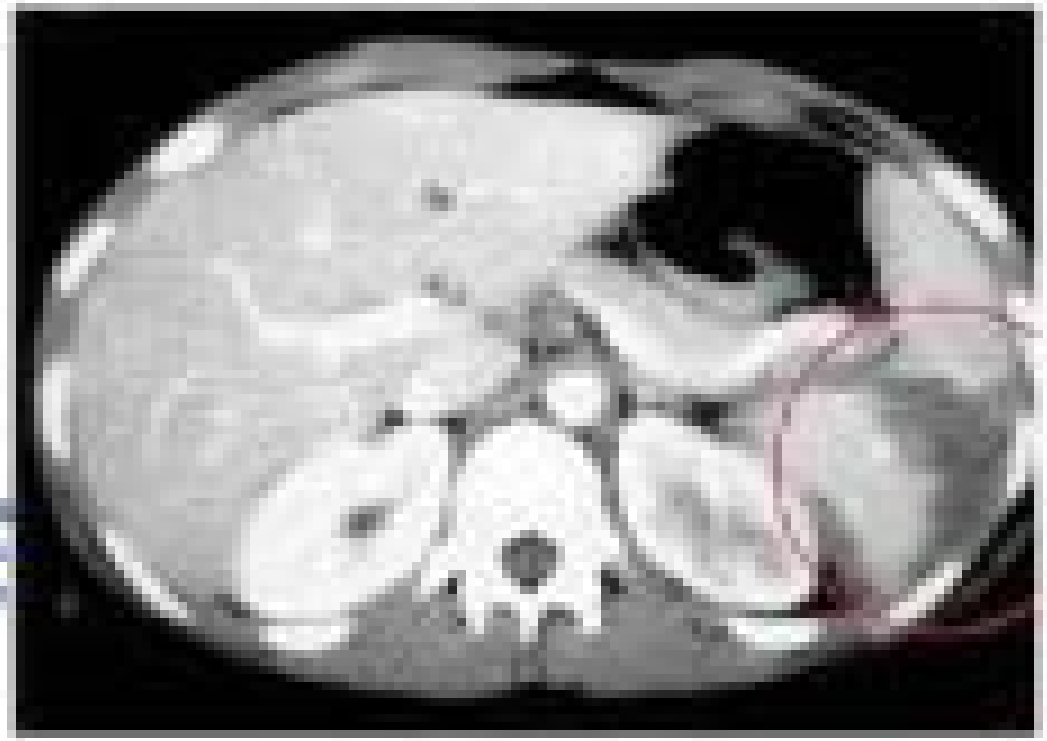
Parenchyme : lacération capsulaire hémorragique, fracture parenchymateuse profonde de 1 à 3 cm sans atteinte des vaisseaux trabéculaires



Trauma splénique

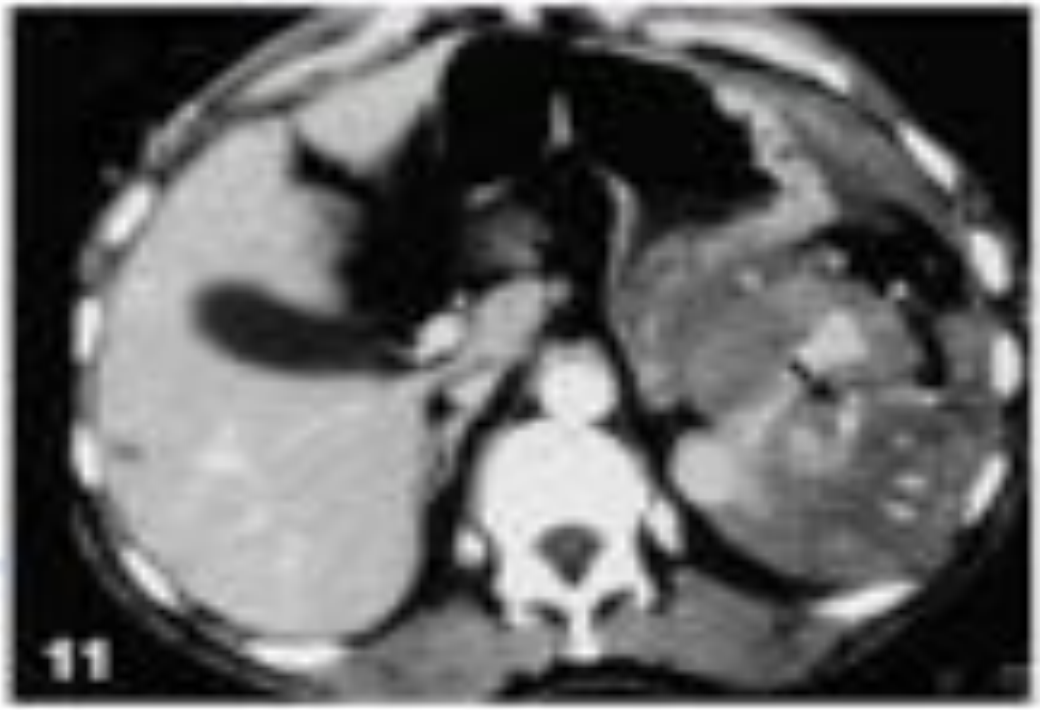
Trauma splénique

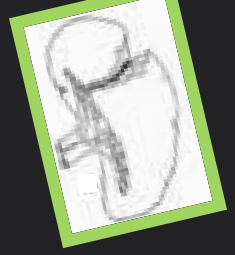
Grade IV



Trauma splénique

Grade V





Blunt Splenic Injury in Adults: Multi-institutional Study of the Eastern Association for the Surgery of Trauma

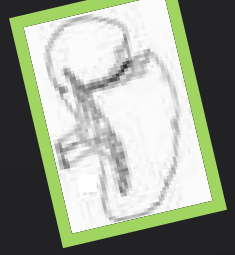
Andrew B. Peitzman, MD, Brian Heil, MD, Louis Rivera, MD, Michael B. Federle, MD, Brian G. Harbrecht, MD, Keith D. Clancy, MD, Martin Croce, MD, Blaine L. Enderson, MD,

The EAST Multi-institutional Spleen Study

Table 3 Differences between Patient Groups

	Group I (Direct to OR) n = 575	Group II (Successful Observation) n = 816	Group III (Failed Nonoperative Management) n = 87
Age[A,C] (y)	36 ± 19	34 ± 17	41 ± 20
Highest ED heart rate[A,B] (bpm)	120 ± 26	107 ± 22	109 ± 23
Lowest SBP in ED[A,B] (mm Hg)	90 ± 30	112 ± 23	106 ± 23
GCS score[A,B]	11.1 ± 5.0	13.1 ± 3.8	13.4 ± 3.4
ISS[A,B,C]	31.6 ± 13.1	20.3 ± 11.3	26.5 ± 12.6
Hematocrit in ED[A,B,C] (%)	32.2 ± 7.4	37.4 ± 6.5	35.4 ± 5.9
Base deficit[A,B]	8.7 ± 6.2	4.7 ± 3.9	5.0 ± 3.9
Red cell transfusion in the ED[A,B] (units of RBCs)	1.6 ± 2.6	0.3 ± 1.1	0.6 ± 1.3
Red cell transfusions in first 24 h[A,B,C] (units)	6.4 ± 10.6	1.2 ± 3.0	4.1 ± 6.9
Red cell transfusions preoperatively (units)	2.1 ± 3.1	–	2.9 ± 4.5
Mortality within group[A,B,C] (%)	25.9	4.2	16.5
Time to operation[A] (h)	1.7 ± 1.3	–	83.2 ± 136.8
ICU length of stay[A,C] (days)	6.2 ± 13.5	4.1 ± 7.5	9.5 ± 17.1
Hospital length of stay[A,C] (days)	14.9 ± 19.1	10.0 ± 15.8	16.6 ± 21.9

J Trauma. 2000;49:177–189.



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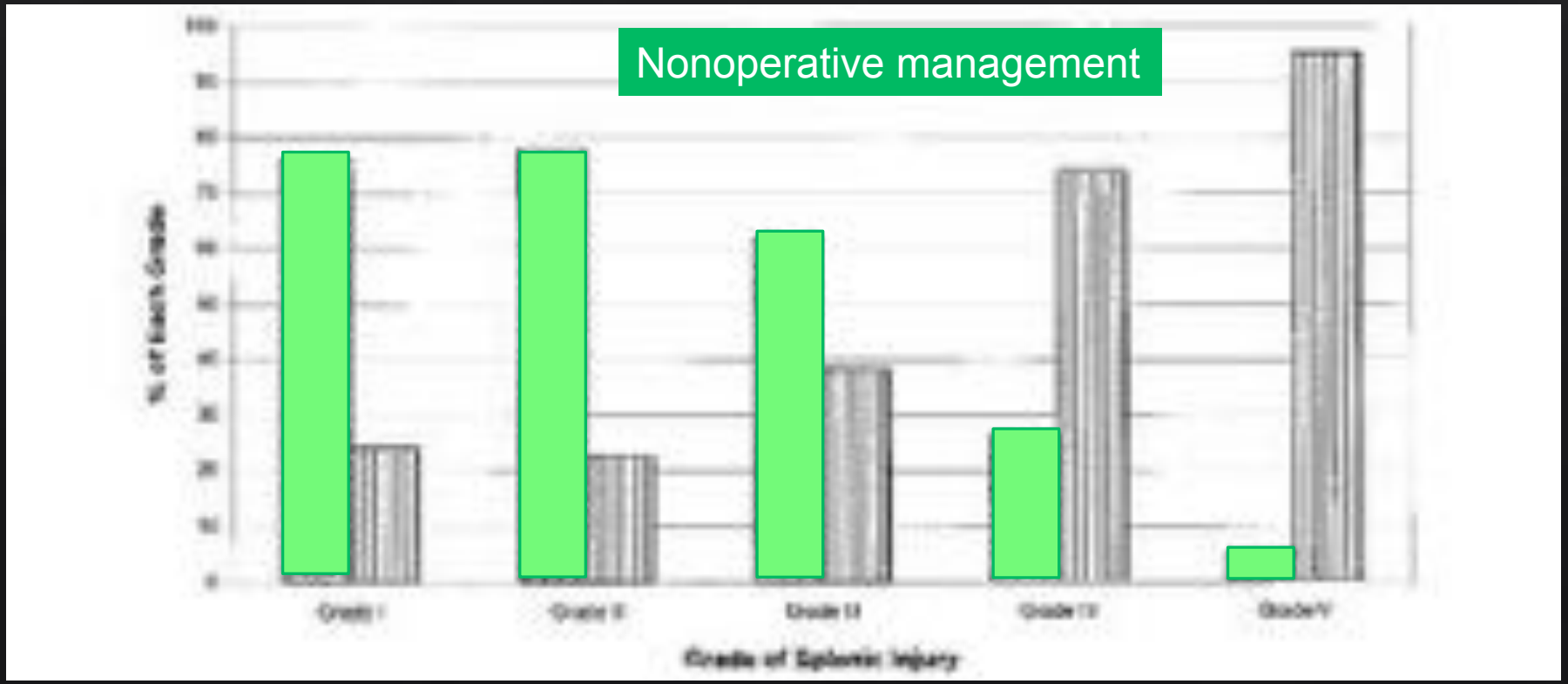

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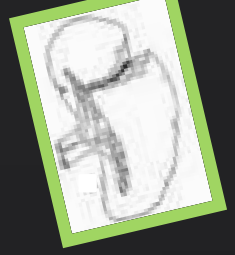

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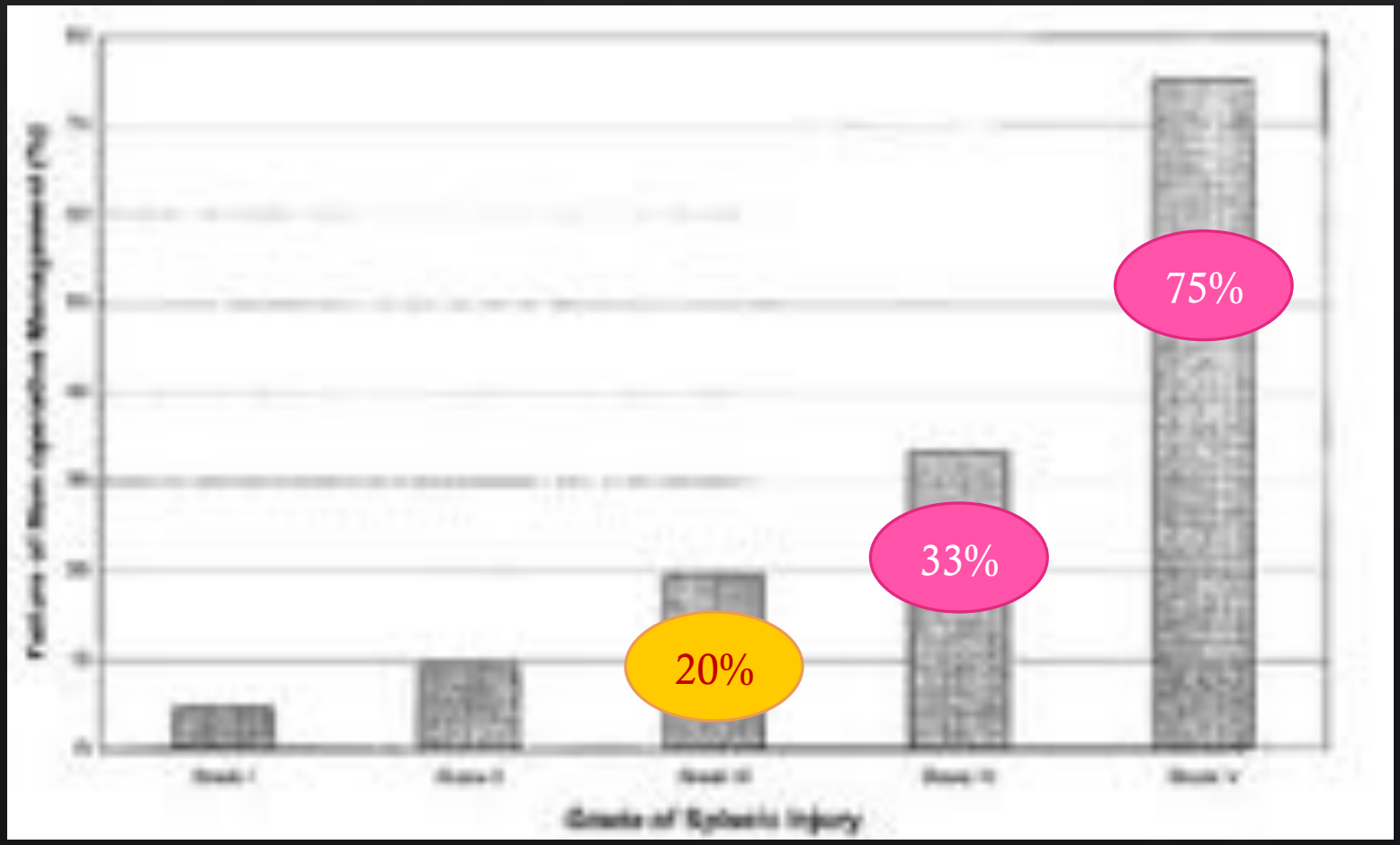

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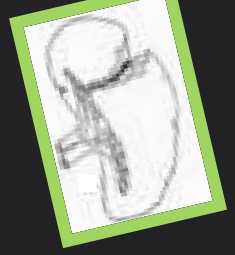

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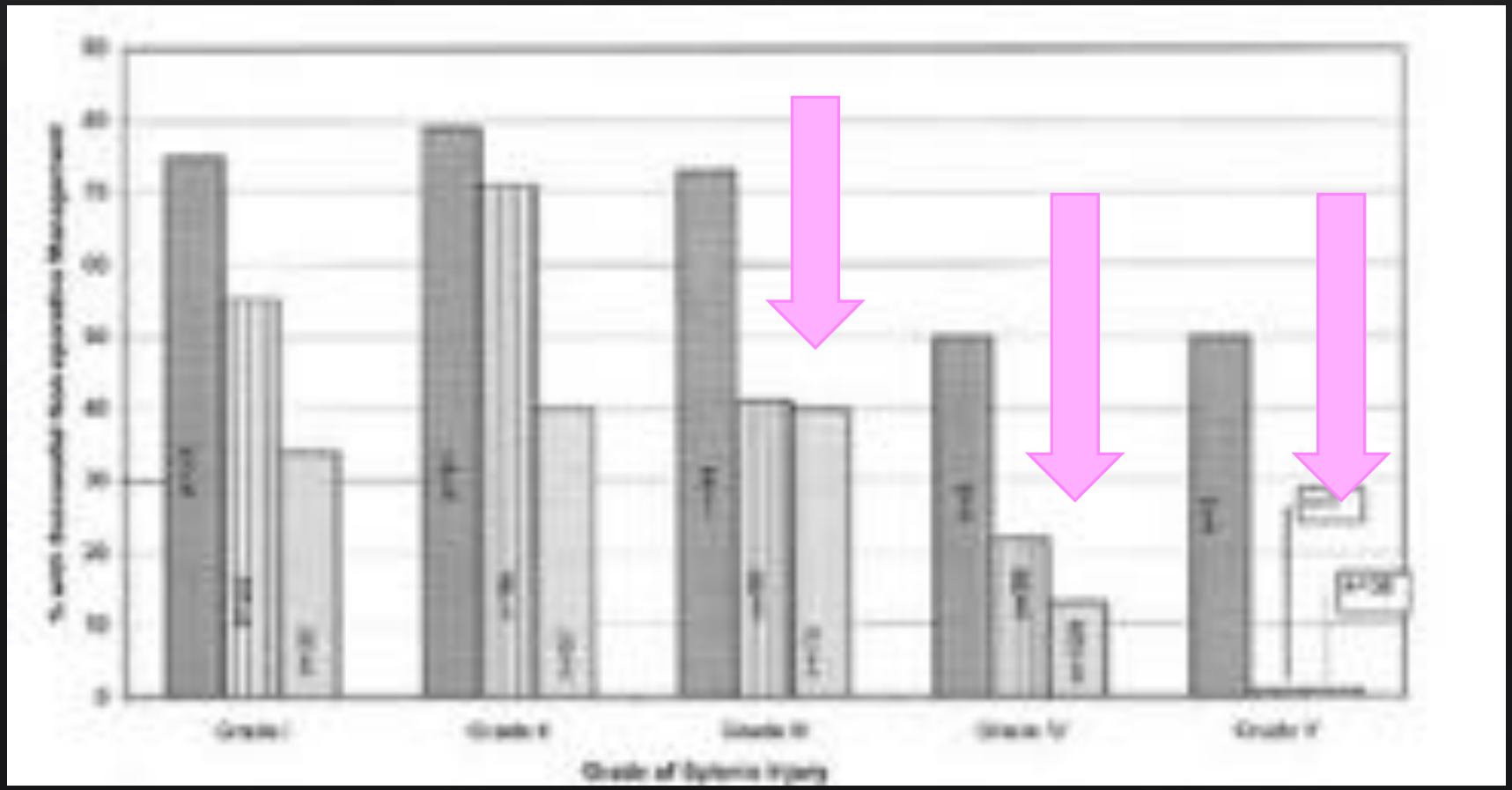
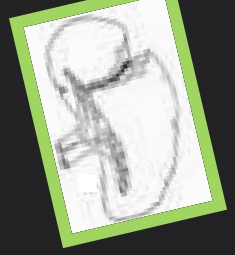
Andrew B. Peitzman, MD, Brian Heil, MD, Louis Rivera, MD, Michael B. Federle, MD, Brian G. Harbrecht, MD, Keith D. Clancy, MD, Martin Croce, MD, Blaine L. Enderson, MD,

The EAST Multi-institutional Spleen Study



J Trauma. 2000;49:177–189.



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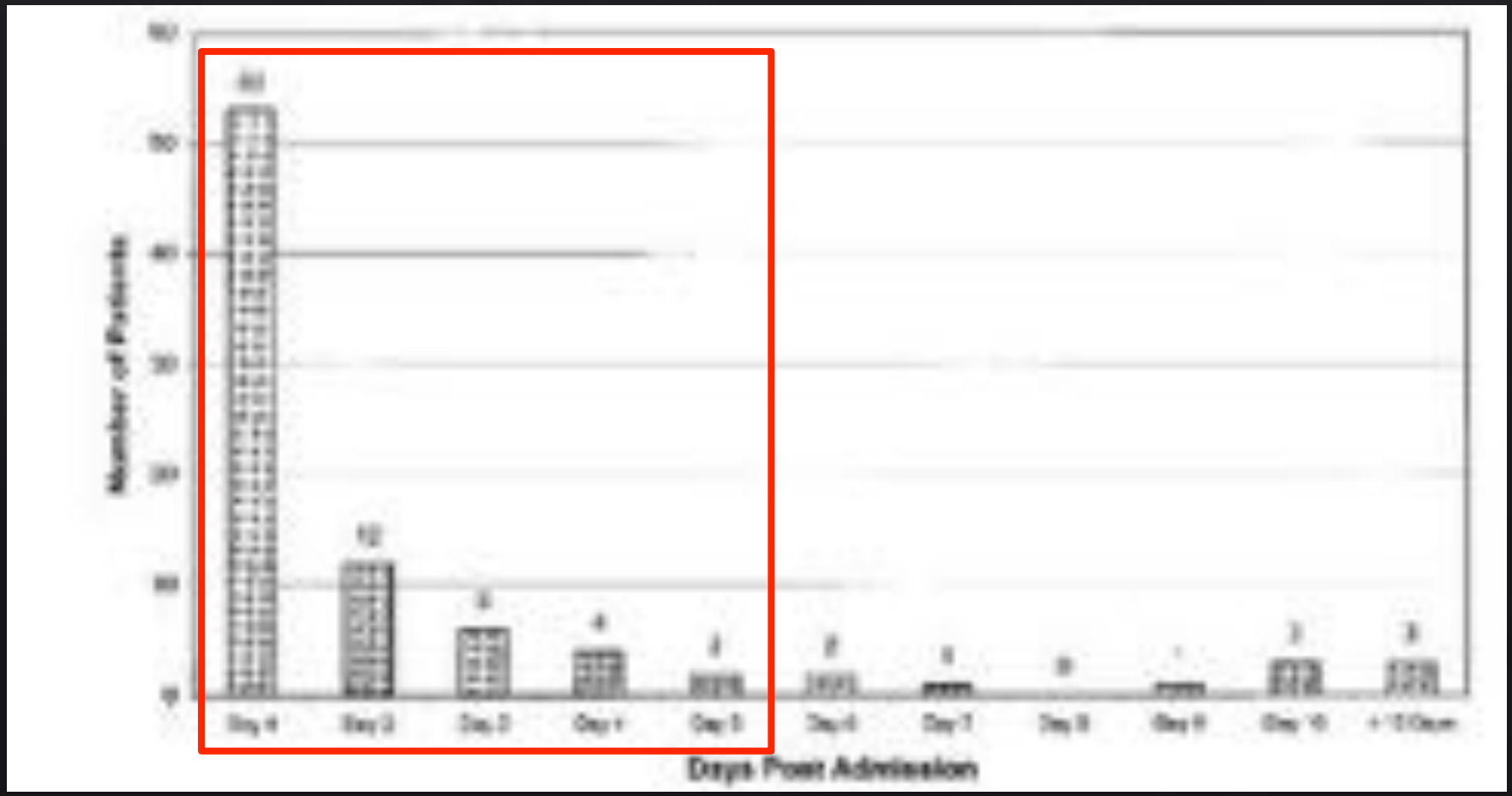

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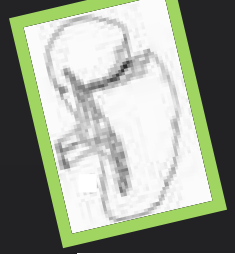
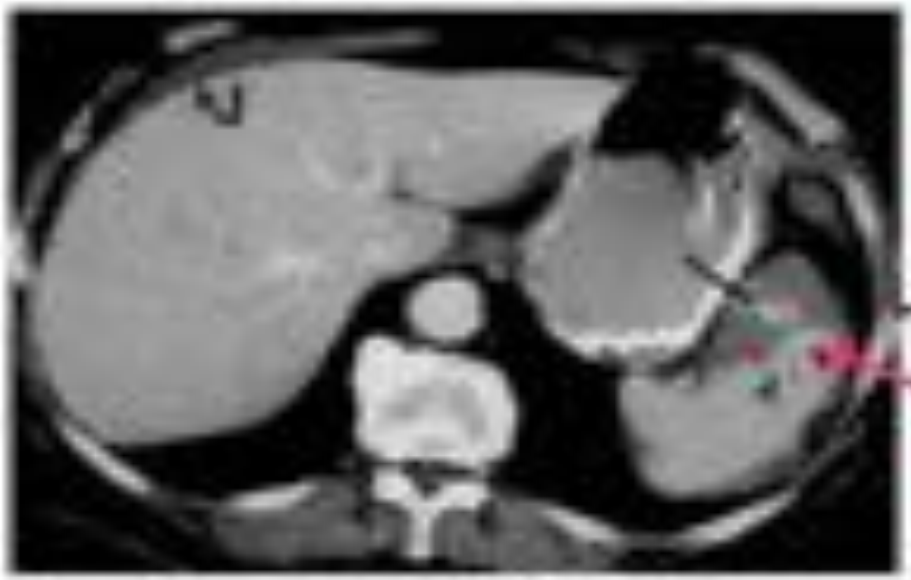
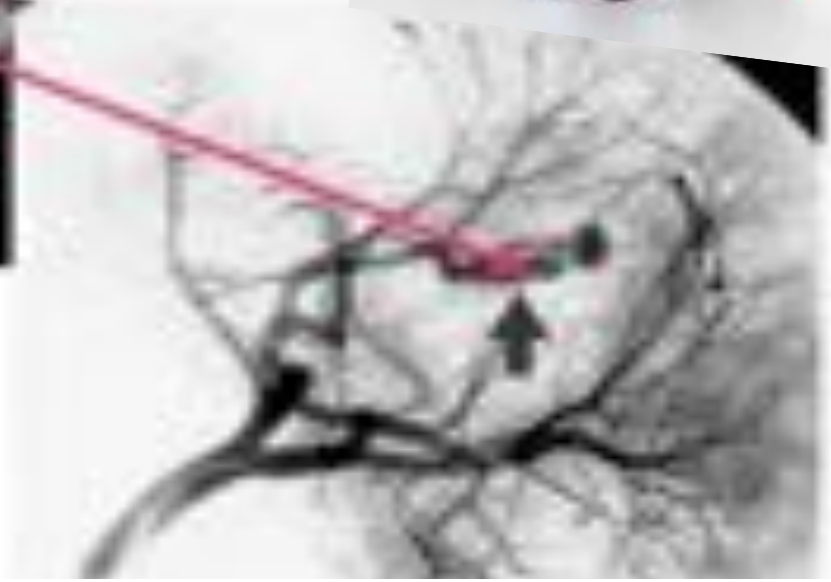
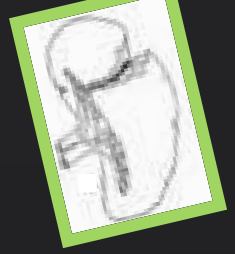


Trauma splénique





Embolisation hémostatique



Nonoperative Management of Blunt Splenic Injury: A 5-Year Experience

James M. Haan, MD, FACS, Grant V. Bochicchio, MD, MPH, N. Kramer, RN, and Thomas M. Scalea, MD, FACS

Table 6 WTA Results vs. EAST

CT Scan Grade	WTA Splenic Salvage (%)	EAST Splenic Salvage (%)	*P* Value
1	0	95.2	NS
2	94	90.5	NS
3	92	80.4	0.03
4	83	66.7	0.02
5	83	25	0.002

WTA, Western Trauma Association; NS, not significant.

Conclusion: Splenic embolization remains a valuable technique in splenic salvage, especially in higher grade injuries. Complications are common but do not seem to affect outcome.

J Trauma. 2004;56:542–547.

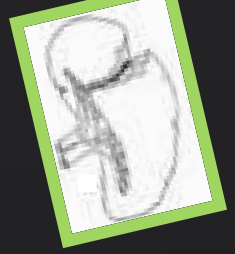


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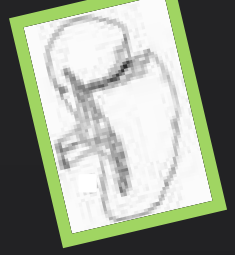
Table 5 Complications

Complication	No.	%	Splenic Salvage
Major	27	20	
Hemorrhage	16	11	7
Missed injuries	4	3	0
Diaphragm	3	2	0
Pancreas	1	1	0
Infection	6	4	0
Proven abscess	4	3	1
Suspected abscess	2	0	0
Iatrogenic vascular injury	1	1	1
Minor			
Infarct	30	21	30
Coil migration	3	2	3

J Trauma. 2004;56:542–547.



Akiyoshi Hagiwara, MD
Hideki Fukushima, MD
Atsuo Murata, MD
Hiroharu Matsuda, MD
Shuji Shimazaki, MD

Published online before print
10.1148/radiol.2351031132
Radiology 2005; 235:57–64

Abbreviation:
TAE = transcatheter arterial embolization

Blunt Splenic Injury: Usefulness of Transcatheter Arterial Embolization in Patients with a Transient Response to Fluid Resuscitation[1]

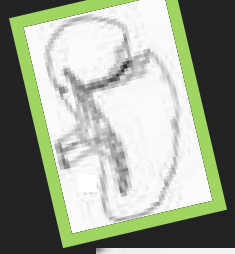
- étude prospective (1999-2002)
- 71 patients hypotendus sur un traumatisme fermé de la rate
- **15 ayant une réponse transitoire au remplissage**
- Angiographie sur critère TDM, embolisation si **SG+** à l'angio

TABLE 3
Hemodynamic Status in 15 Patients Undergoing TAE for Blunt Splenic Trauma

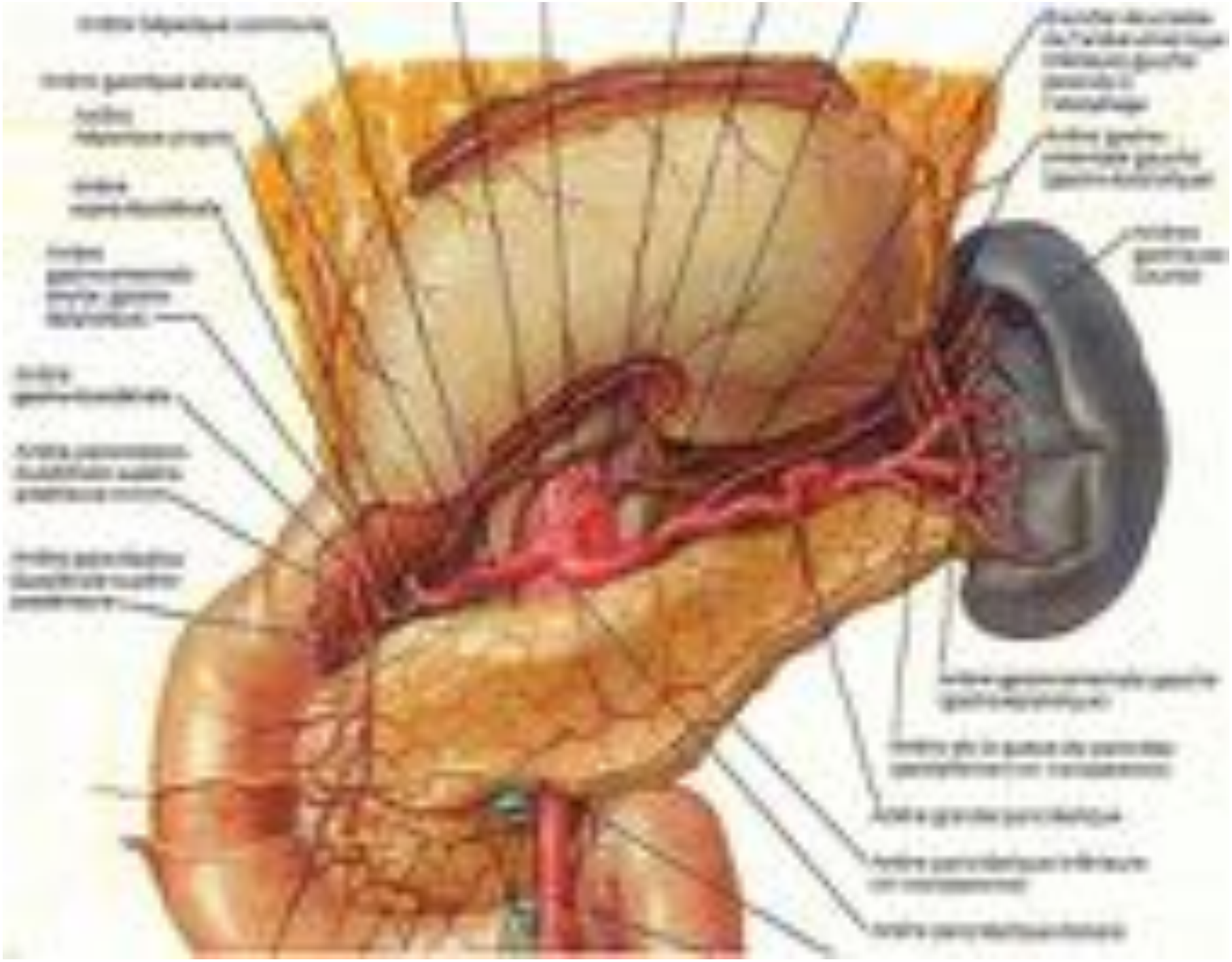
Parameter	Mean ± Standard Deviation
Systolic blood pressure (mm Hg)	
At admission	78.7 ± 12.7
At start of TAE	84.2 ± 9.2*
At completion of TAE	132.1 ± 16.7*
Shock index (heart rate/systolic blood pressure)	
At admission	1.57 ± 0.45
At start of TAE	1.46 ± 0.30*
At completion of TAE	0.77 ± 0.21*
Rate of fluid administration (mL/h)†	
Until completion of TAE	1230.6 ± 264.8‡
24 Hours after TAE	132.1 ± 71.1‡

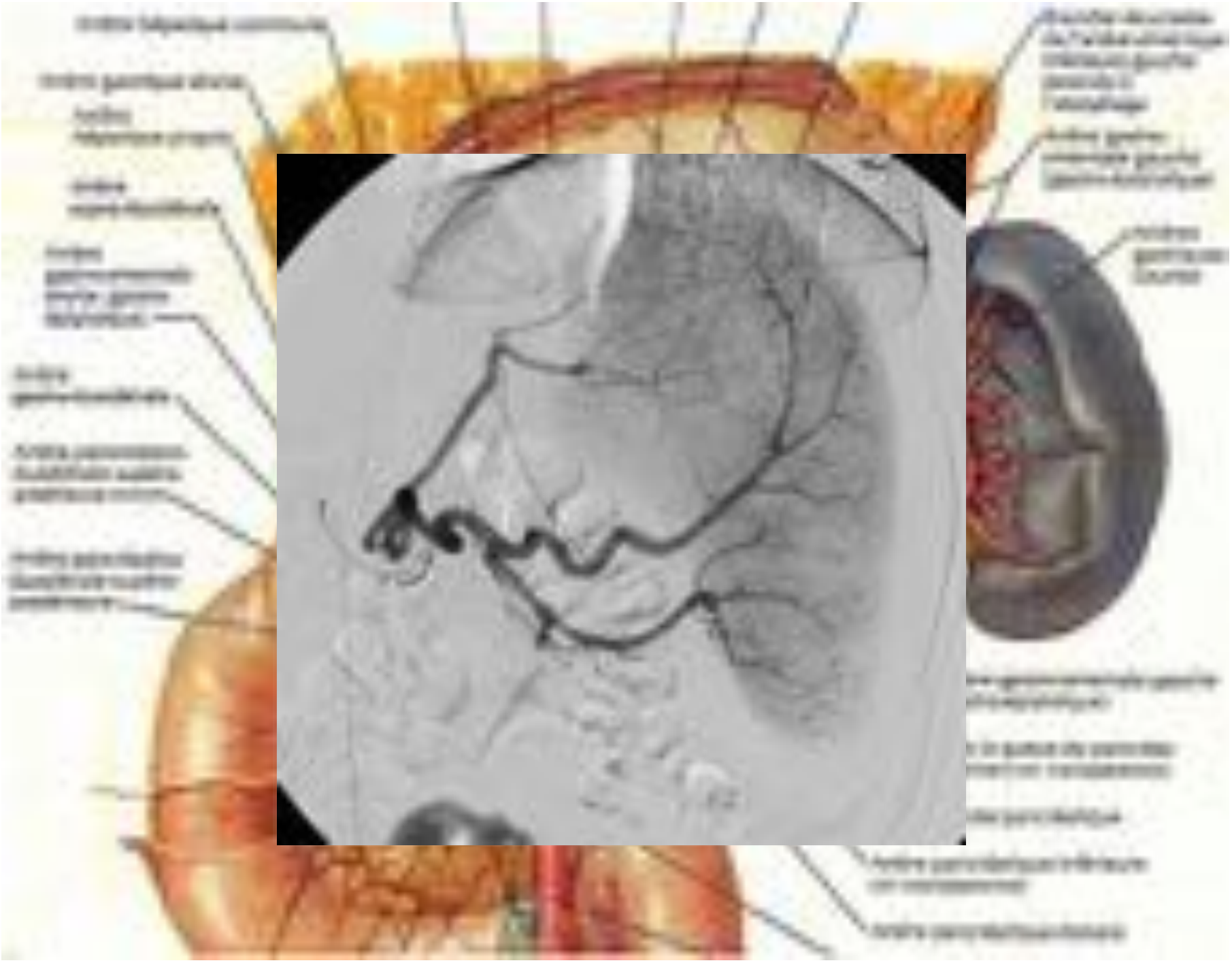
100% de succès

Radiology · April 2005



Trauma splénique



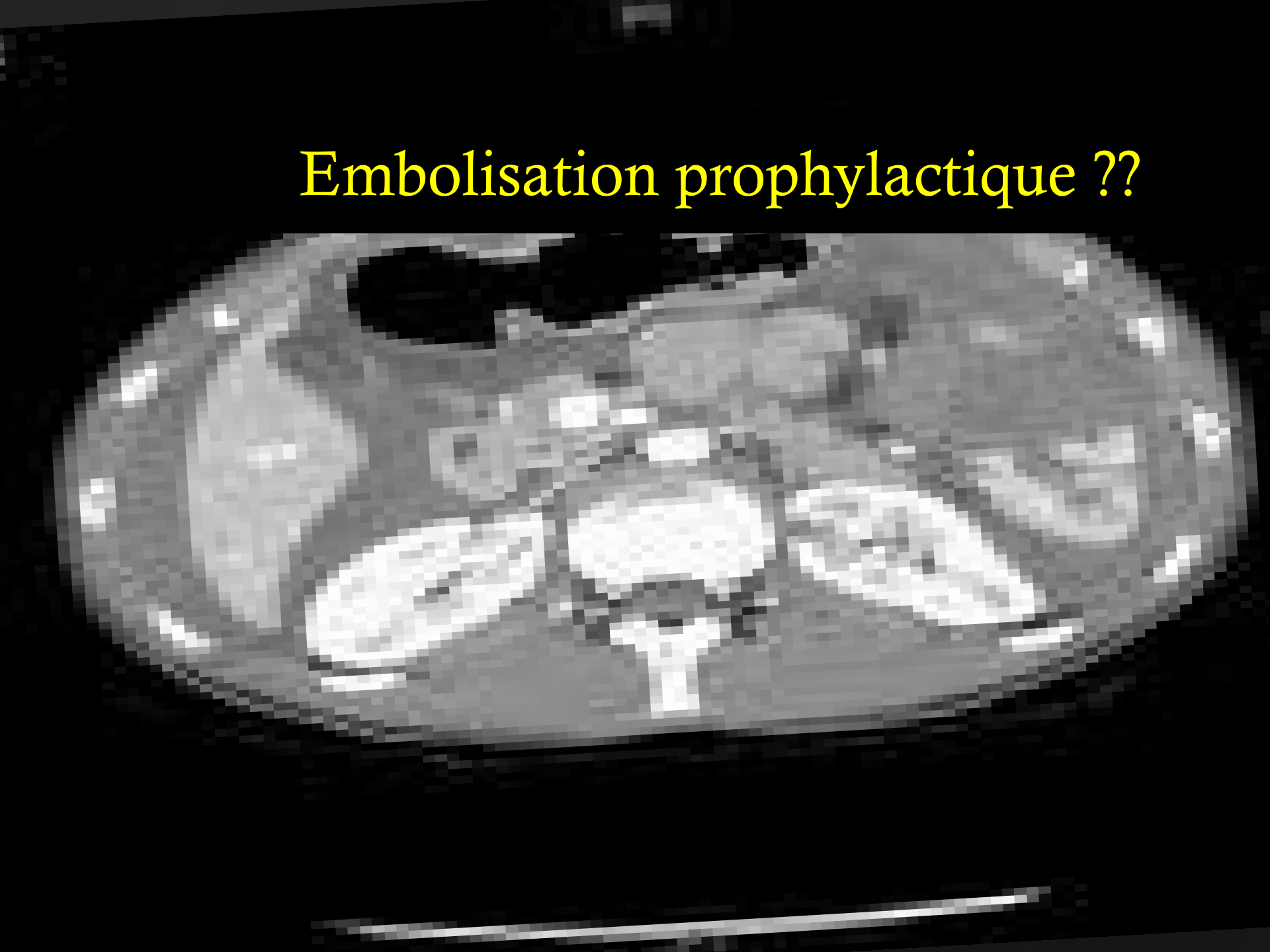


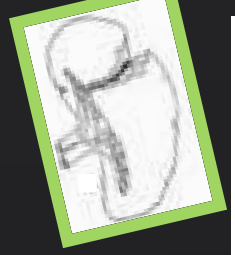
Embolisation prophylactique ??

Figure 4. Patient âgé de 18 ans, accident de rugby.
a) Scanner avant embolisation, montrant un traumatisme grade 3 avec hématome sous capsulaire de plus de 50 % de la surface de la rate.
b) Artériographie pré-embolisation normale.
c) Artériographie après embolisation par plug montrant l'occlusion de l'artère splénique proximale.

e-mémoires de l'Académie Nationale de Chirurgie, 2015, 14 (2) : 023-030

Embolisation prophylactique ??





The Effects of Splenic Artery Embolization on Nonoperative Management of Blunt Splenic Injury: A 16-Year Experience

Ashraf A. Sabe, BA, Jeffrey A. Claridge, MD, David I. Rosenblum, DO, Kevin Lie, MD, and Mark A. Malangoni, MD

- étude rétrospective (1991-2007)
- 576 blunt splenic trauma
- Stratégie d'embolisation systématique basée sur la TDM

Critères TDM de haut-risque:

- Grade OIS 4 et 5
- Grade OIS 3 + hémopéritoine abondant
- Extravasation de produit de contraste
- Pseudo-anévrisme

(*J Trauma*. 2009;67: 565–572)

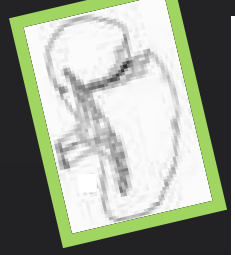


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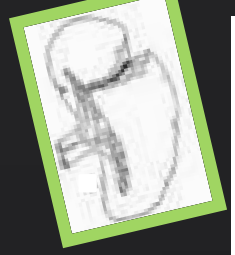
TABLE 6. Outcomes by AAST Splenic Injury Score of Patients With Blunt Splenic Injury in Groups II and III

SIS Grade	n	Initial NOM (%)	Splenic Artery Embolization (%)	Successful NOM (% of Initial NOM)	Splenic Salvage (%)
1	129	123 (95.3)	1 (0.8)	123 (100)	127 (98.4)
2	123	117 (95.1)	9 (7.3)	115 (98.3)	117 (95.1)
3	159	146 (91.8)	60 (37.7)	137 (93.8)	141 (88.7)
4	145	109 (75.2)	77 (53.1)	101 (92.7)	113 (77.9)
5	20	3 (15.0)	3 (15.0)	2 (66.7)	2 (10.0)
Total	576	498	150	478	500

(*J Trauma.* 2009;67: 565–572)



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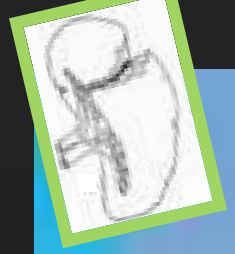
4	145	109 (75.2)	77 (53.1)		
5	20	3 (15.0)	3 (15.0)		
Total	576	498	150		500

150 embolisations = 30%

Taux de succès du NOM = 97%

(*J Trauma.* 2009;67: 565–572)



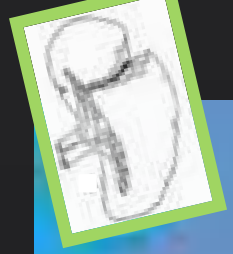
SPLASH

Bénéfice de l'embolisation prophylactique sur le sauvetage splénique chez les patients traumatisés à haut risque de splénectomie

Réunion d'information – 18.12.2013

Investigateur : Pr. Catherine ARVIEUX

Promoteur : CHU de Grenoble



Transplantation de rein à MRc
- âge< 70 ans
- Cardiopathie ischémique ?
- Pas de récidive de l'hémopathie originelle

ECG

ECG

ECHO + Echographie abdominale

ECHO 3-4 mois après

- Pas d'hémorragie péricardique ?
- Pas de péricardite ou d'autre athéromatose péricardique associée ?
- Pas de valvulopathie cardiaque organique ?
- Pas de cardiopathie ischémique sur le long terme ?

ECHO

ECHO + Angioscanner thoracique au cours
- Signes d'HTAP ?
- Dilatation des cavités droites ?

Absence cardiopathie évidente

Absence cardiopathie évidente

Absence athéromatose à risque

- Hémodynamique équilibrée ?
- Absence de valvulopathie ?

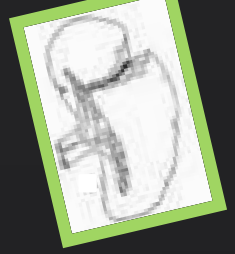
ECHO + Scintigraphie

ECG + Ramènement

CARDIOLOGUE

CARDIOLOGUE

CARDIOLOGUE



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⇒ Etude rétrospective monocentrique de 1991 à 2007

- Période 1991-1998 : Pas d'embolisation
- Période 1998-2001 : embolisation de certains patients
  - ⇒ *Critères mal définis !*
- Période 2002-2007 :
  - embolisation hémostatique
  - embolisation prophylactique si :
    - Grade OIS 3 et 4
    - extravasation de produit de contraste et/ou pseudo anévrysme

(*J Trauma.* 2009;67: 565–572)

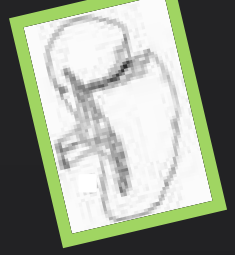

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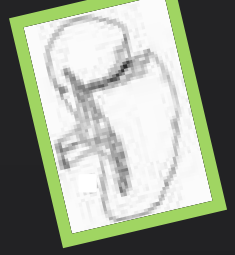
TABLE 1. Characteristics, Treatments, and Outcomes of Patients With Blunt Splenic Injuries

Characteristics				
Age (yr)				
Male (%)				
Injury severity score				
Splenic injury score				
Initial systolic blood pressure (mm Hg)				
Initial pulse (beats/min)				
Hemoglobin (%)				
Treatments				
Initial operation (%)				
Initial nonoperative management (%)				
Initial splenic artery embolization (%)				
Overall splenic artery embolization (%)				
Outcomes				
Successful nonoperative management (% of initial nonoperative management)				
Mortality (%)				
Length of stay (d)				
Splenic salvage (%)				

(*J Trauma.* 2009;67: 565–572)



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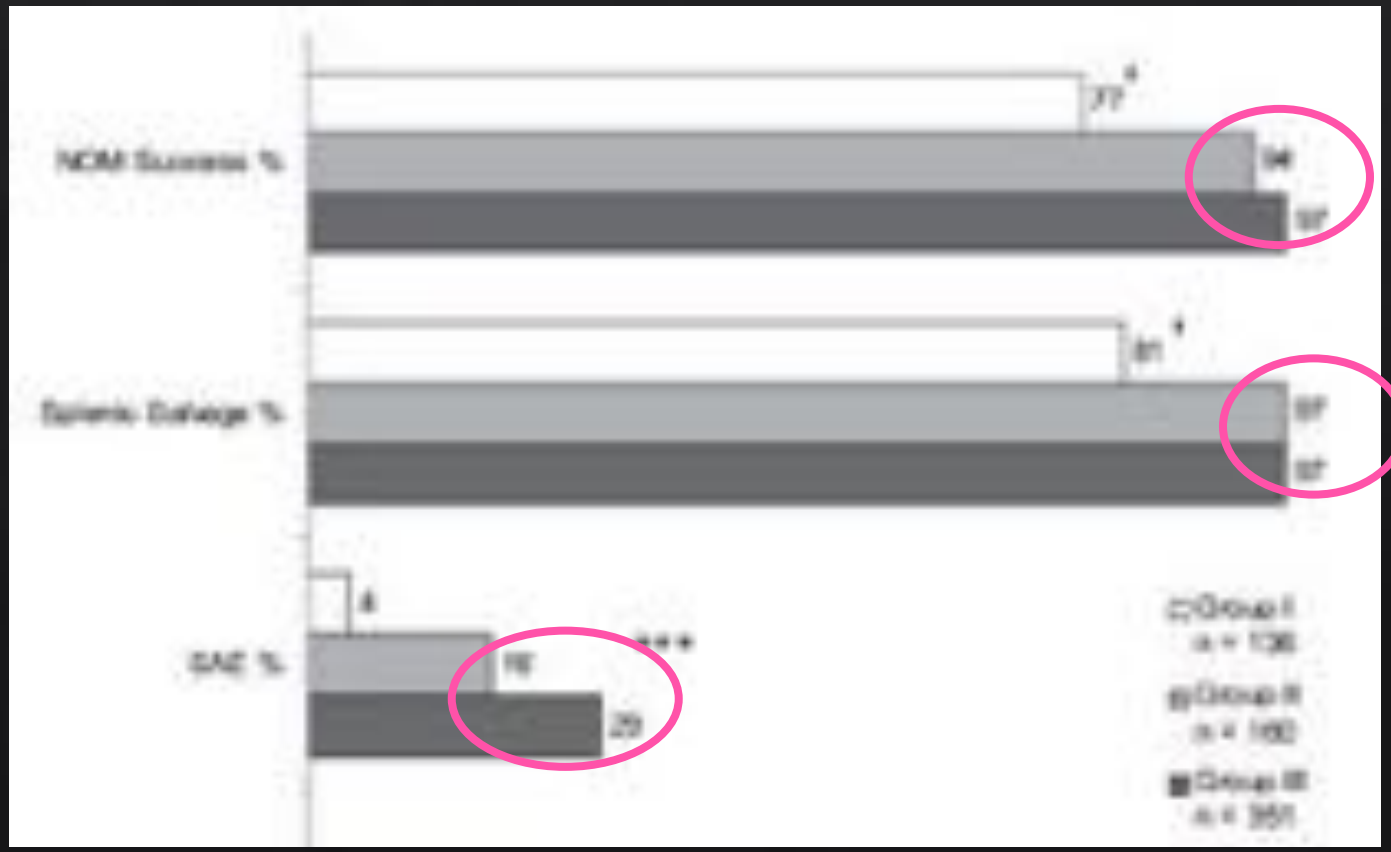

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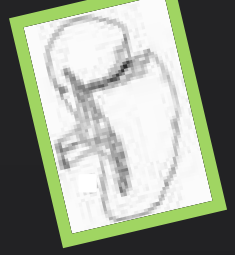


?

Critères TDM de haut-risque:

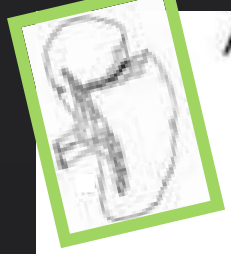
- Grade OIS 4 et 5
- Grade OIS 3 + hémopéritoine abondant
- Extravasation de produit de contraste
- Pseudo-anévrisme

Critères de saignement

+

Critères TDM de haut-risque:

OIS 4, 5 et OIS 3 + hémopéritoine abondant



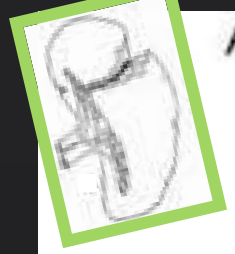
Age should be considered in the decision making of prophylactic splenic angioembolization in nonoperative management of blunt splenic trauma: A study of 208 consecutive civilian trauma patients

Guillaume Brault-Noble, MD, MSc, Jonathan Charbit, MD, Patrick Chardon, MD, Laurent Barral, MD, Françoise Guillon, MD, Patrice Taourel, MD, PhD, Xavier Capdevila, MD, PhD, *and* **Ingrid Millet, MD,** *Montpellier, France*

Brault-Noble G[1], Charbit J, Chardon P, Barral L, Guillon F, Taourel P, Capdevila X, Millet I.

- Etude rétrospective 2005-2009
- 208 Traumas fermés de la rate
- 161 traités par observation initiale
- 13 ruptures tardives
  - 10 laparos
  - 3 embolisations

J Trauma Acute Care Surg
Volume 73, Number 5



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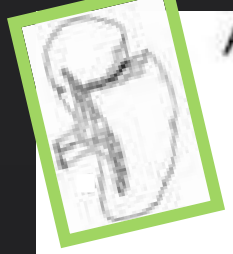

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TABLE 6. Predictive Values of High OFR CT Scan Criteria*

	n	PPV	NPV
All observed patients	161	18% [12−24%] (9/49)	96% [93−99%] (108/112)
Patients ≥ 50 y	41	67% [37−97%] (8/12)	90% [79−100%] (26/29)
Patients < 50 y	120	3% [0−9%] (1/37)	99% [97−100%] (82/83)

J Trauma Acute Care Surg
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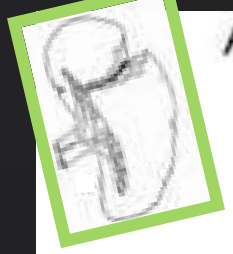

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Brault-Noble G[1], Charbit J, Chardon P, Barral L, Guillon F, Taourel P, Capdevila X, Millet I.

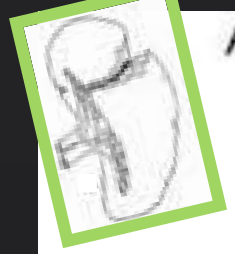
Critères TDM de haut-risque:

- Grade OIS 4 et 5
- Grade OIS 3 + hémopéritoine abondant
- Extravasation de produit de contraste
- Pseudo-anévrisme

TABLE 6. Predictive Values of High OFR CT Scan Criteria*

	n	PPV	NPV
All observed patients	161	18% [12−24%] (9/49)	96% [93−99%] (108/112)
Patients ≥ 50 y	41	67% [37−97%] (8/12)	90% [79−100%] (26/29)
Patients < 50 y	120	3% [0−9%] (1/37)	99% [97−100%] (82/83)

J Trauma Acute Care Surg
Volume 73, Number 5



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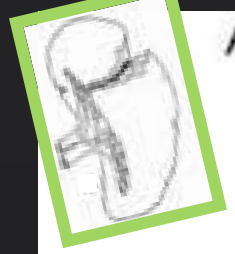

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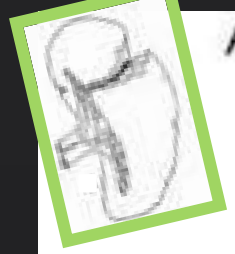
Brault-Noble G[1], Charbit J, Chardon P, Barral L, Guillon F, Taourel P, Capdevila X, Millet I.

10% embolisations spléniques

Taux de succès du NOM = 93%

Taux de sauvetage de rate = 77%

J Trauma Acute Care Surg
Volume 73, Number 5



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Trauma du rein

OIS Rein

GRADE 3

- Rupture capsul[illegible], avec diffusion d'hématome
- Lacération > 1 cm

GRADE 1

- Hématome capsul[illegible] minime
- Pas de lacération

GRADE 4

- Lacération profonde (parenchyme ou tubes collecteurs)
- Atteinte vasculaire proximale
- Urinome

GRADE 2

- Hématome capsul[illegible] étendu
- Lacération < 1 cm

GRADE 5

- Rein éclaté
- Atteinte pédiculaire
- avulsion rénale

American Association for the Surgery of Trauma Organ Injury Scale for Kidney Injuries Predicts Nephrectomy, Dialysis, and Death in Patients with Blunt Injury and Nephrectomy for Penetrating Injuries

James K. Kuan, MD, Jonathan L. Wright, MD, MS, Avery B. Nathens, MD, MPH, PhD, Frederick P. Rivara, MD, MPH, and Hunter Wessells, MD

Table 3 Unadjusted Relationship of AAST Renal Grade and Relative Risks of Adverse Event

AAST	Nephrectomy RR (95% CI)		Dialysis RR (95% CI)		Death RR (95% CI)	
	Blunt (n = 289)	Penetrating (n = 333)	Blunt (n = 33)	Penetrating (n = 6)	Blunt (n = 709)	Penetrating (n = 249)
I n = 4663	Ref	Ref	Ref	Ref	Ref	Ref
II n = 1540	2.9 (1.2–7.0)	0.90 (0.27–3.0)	1.4 (0.42–4.1)	*	1.0 (0.8–1.3)	0.38 (0.20–0.73)
III n = 1031	12 (6.2–25)	8.4 (3.0–23)	1.5 (0.43–5.4)	*	2.3 (1.9–2.9)	1.73 (1.0–5.3)
IV n = 832	83 (46–149)	28 (10–77)	5.3 (2.2–13)	1.4 (0.13–16)	2.9 (2.4–3.6)	3.2 (2.0–5.3)
V n = 413	205 (114–371)	37 (14–101)	6.0 (2.1–17)	3.4 (0.35–32)	6.1 (4.9–7.7)	4.6 (2.8–7.5)

*The absence of patients in these cells precluded meaningful analyses.

J Trauma. 2006;60:351–356.

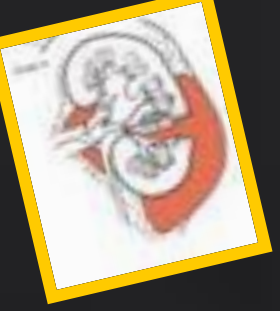
Evidence-Based Validation of the Predictive Value of the American Association for the Surgery of Trauma Kidney Injury Scale

Shahrokh F. Shariat, MD, Claus G. Roehrborn, MD, Pierre I. Karakiewicz, MD, Gurleen Dhami, MD, and Key H. Stage, MD

Table 2 Associations of Categorical Variables With the American Association for the Surgery of Trauma Kidney Injury Scale in 424 Consecutive Patients (continued)

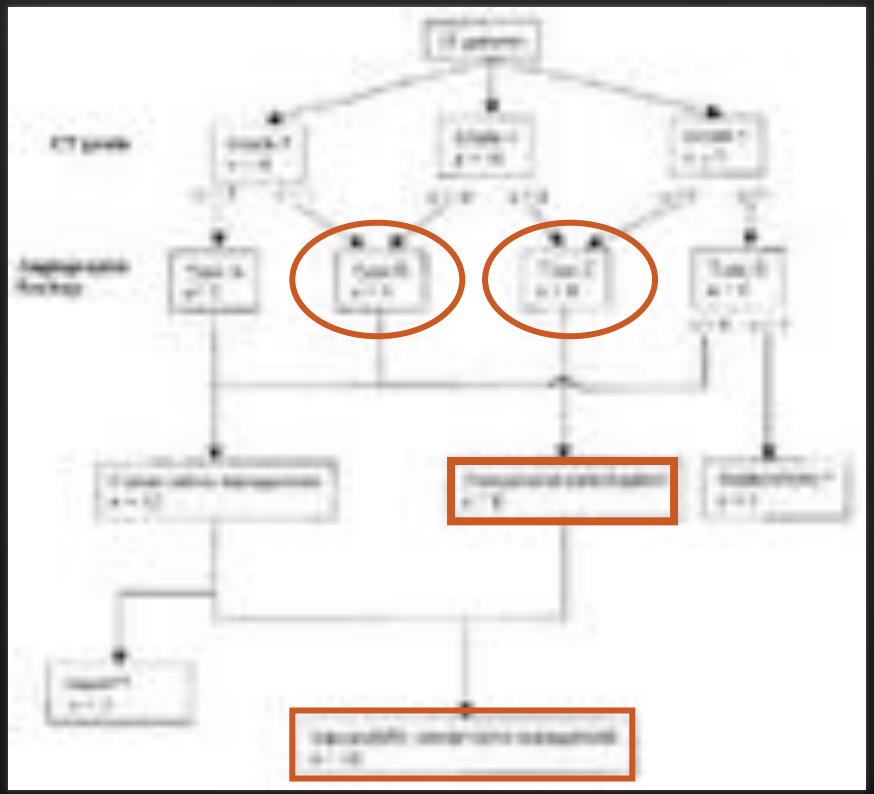
	No. Pts (%)	American Association for the Surgery of Trauma Kidney Injury Scale (No. Pts, %)					
		1	2	3	4	5	*p*
Nonenhaphy (%)							0.001
Negative	389 (91.7)	116 (30.3)	102 (26.2)	73 (18.8)	64 (16.5)	32 (8.2)	
Positive	35 (8.3)	0	10 (28.6)	9 (25.7)	13 (37.1)	3 (8.6)	
Nephrectomy (%)							<0.001
Negative	369 (87.0)	116 (32.0)	112 (30.4)	78 (21.1)	58 (15.7)	3 (0.8)	
Positive	55 (13.0)	0	0	4 (7.3)	19 (34.5)	32 (58.2)	
Dead (%)							0.207
Negative	378 (89.6)	106 (28.0)	101 (26.7)	77 (20.4)	65 (17.2)	29 (7.7)	
Positive	44 (10.4)	11 (25.0)	10 (22.7)	5 (11.4)	12 (27.3)	6 (13.6)	

J Trauma. 2007;62:933–939.



The Role of Interventional Radiology in the Management of Blunt Renal Injury: A Practical Protocol

Akiyoshi Hagiwara, MD, Seiki Sakaki, MD, Hideaki Goto, MD, Ken Takenega, MD, Hideki Fukushima, MD, Hiroharu Matuda, MD, and Shuji Shimazaki, MD

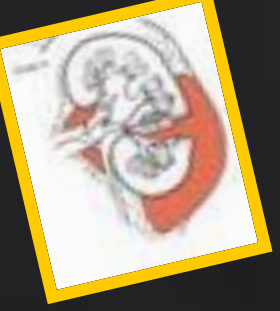


Angiographie si :
- GRADE ≥ 3 au TDM

Embolisation si :
-Extravasation artérielle de PC
-Fistule artérioveineuse

→ Taux de succès du NOM = **90%**

J Trauma. 2001;51:526–531.



Percutaneous Embolization for the Management of Grade 5 Renal Trauma in Hemodynamically Unstable Patients: Initial Experience

M. Eric Brewer, Jr., Bradley T. Strnad, Brian J. Daley,* Ryan P. Currier, Frederick A. Klein, Joe D. Mobley and Edward D. Kim†,‡

- étude rétrospective (2004-2007)
- **9 patients instables sur un trauma du rein grade 5 au TDM**
- Embolisation sur critères angiographiques

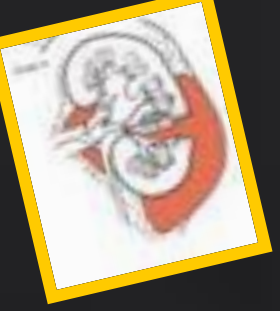
-4 réno-vasculaires
-5 lacérations rénales

7 embolisations proximales

2 embolisations sélectives

succès 100%

THE JOURNAL OF UROLOGY®
Vol. 181, 1737-1741, April 2009



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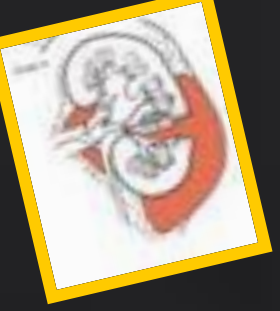
- ét … 007)
- 9 … trauma … TDM
- En … giograph…

…culaires
…ns rénale…

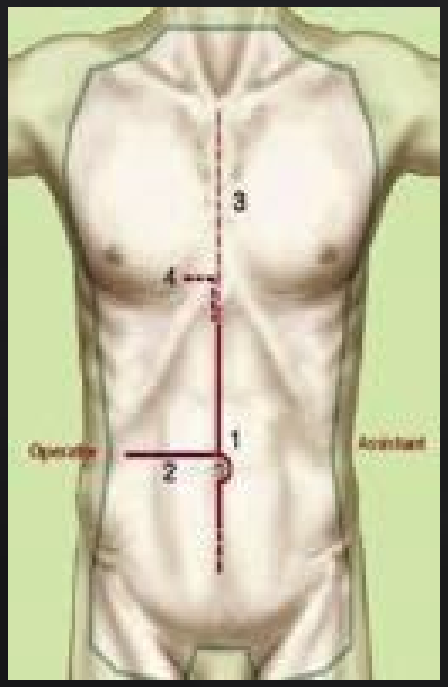
2 embolisations sélectives

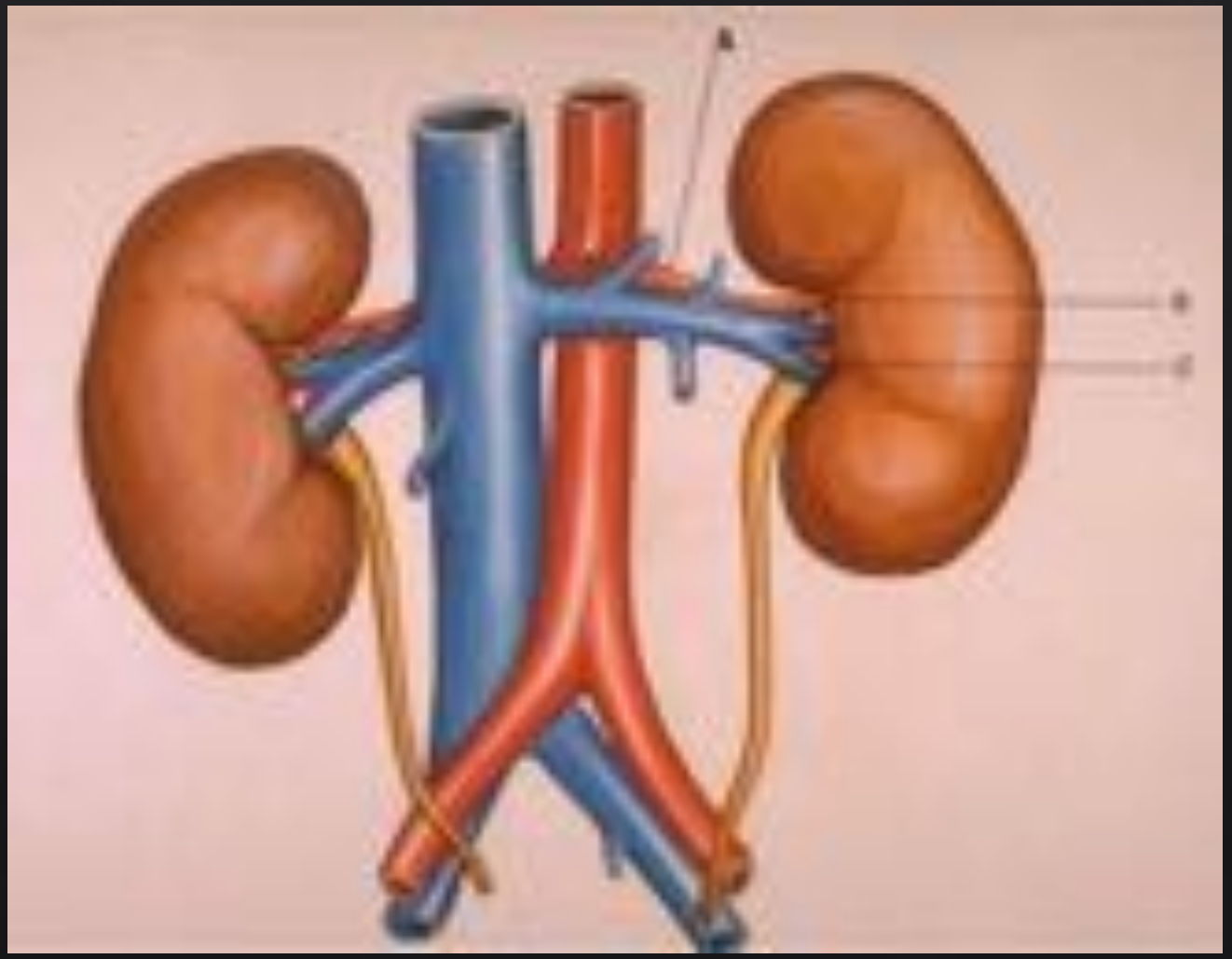
…00%

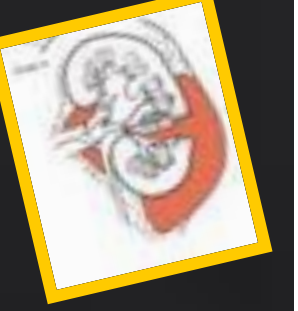
THE JOURNAL OF UROLOGY®
Vol. 181, 1737-1741, April 2009



Trauma du rein







What Are the Specific Computed Tomography Scan Criteria That Can Predict or Exclude the Need for Renal Angioembolization After High-Grade Renal Trauma in a Conservative Management Strategy?

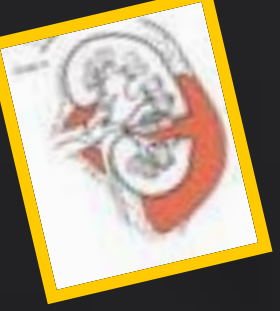
Jonathan Charbit, MD, Jonathan Manzanera, MD, Ingrid Millet, MD, Jean-Paul Roustan, MD, Patrick Chardon, MD, Patrice Taourel, MD, PhD, and Xavier Capdevila, MD, PhD

- étude rétrospective (2005-2009)
- Population : 101 traumas du rein
  - 57% traumas de haut-grades
  - 94% traités par NOM
  - 10% RAE

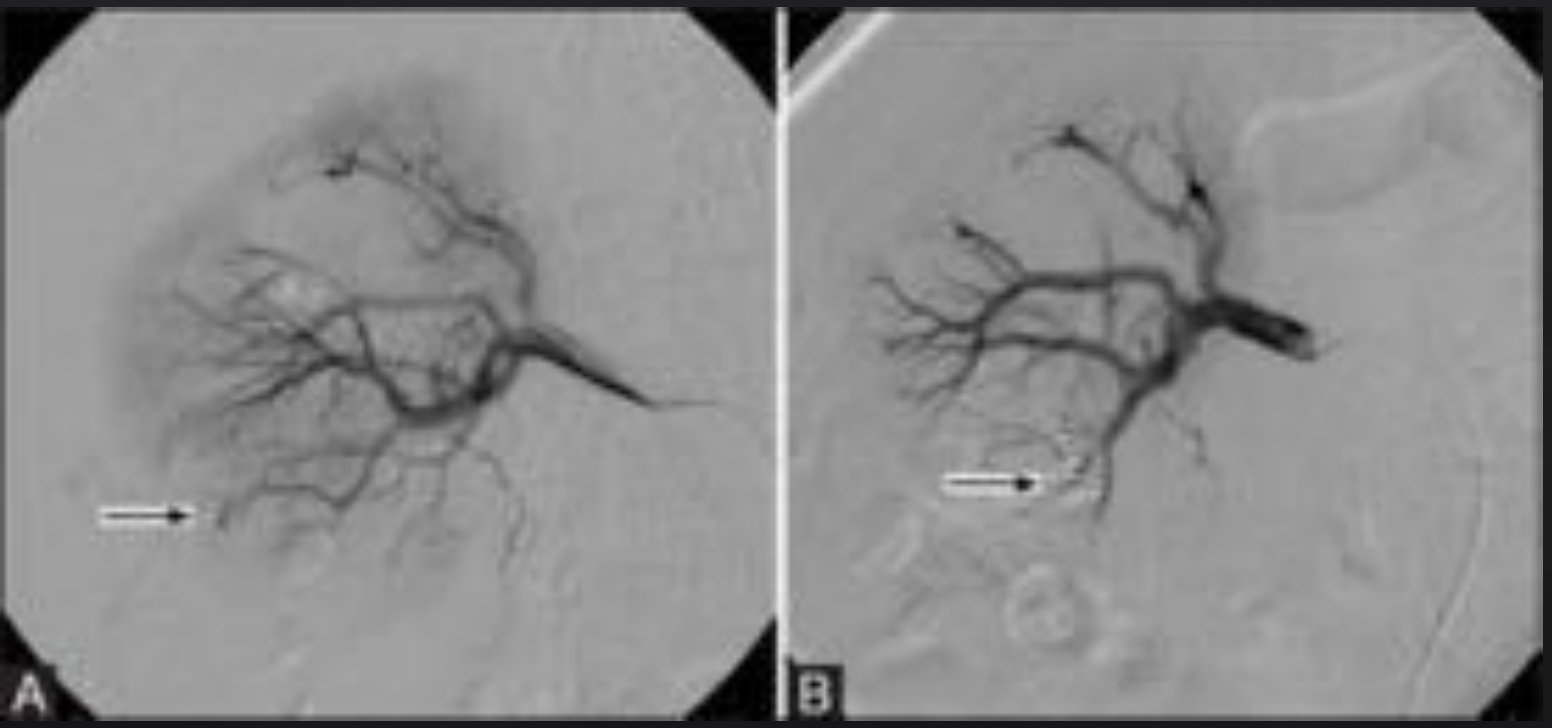
-98% de succès du NOM

-93% de conservation rénale

(*J Trauma*. 2011;70: 1219–1228)



Trauma du rein



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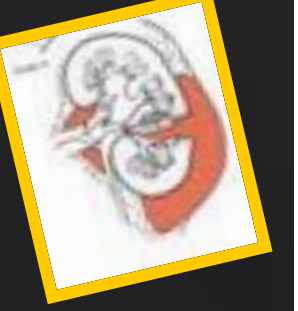

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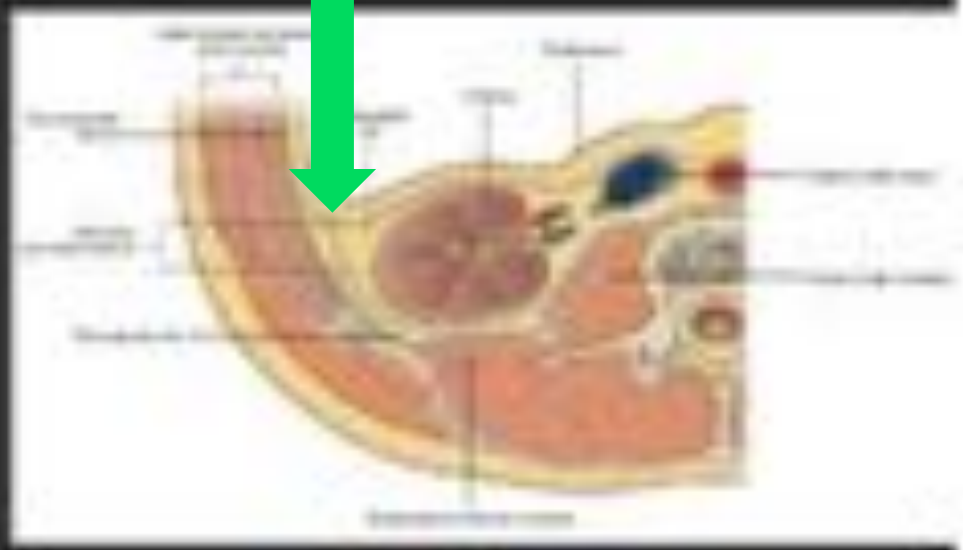
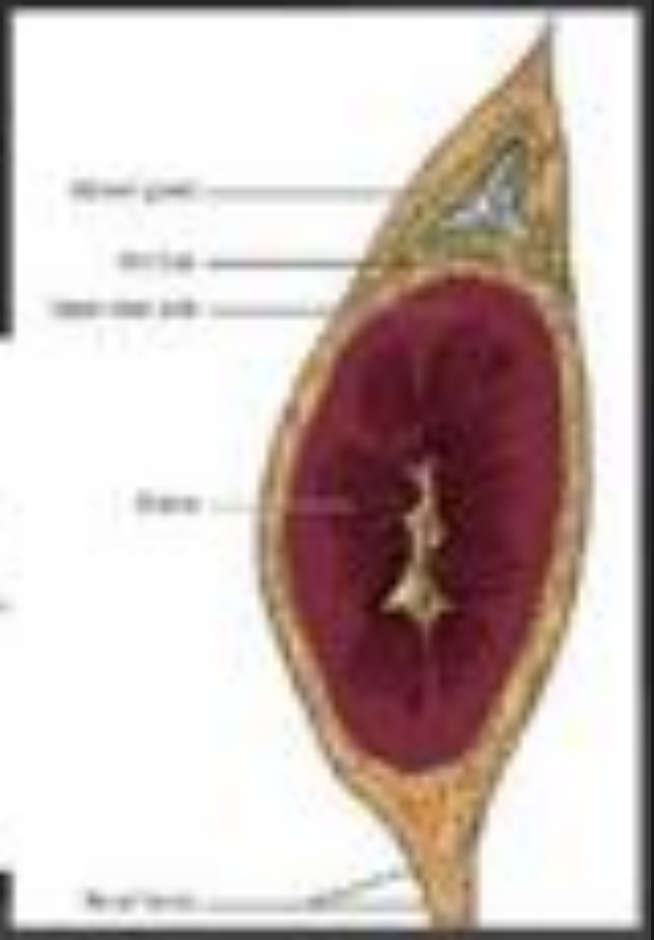
TABLE 5. Retrospective Analysis of Predictive Values of CT Criteria for the Need of Renal Embolization

	All Patients With HGRT (n = 53)		Patients With HGRT Needed at 2 PRBCs (n = 27)	
	PPV (%)	NPV (%)	PPV (%)	NPV (%)
Single CT criteria				
ICE	38	65	76	83
PED				
≥15 mm	33	56	50	80
≥20 mm	50	55	60	88
≥25 mm	64	51	69	84
≥30 mm	67	67	68	71
≥35 mm	100	62	100	71
DGF	71	69	86	80
Both CT criteria combined				
ICE and PED ≥25 mm	80	68	100	74
ICE and DGF	79	69	83	74
DGF and PED ≥25 mm	71	69	77	83

(*J Trauma*. 2011;70: 1219–1228)

FASCIA DE GEROTA





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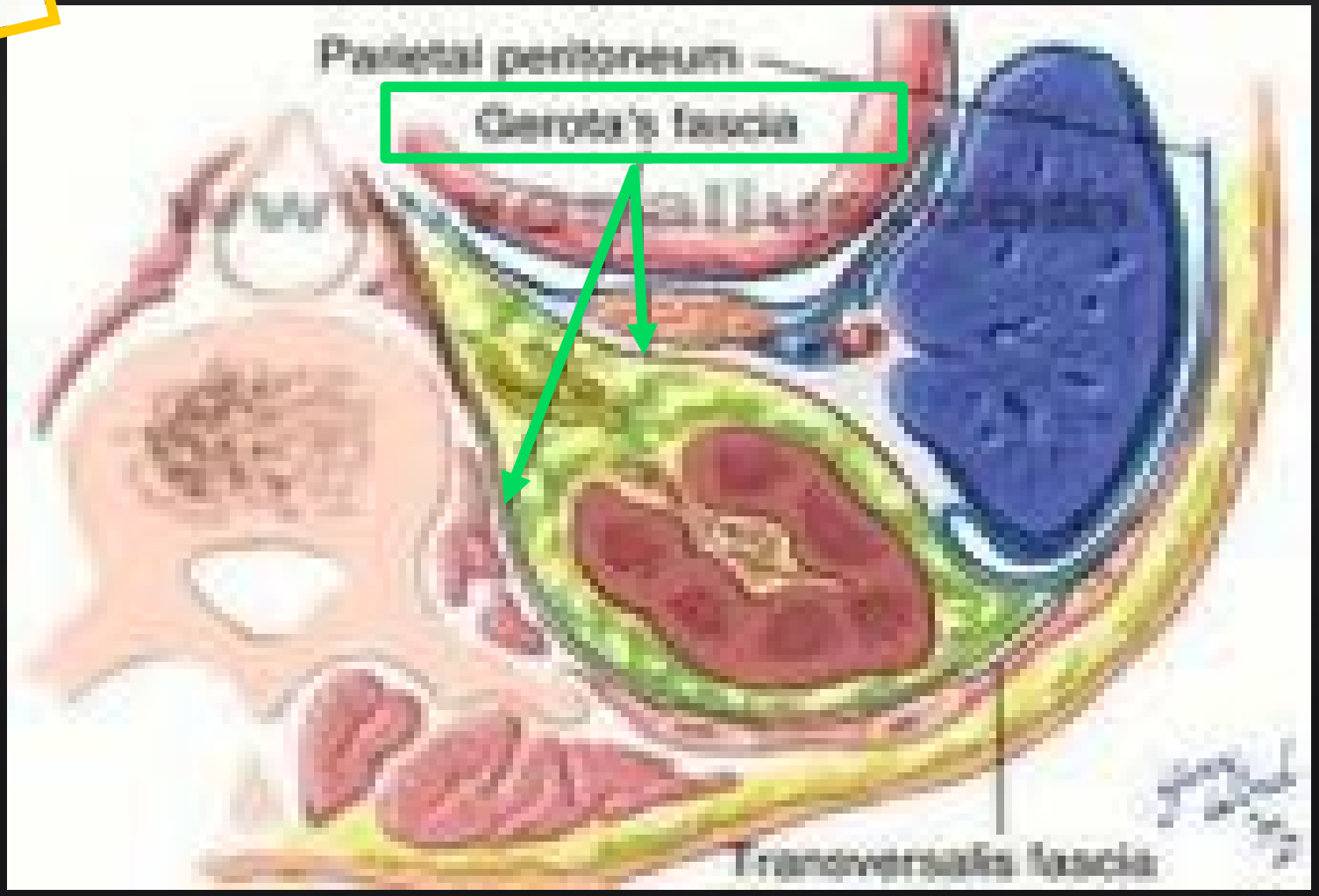
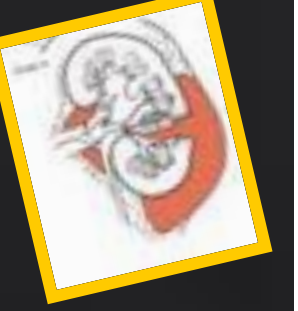

Parietal peritoneum
Gerota's fascia
Transversalis fascia



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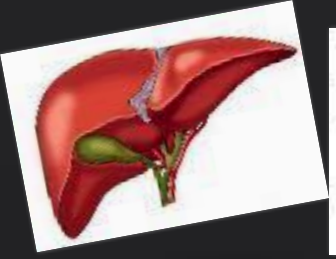


Hepatic Angiography in Patients Undergoing Damage Control Laparotomy

Jon W. Johnson, MD, Vicente H. Gracias, MD, Rajan Gupta, MD, Oscar Guillamondegui, MD, Patrick M. Reilly, MD, Michael B. Shapiro, MD, Donald R. Kauder, MD, and C. William Schwab, MD

Etude rétrospective de 1997 à 2000
19 Laparo damage control
8 embolisations post-opératoire

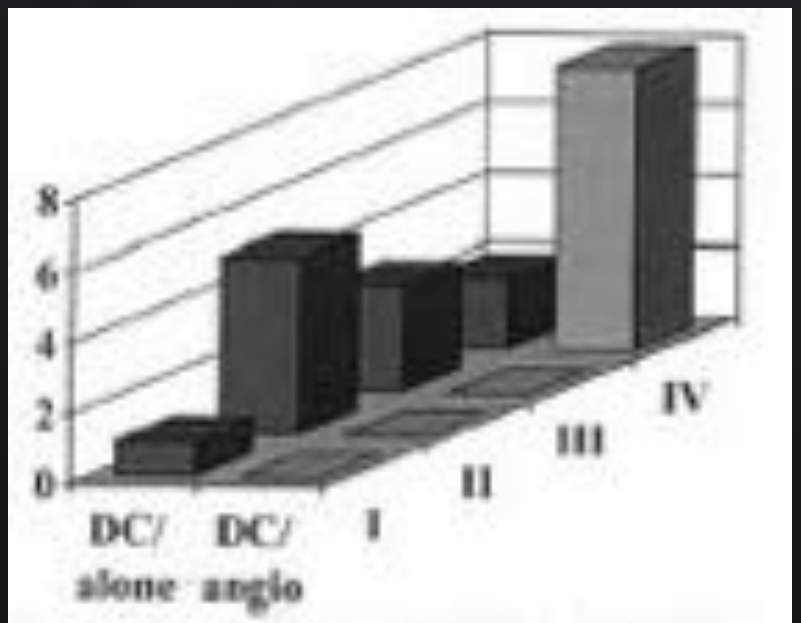


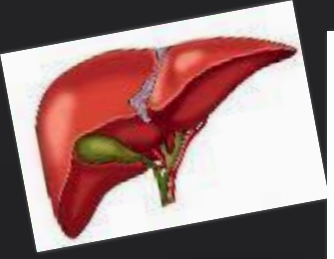
Fig. 1. *AAST grading of hepatic injuries in DC/angio and DC/alone patients.*

Table 1 Operative Phase

Parameter	DC/angio (n = 8)	DC/alone (n = 11)	p Value
LpH	7.15 ± .12	7.17 ± 0.12	0.82
LBE	−10.6 ± −6.2	−10.0 ± −6.4	0.81
LTemp (degrees)	34.9 ± 1.1	34.3 ± 1.2	0.37
SBP (mm Hg)	107 ± 26	119 ± 26	0.34
Time (min)	76.7 ± 43.0	203.5 ± 108.6	.003
Crystalloid (L)	5.6 ± 3.4	9.9 ± 6.5	0.13
PRBCs (U)	9.25 ± 4.6	12.4 ± 3.9	0.45
FFP (U)	2.1 ± 2.0	5.4 ± 4.2	0.06
Platelets (U)	4.2 ± 4.2	6.0 ± 5.4	0.45

100% control dans le groupe angio

J Trauma. 2002;52:1102–1106.

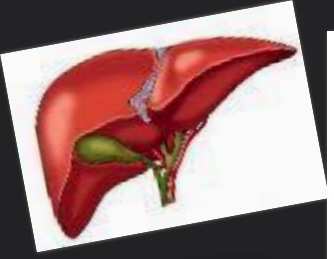


Recent experiences with a multidisciplinary approach to complex hepatic trauma☆

Shawn MacKenzie[a], John B. Kortbeek[b], Robert Mulloy[c], S. Morad Hameed[d,*]

- Etude rétrospective de 1995 à 2001
- 280 traumatismes hépatiques
- 47 lésions de haut grade : IV et V
- 37 hémodynamiquement instables
- 2 Groupes :
  - 30 chirurgies d'hémostase complète
  - 7 control damage surgery + embolisation post op

Injury, Int. J. Care Injured (2004) 35, 869–877



Recent experiences with a multidisciplinary approach to complex hepatic trauma☆

Shawn MacKenzie[a], John B. Kortbeek[b], Robert Mulloy[c], S. Morad Hameed[d,*]

Table 3 Outcomes after definitive laparotomy (DL) and early packing with multidisciplinary interventions (EP) in complex liver trauma

Variable	Definitive laparotomy (DL)	Early packing/multidisciplinary (EP)
In hospital mortality (%)	11 (36.7)	0 (0)
Liver specific mortality (%)	7 (23)	0 (0)
LOS[a] (days)	10.5 (1–73)	30 (2–56)
ICU[a] (days)	2 (0–40)	7 (2–13)
Transfusions[a] (number of units)	13.5 (0–153)	34 (8–72)
OR time[a] (min)	127 (37–315)	92 (38–136)

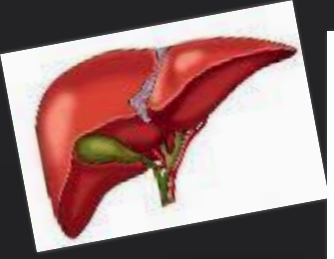
[a] median (range).

Table 4 Complications

Variable	Definitive laparotomy (DL, $n = 30$)	Early packing/multidisciplinary (EP, $N = 7$)
Liver necrosis (%)	4 (13)	3 (43)[a]
Sepsis (%)	9 (30)	3 (43)
Abscess (%)	3 (10)	3 (43)
Bile leak (%)	7 (23)	4 (57)
Missed injury (%)	3 (10)	0 (0)

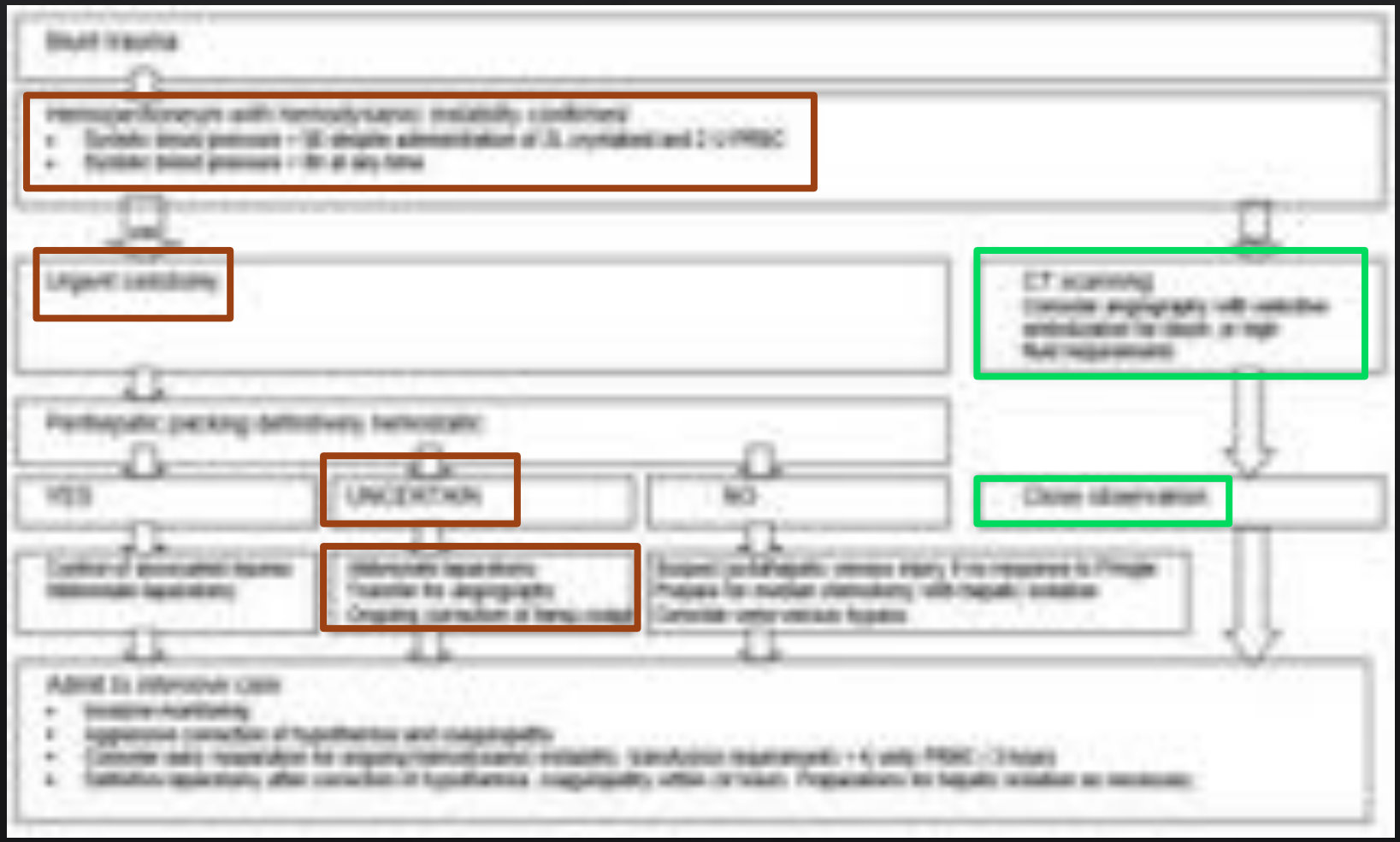
[a] One patient with liver necrosis severe enough to warrant liver transplantation.

Injury, Int. J. Care Injured (2004) 35, 869–877



Recent experiences with a multidisciplinary approach to complex hepatic trauma☆

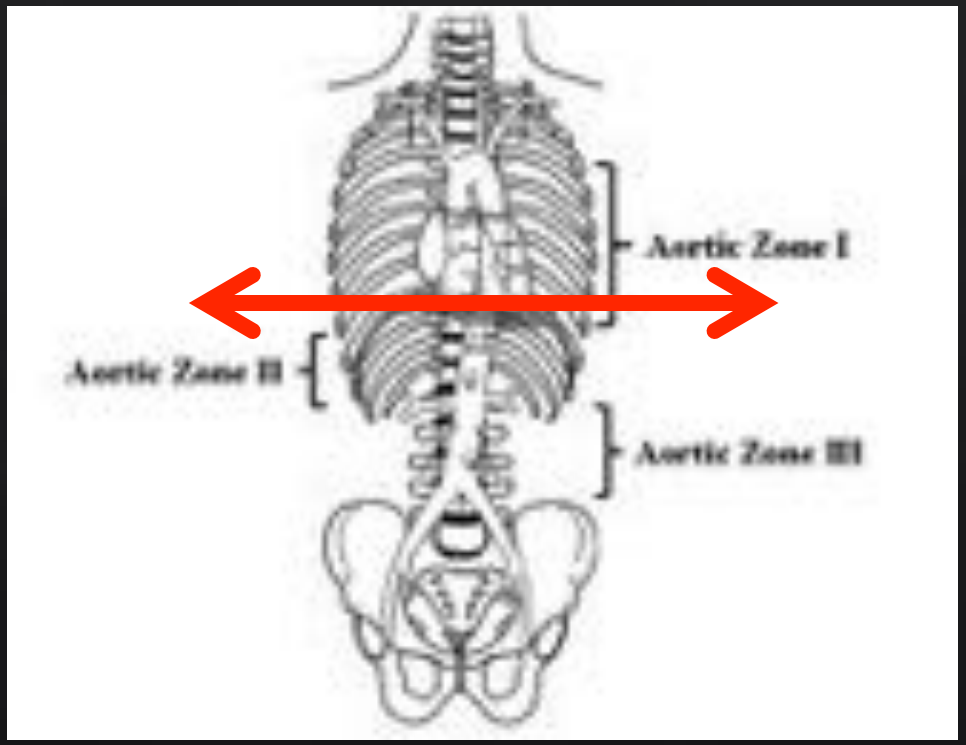
Shawn MacKenzie[a], John B. Kortbeek[b], Robert Mulloy[c], S. Morad Hameed[d,*]



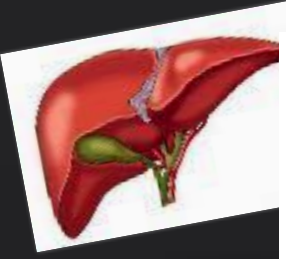
Injury, Int. J. Care Injured (2004) 35, 869–877

A clinical series of resuscitative endovascular balloon occlusion of the aorta for hemorrhage control and resuscitation

Megan L. Brenner, MD, Laura J. Moore, MD, Joseph J. DuBose, MD, George H. Tyson, MD, Michelle K. McNutt, MD, Rondel P. Albarado, MD, John B. Holcomb, MD, Thomas M. Scalea, MD, *and* Todd E. Rasmussen, MD

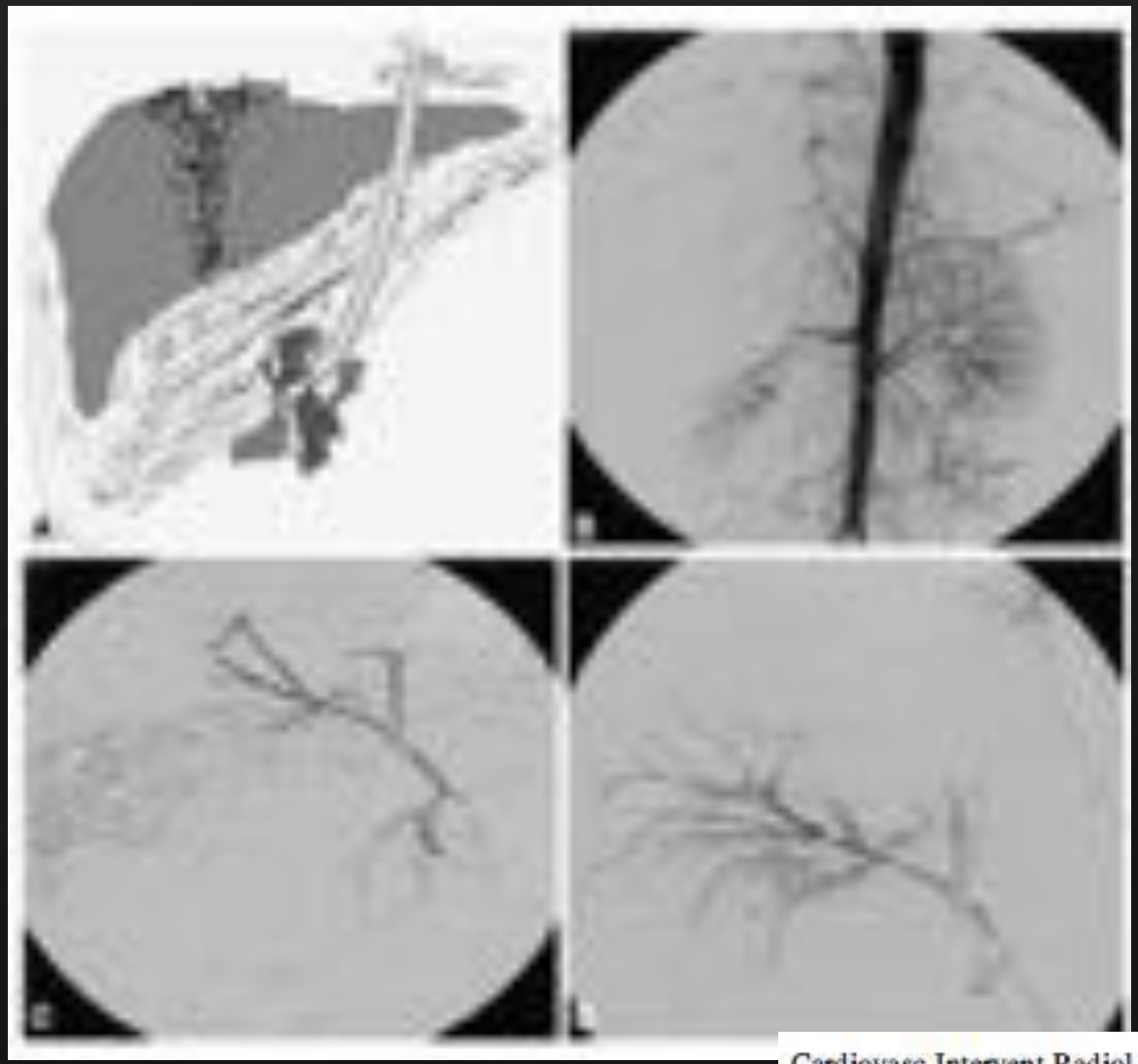


J Trauma. 2013;75:506-511

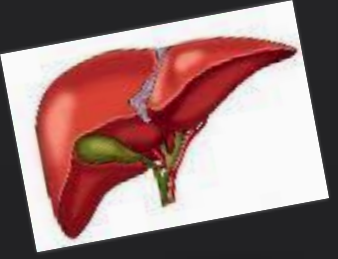


Place of Arterial Embolization in Severe Blunt Hepatic Trauma: A Multidisciplinary Approach

Valérie Monnin · Christian Sengel · Frédéric Thony · Ivan Bricault · David Voirin · Christian Letoublon · Christophe Broux · Gilbert Ferretti

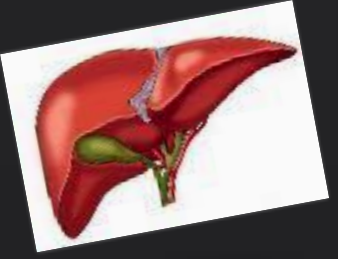


Cardiovasc Intervent Radiol (2008) 31:875–882

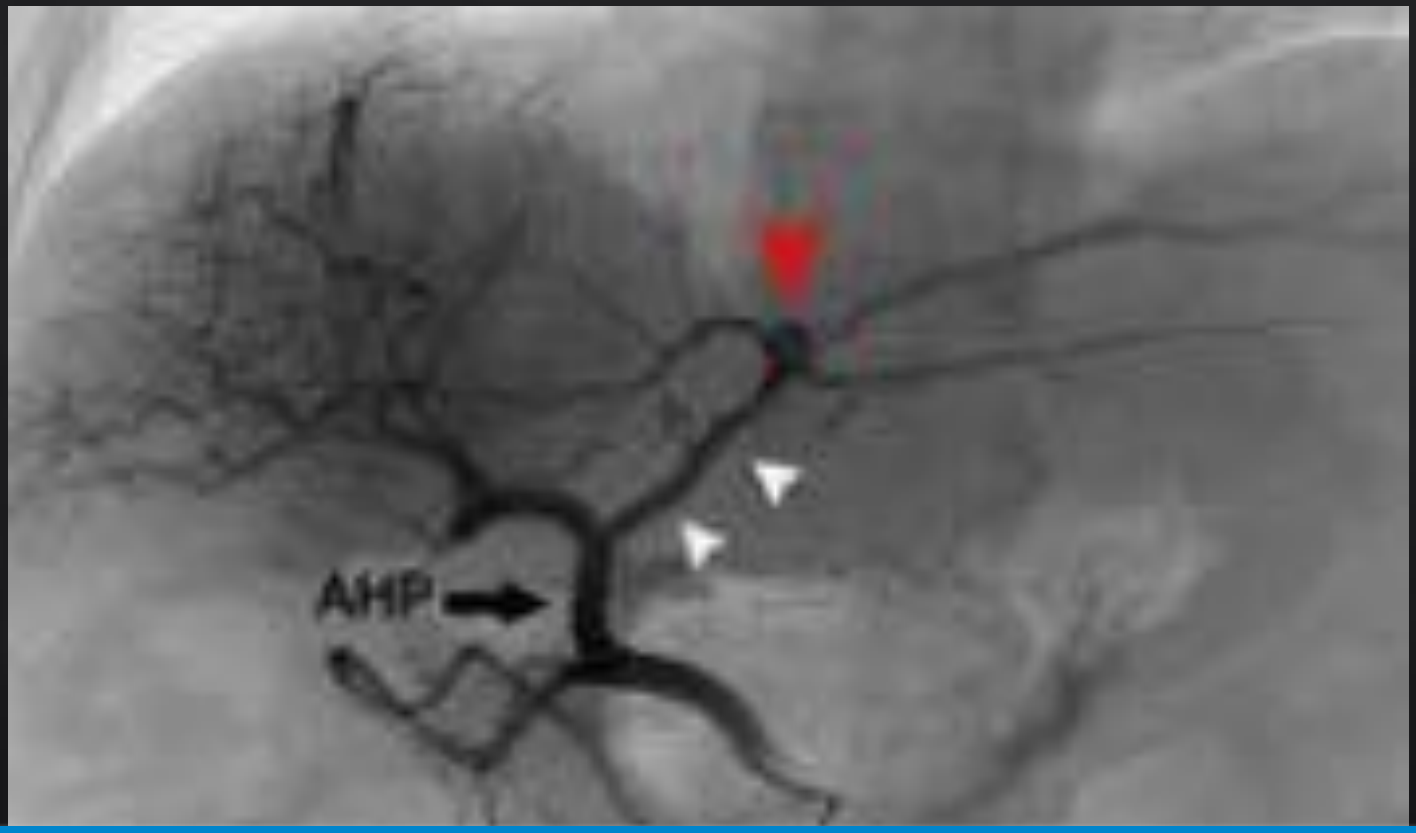


Angiographie hépatique

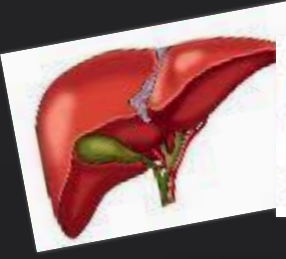
EMBOLISATION HEMOSTATIQUE
COMPLEMENTAIRE A LA CHIRURGIE



Angiographie hépatique



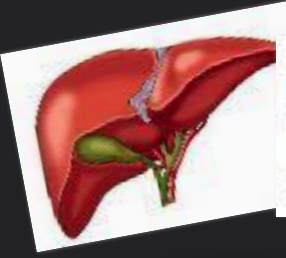
EMBOLISATION HEMOSTATIQUE
EN **ALTERNATIVE** A LA CHIRURGIE



The Efficacy and Limitations of Transarterial Embolization for Severe Hepatic Injury

Akiyoshi Hagiwara, MD, Atsuo Murata, MD, Taketo Matsuda, MD, Hiroharu Matsuda, MD, and Shuji Shimazaki, MD

J Trauma. 2002;52:1091–1096.



The Efficacy and Limitations of Transarterial Embolization for Severe Hepatic Injury

Akiyoshi Hagiwara, MD, Atsuo Murata, MD, Taketo Matsuda, MD, Hiroharu Matsuda, MD, and Shuji Shimazaki, MD

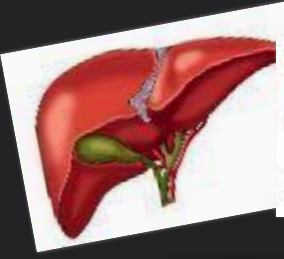
- 51 patients
- 18 avec embolisation
- Critère TDM :
  - Embolisation si :
    - AAST ≥ 3
    - Type C et D

Table 2 Angiographic Grading System for Blunt Hepatic Trauma*

Type	Criteria
A	Variable avascularity and irregularity in the accumulation of contrast medium in the hepatic parenchyma or displacement of the hepatic arterial branches
B	Arterial-portal venous fistula or disruption of hepatic arterial branches
C	Extravasation of contrast medium extending within the hepatic parenchyma
D	Extravasation of contrast medium extending beyond the hepatic parenchyma

* After Hagiwara et al.[1]

J Trauma. 2002;52:1091–1096.



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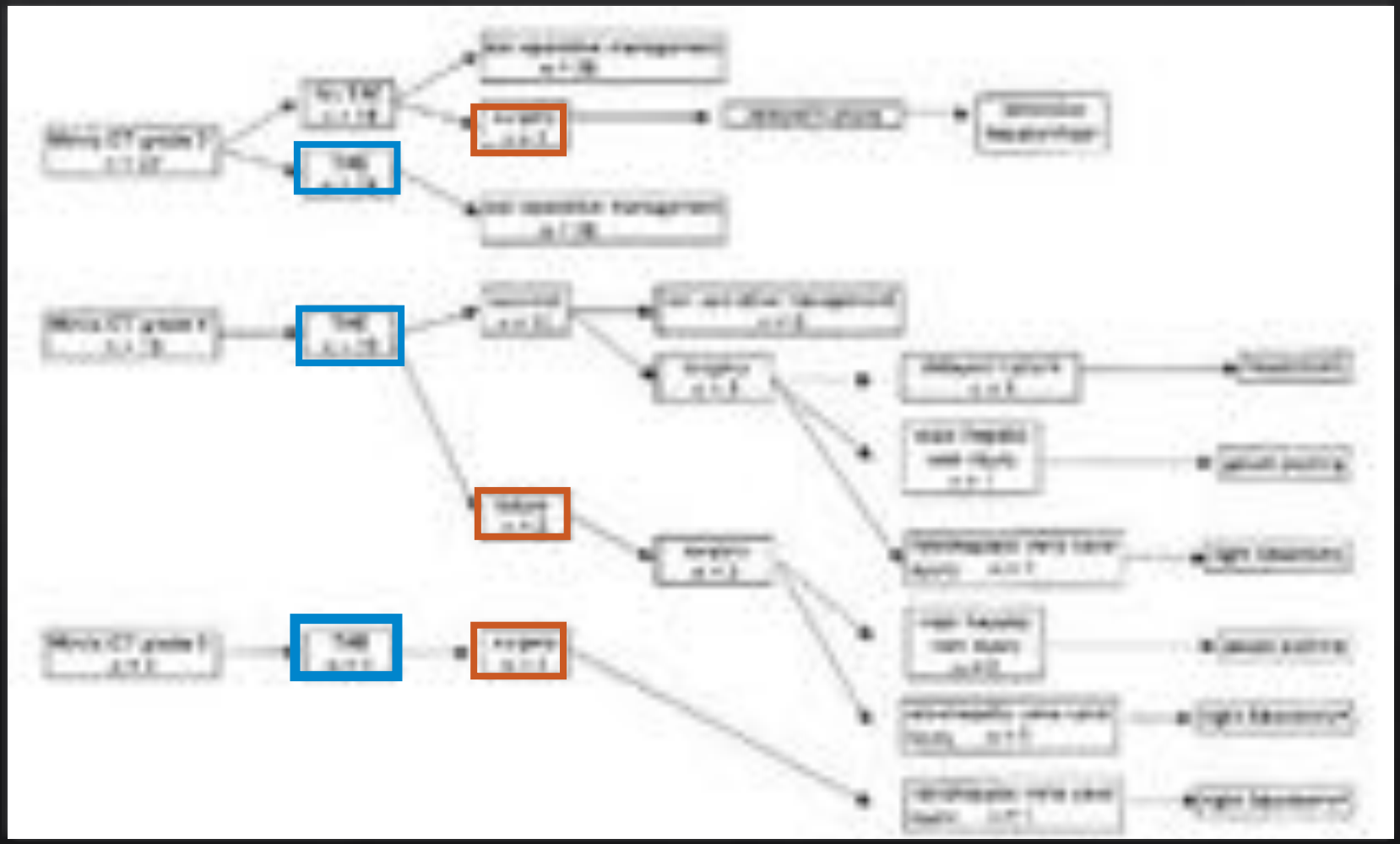
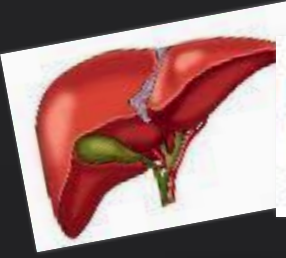


J Trauma. 2002;52:1091–1096.



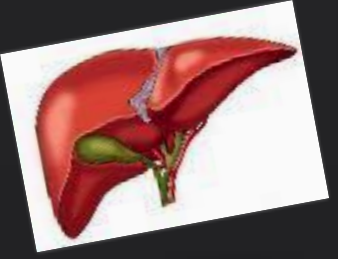
The Efficacy and Limitations of Transarterial Embolization for Severe Hepatic Injury

Akiyoshi Hagiwara, MD, Atsuo Murata, MD, Taketo Matsuda, MD, Hiroharu Matsuda, MD, and Shuji Shimazaki, MD

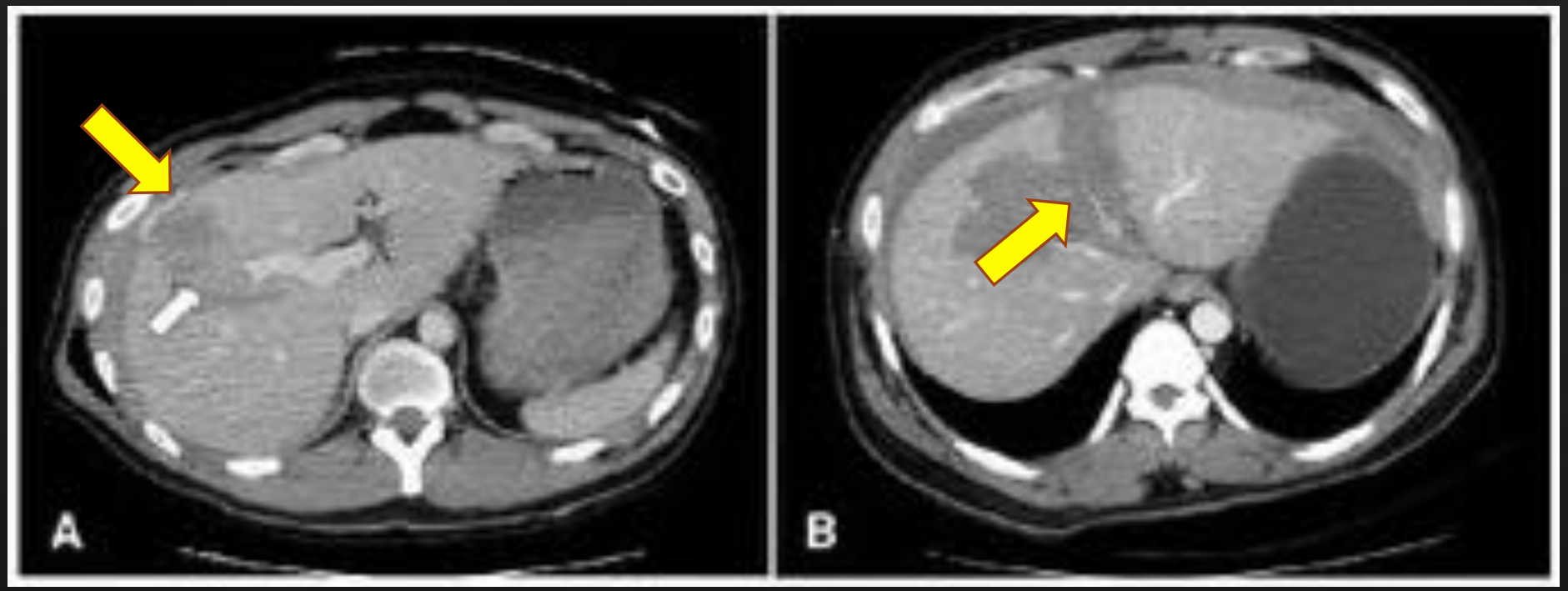
Succès embolisation = 93%

Succès du NOM = 78%

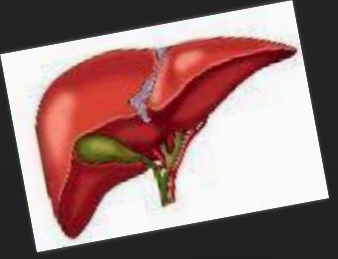
J Trauma. 2002;52:1091–1096.



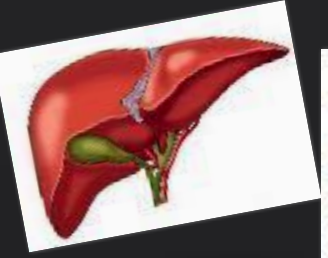
Trauma hépatique



The American Journal of Surgery, 2011



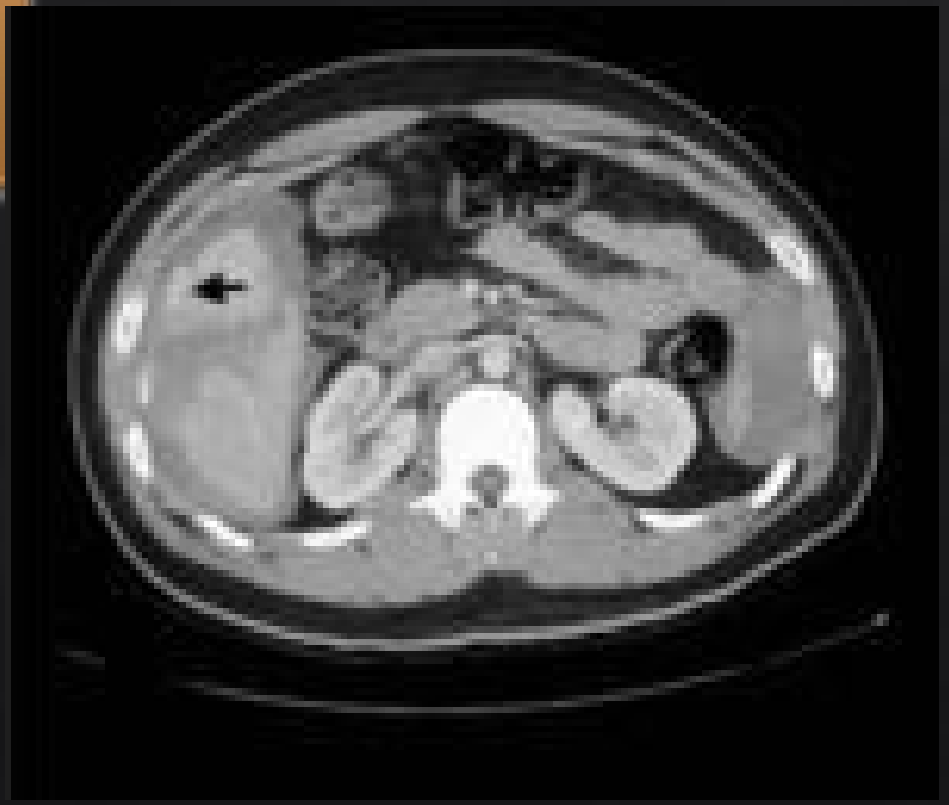
Saignements extra-hépatiques



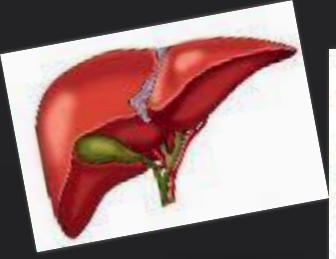
Role of arterial embolization on blunt hepatic trauma patients with type I contrast extravasation

Yu-Chun Wang MD[a,*], Chih-Yuan Fu MD[a], Yung-Fang Chen MD[b], Chi-Hsun Hsieh MD[a], Shih-Chi Wu MD[a], Chun-Chieh Yeh MD[a]

Etude rétrospective de 2005 à 2007
91 patient avec traumatisme hépatique
Hémodynamiquement stable
Seulement 5 embolisations…….

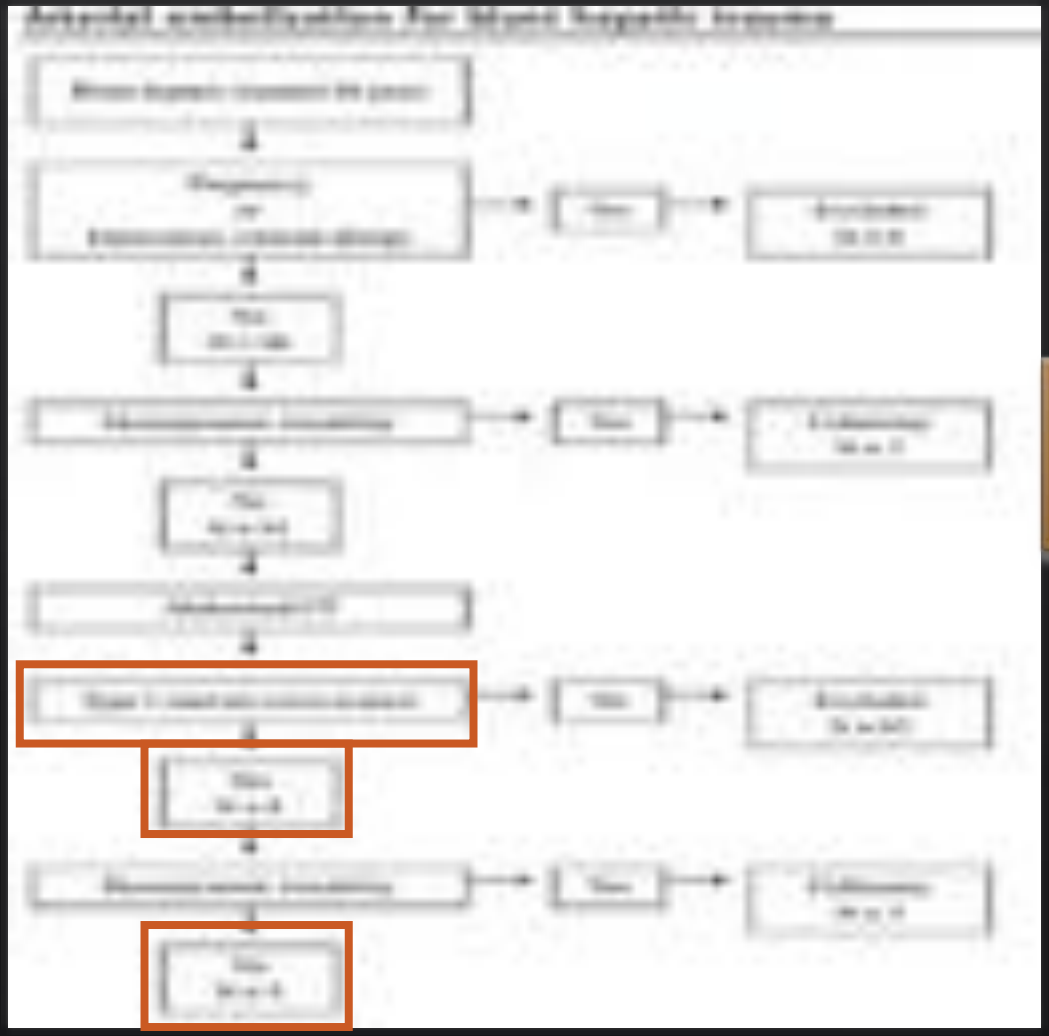


doi:10.1016/j.ajem.2010.06.001



Role of arterial embolization on blunt hepatic trauma patients with type I contrast extravasation

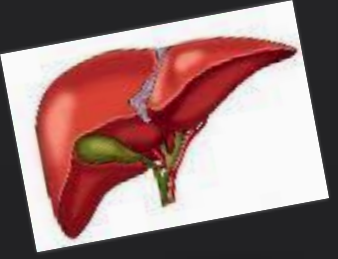
Yu-Chun Wang MD[a,*], Chih-Yuan Fu MD[a], Yung-Fang Chen MD[b], Chi-Hsun Hsieh MD[a], Shih-Chi Wu MD[a], Chun-Chieh Yeh MD[a]



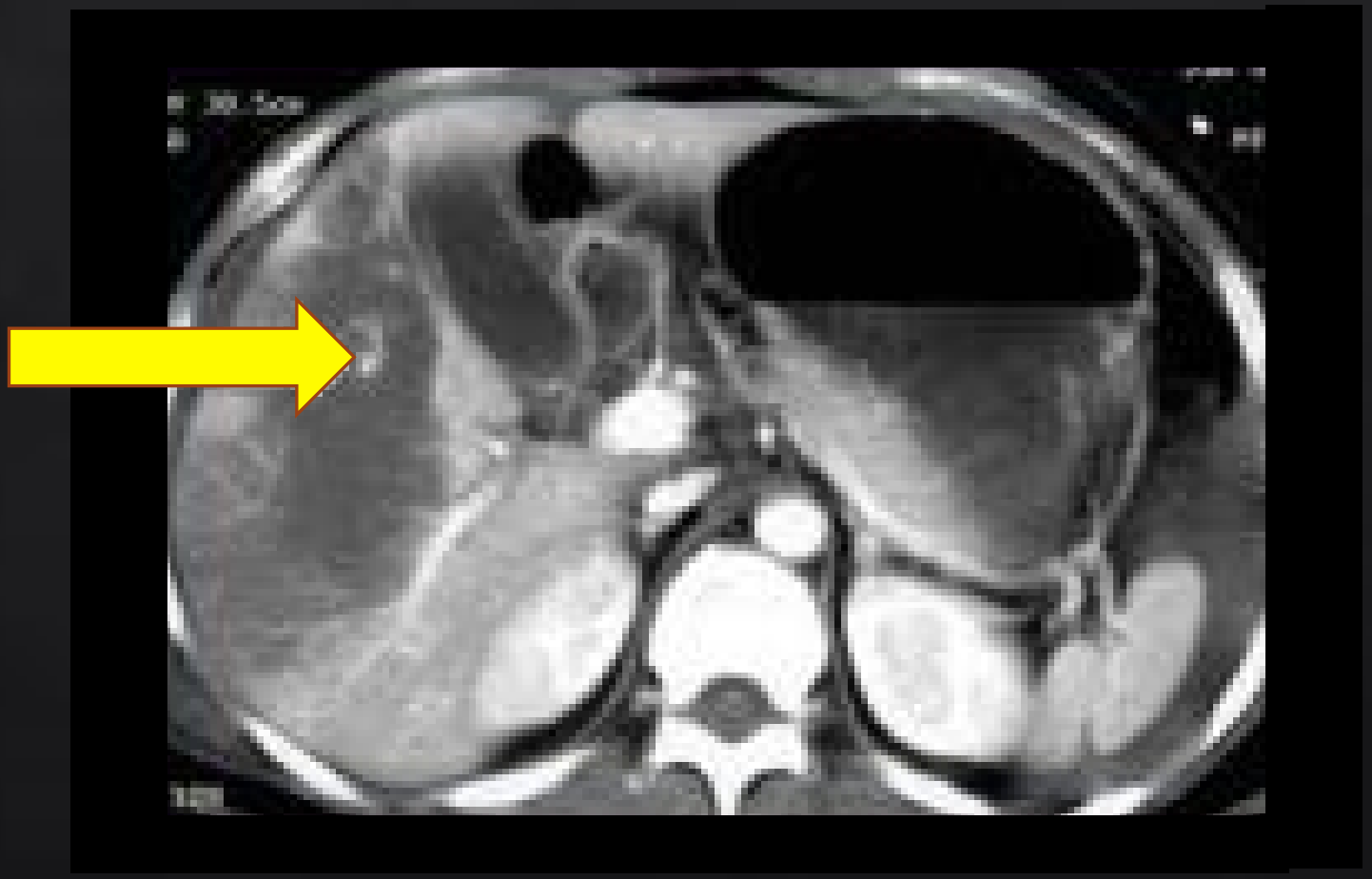
Critère d'embolisation :
-Stabilité hémodynamique
-Extravasation artériel au TDM

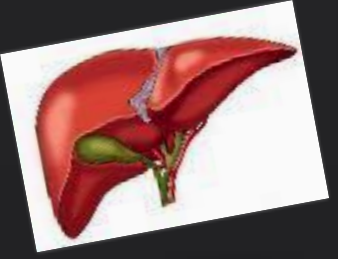
Succès du NOM = 80%

doi:10.1016/j.ajem.2010.06.001

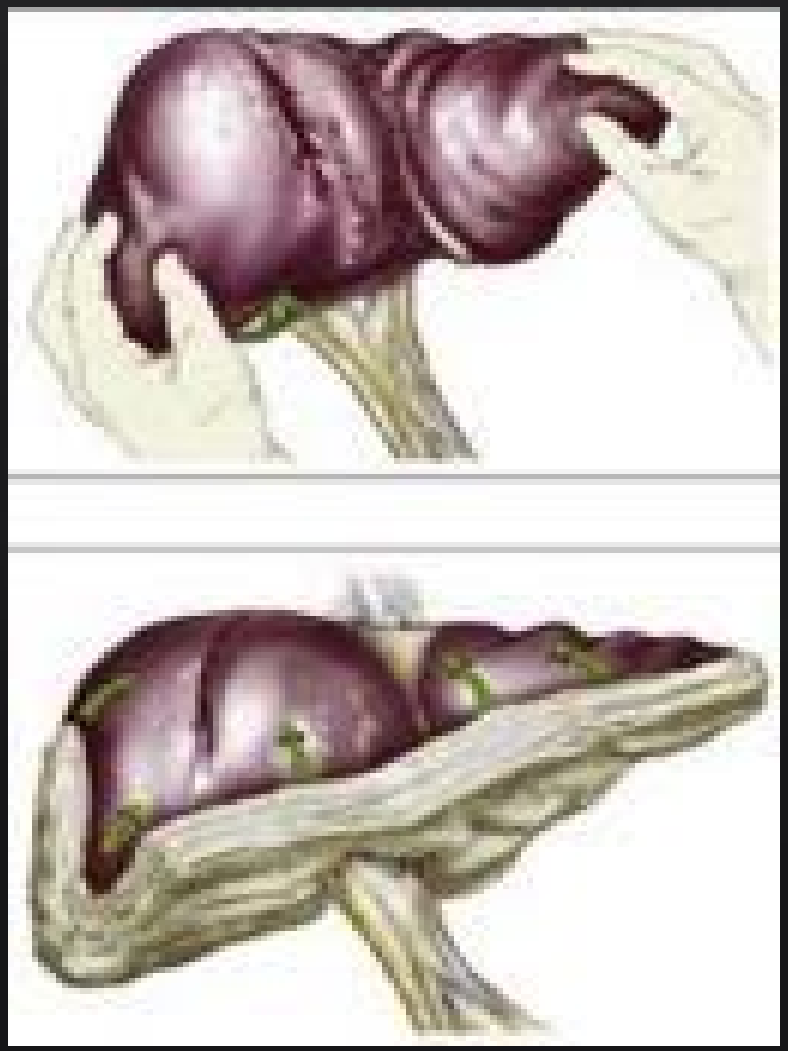


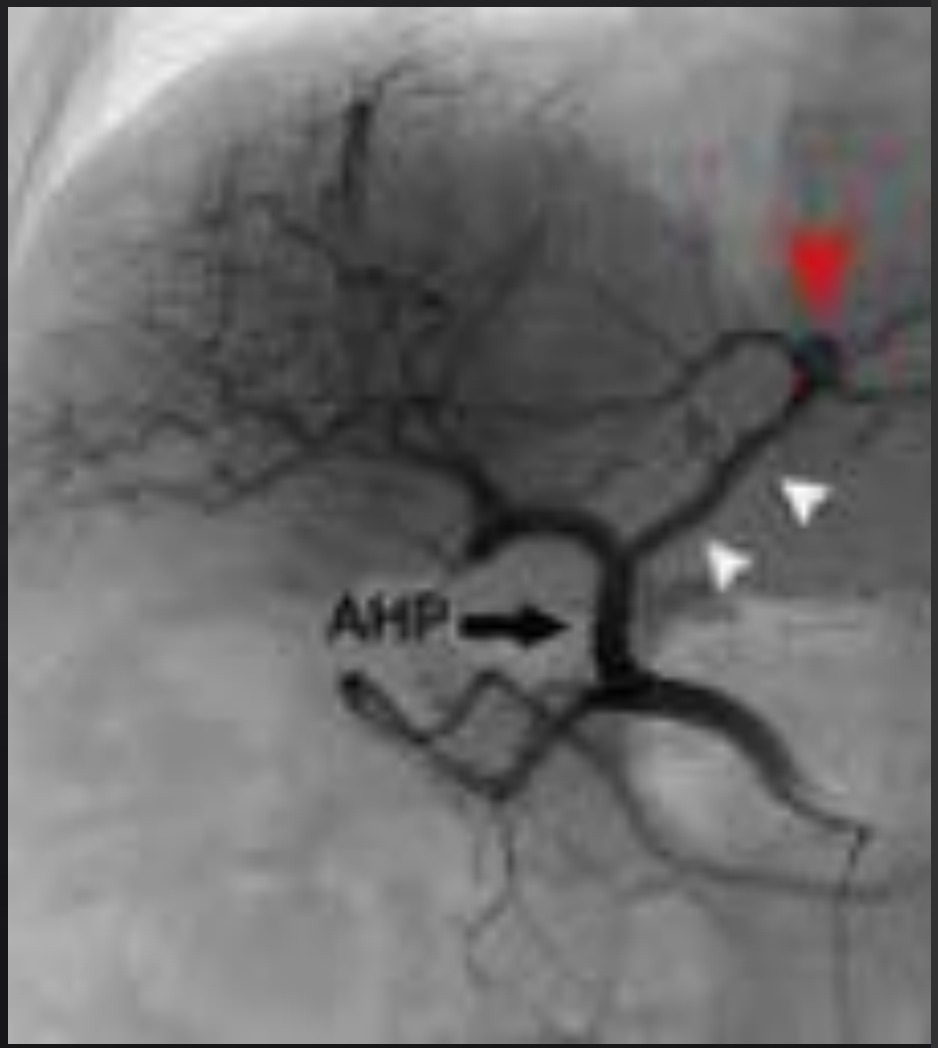
Saignements intra-hépatiques

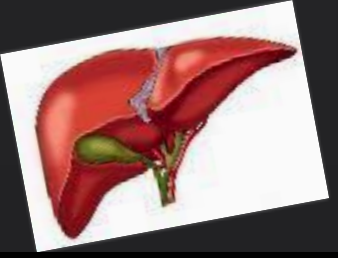




Trauma hépatique

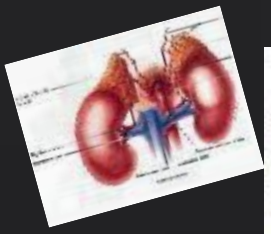






Trauma hépatique

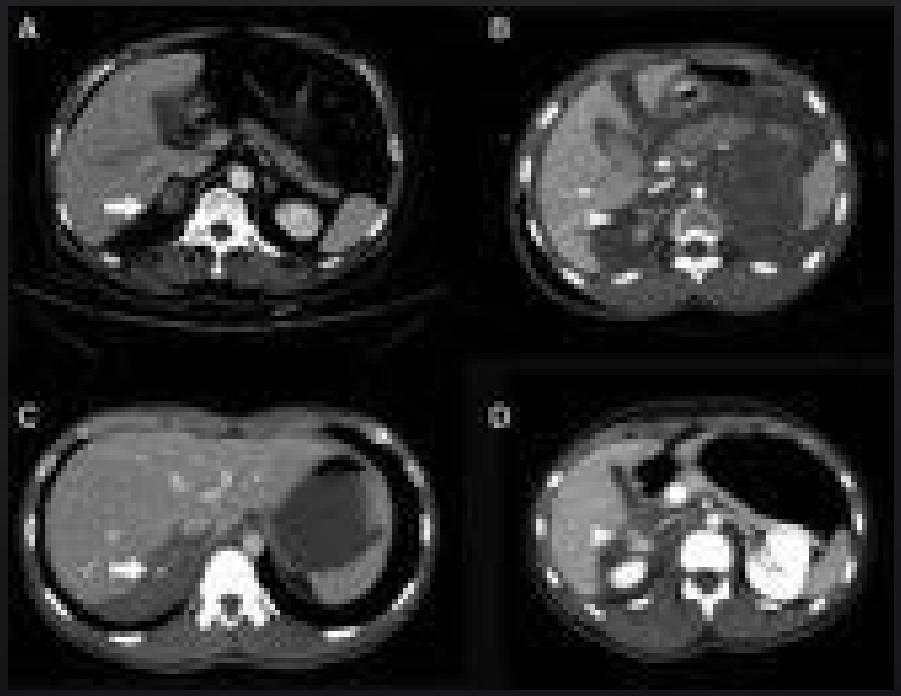
Trauma des organes creux



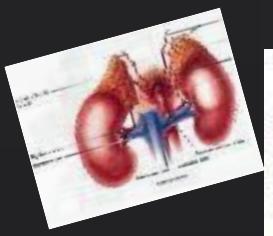
The current status and management of blunt adrenal gland trauma

Chien-Hung Liao, MD[a], Chun-Hsiang Ouyang, MD[a], Chih-Yuan Fu, MD[a], Shang-Yu Wang, MD[a], Kuo-Jen Lin, MD[b], I-Ming Kuo, MD[a], Chih-Po Hsu, MD[a], Shang-Ju Yang, MD[a], Kuo-Chin Yuan, MD[a], Yu-Pao Hsu, MD[a]

- Etude rétrospective de 2004 à 2013
- 77 inclus avec trauma de la surrénale
  - 6 patients opérés
  - 18 Angiographies
    - ⇒ 4 embolisations (Succès 100 %)



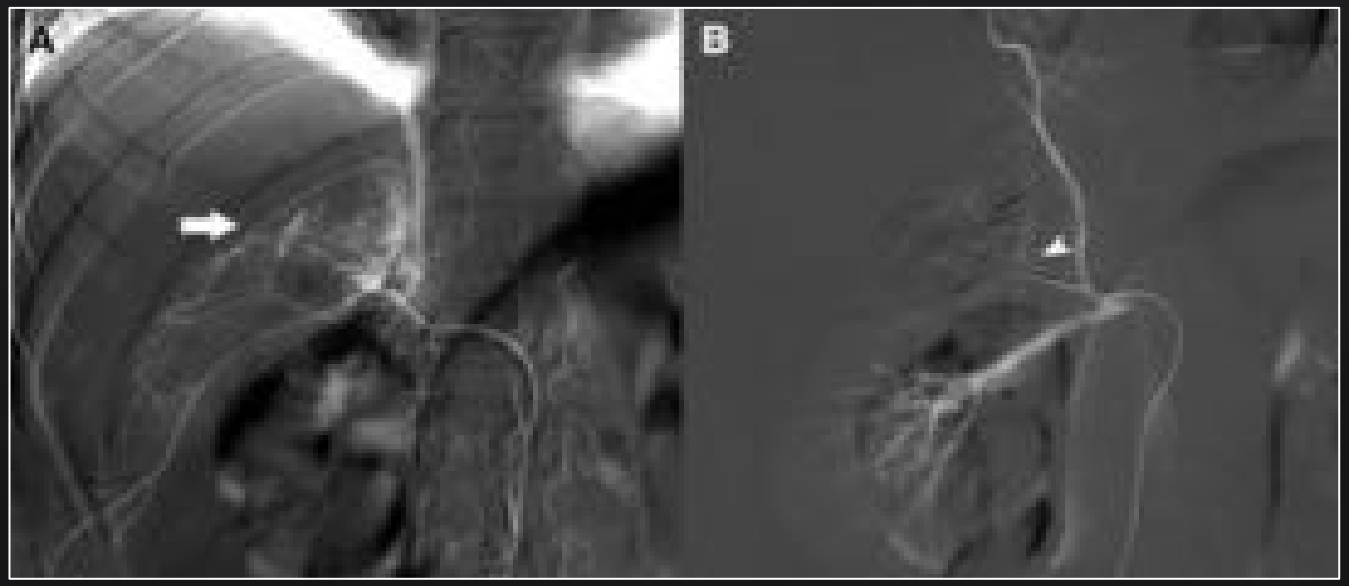
j.surg.2014.09.001



The current status and management of blunt adrenal gland trauma

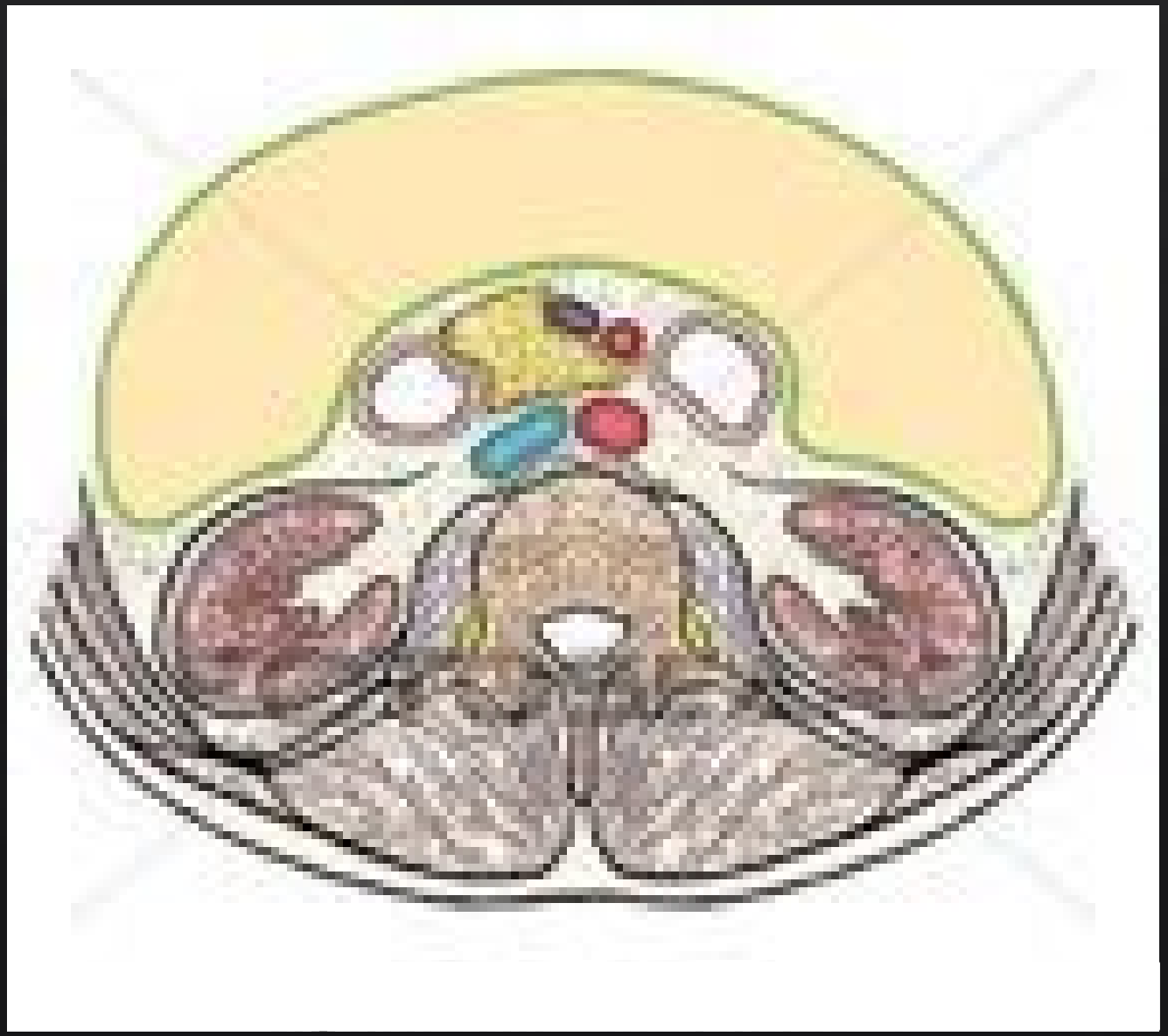
Chien-Hung Liao, MD[a], Chun-Hsiang Ouyang, MD[a], Chih-Yuan Fu, MD[a], Shang-Yu Wang, MD[a], Kuo-Jen Lin, MD[b], I-Ming Kuo, MD[a], Chih-Po Hsu, MD[a], Shang-Ju Yang, MD[a], Kuo-Chin Yuan, MD[a], Yu-Pao Hsu, MD[a]

CONCLUSION: In conclusion, BAGT is a rare injury with a benign prognosis. Most patients can be treated conservatively. Furthermore, this study demonstrates that both TAE and operation can be used to achieve hemostasis. The mortality of BAGT was related to severe associated injuries. BAGT is an indicator of severe multiple trauma; however, it does not increase mortality or prolong hospital stay.



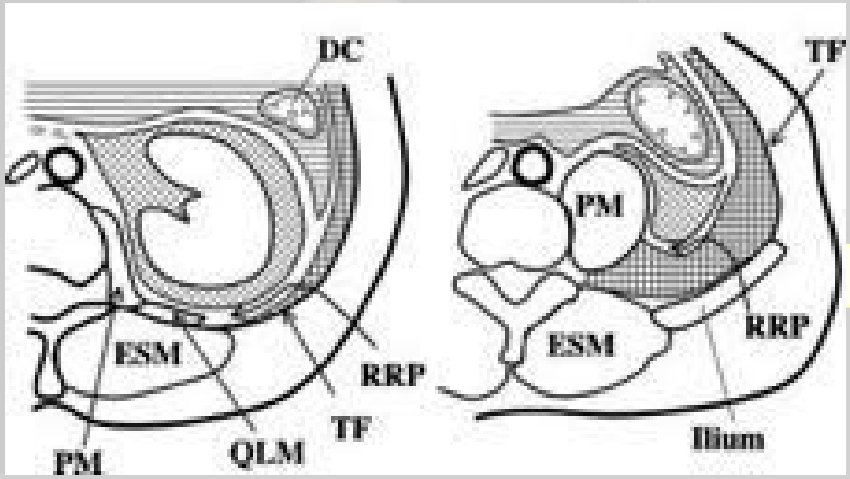
j.surg.2014.09.001

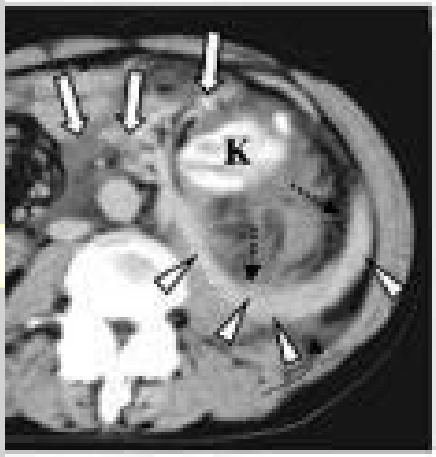
Zone rétro-péritonéale

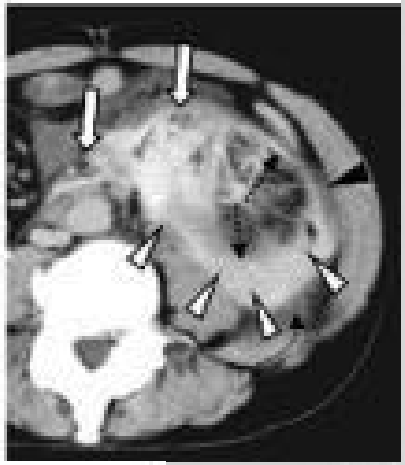


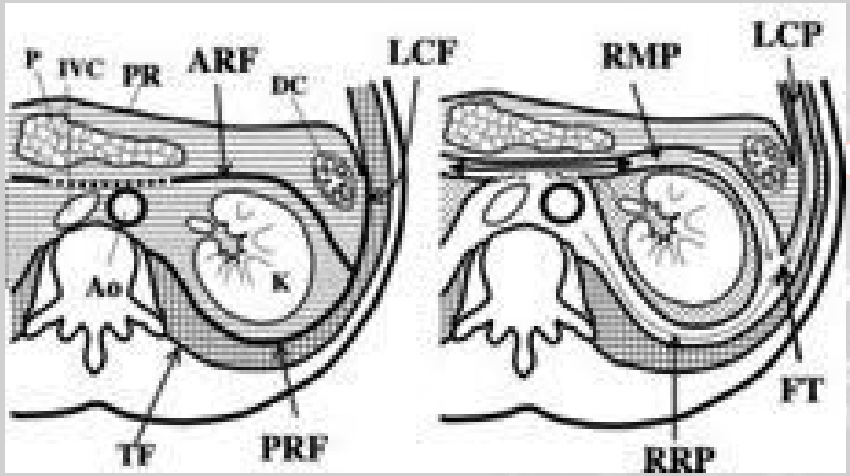
Traumatic Retroperitoneal Hematoma Spreads Through the Interfascial Planes

Kazuo Ishikawa, MD, PhD, Hideo Tohira, MD, Yasuaki Mizushima, MD, PhD, Tetsuya Matsuoka, MD, PhD, Yasumitsu Mizobata, MD, PhD, and Junichiro Yokota, MD, PhD









J Trauma. 2005

Conclusion

- Lésions très fréquentes chez le polytrauma
- Complications précoces et tardives graves
- TDM_{inj} = examen central dans la prise en charge initiale / retardé
- Stratégie chirurgicale & multidisciplinaire
  - ⇒ ***Urgence-gold standard = Laparotomie explo + damage control***
  - ⇒ ***NOM la règle***
  - ⇒ ***Angio-embolisation hémostatique complément / alternative***
  - ⇒ ***Angio-embolisation prophylactique en discussion***
  - ⇒ ***Selon les associations lésionnelles***
- Complications secondaire → $TDM_{injecté}$
  - ⇒ *Reprise/intervention tardive fréquente*
- Place du REBOA sur chocs majeurs abdo-pelvien ++++
- Attention au piège du trauma pénétrant…

merci de votre attention…

Jonathan CHARBIT