



The dark side of the guidelines

1st Interventional Radiologist under 40 Meeting

Emergencies in Interventional Radiology



21-23 Novembre 2016

all'Archiginnasio



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Emergencies in Interventional Radiology



UNDER 40

OVER 40

21-23 Novembre 2016

Bologna

Società Medica Chirurgica - Palazzo dell'Archiginnasio

Emorragie Spleniche

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AOU Careggi
Firenze

Background

Emorragie Traumatiche

- Organo frequentemente coinvolto traumi chiusi dell' addome (46%)
- Lesioni spleniche (isolate o associate) sono presenti nel 20% dei

Rischi

Emorragia → Emoperitoneo → Shock ipovolemico

Rottura secondaria

rare, legate ad aumento dimensioni e tensione capsula
malattie ematologiche/infettive
(assimilabili per management e trattamento alle rotture traumatiche)

Leenen LP. Abdominal trauma: from operative to nonoperative management. Injury 2009; 40 Suppl 4: S62-8.

Brickov I Nonoperative management of spontaneous splenic rupture in infectious mononucleosis: the role for emerging diagnostic and treatment modalities.

Am Surg. 2006 May;72(5):401-4.

Interventional Radiologist under 40 Meeting

Emergencies in Interventional Radiology

Background

- Laparotomia/Splenectomy → Management Non Operativo MNO

- Vantaggi Management Non Operativo
 - Riduzione Laparotomie Non Terapeutiche
 - Riduzione emotrasfusioni
 - Riduzione Costi
 - Riduzione Tempi Degenza
 - Ridotta Mortalità
 - Preservazione Funzione Splenica (Batteri Capsulati)
 - Riduzione complicanze addominali

Sartorelli KH, Frumiento C, Rogers FB, et al. Non-operative management of hepatic, splenic, and renal injuries in adults with multiple injuries. J Trauma. 2000;49:56Y61

Rischio Severa infezione post splenectomia <1% Mortalità 50%

Malhotra et al Preservation of Splenic Immunocompetence After Splenic Artery Angioembolization for Blunt Splenic Injury (J Trauma. 2010;69: 1126

Blunt splenic trauma: Splenectomy increases early infectious complications: A prospective multicenter study

TABLE 3. Infectious Complications According to the Management of the Splenic Injury

	Total (n = 269)	Splenectomy (n = 97)	No Splenectomy (n = 172)	p
Infectious complication	14.9 (40)	32.0 (31)	5.2 (9)	<0.001
Intra-abdominal abscess	2.2 (6)	6.2 (6)	0.0 (0)	0.001
Wound infection	4.8 (13)	8.2 (8)	2.9 (5)	0.050
Urinary tract infection	1.5 (4)	2.1 (2)	1.2 (2)	0.560
Pneumonia	7.1 (19)	14.4 (14)	2.9 (5)	<0.001
Septicemia	5.2 (14)	12.4 (12)	1.2 (2)	<0.001

p values were extracted from χ^2 or Fisher's exact test. Values are presented as (%) n.

TABLE 5. Factors Independently Associated With the Development of an Infectious Complication After a Splenic Injury

Factor	Adjusted Odd Ratio (95% CI)*	Adjusted p*	Cumulative R ²
SBP <90 mm Hg	3.76 (1.40–10.10)	0.009	0.209
ISS >16	3.13 (1.03–10.00)	0.045	0.237
Hollow viscus injury	3.38 (1.18–9.62)	0.023	0.264
Splenectomy	7.09 (3.09–16.39)	<0.001	0.290

Splenectomy: FR indipendente per complicanze infettive

> alti gradi di lesione (IV-V)

Demetriades J Trauma 2012

- 1970-80: Management non operativo(MNO) in chirurgia pediatrica.

Evitare splenectomie in età pediatrica (Osservazione)

The non-operative management of splenic trauma. Aust N Z J Surg. 1977 Apr;47(2):179-82.

- ' 80 estensione alla popolazione adulta (osservazione intraoperatoria assenza di sanguinamento attivo)

OVER-TREATMENT

- Embolizzazione splenica trauma

Sclafani SJ. The role of angiographic hemostasis in salvage of the injured spleen. Radiology 1981; 141: 645-50.

- 1995 Sclafani et al Embolizzazione nel management del trauma splenico

Nonoperative salvage of computed tomography- diagnosed splenic injuries: utilization of angiography for triage and embolization for hemostasis. The Journal of trauma 1995

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Approccio al Paziente con Emorragia Splenica

MNO

In centri di esperienza l'indicazione al MNO fino **85%** pazienti con trauma splenico

OSSERVAZIONE

Management Non Operativo del trauma splenico consiste in un periodo di osservazione/monitoraggio reparto ad intensità di cura (degenza o Terapia intensiva) con monitoraggio strumentale seriato dell' addome, monitoraggio parametri emocromo e periodo di immobilità/riposo seguito da un periodo di restrizione dell' attività fisica in generale.

MNO dovrebbe essere gestito in un contesto attrezzato per laparotomia in emergenza

Raccomandazione livello II

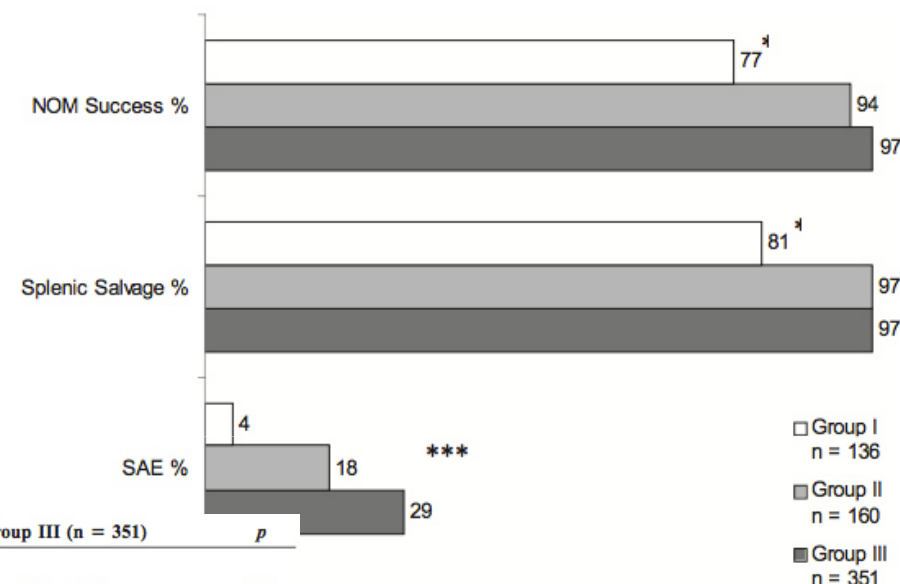
Tra i fattori che hanno contribuito al miglioramento del successo del MNO

EMBOLIZZAZIONE SPLENICA

Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline Stassen et al. J Trauma Acute Care Surg 2012

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

Gruppo I 1991-1998 Embolizzazione No
 Gruppo II 1998-2001 Embolizzazione Discrezionale
 Gruppo III 2002-2007 Embolizzazione Protocollo



	Group I (n = 136)	Group II (n = 160)	Group III (n = 351)	p
Characteristics				
Age (yr)	34.3 ± 1.5	36.9 ± 1.5	37.1 ± 0.9	NS
Injury severity score	22.8 ± 1.0	20.5 ± 0.9	19.9 ± 0.6*	<0.0001
Splenic injury score	2.4 ± 0.1	2.5 ± 0.1	2.5 ± 0.1	NS
Initial systolic blood pressure (mm Hg)	135 ± 2.6	130.5 ± 1.9	128.0 ± 1.2*	<0.0001
Initial pulse (beats/min)	97.6 ± 2.1	97.2 ± 1.5	98.4 ± 1.1	NS
Hematocrit (%)	35.9 ± 0.5	36.5 ± 0.6	36.1 ± 0.4	NS
Treatments				
Initial splenic artery embolization (%)	0 (0)†	17 (10.6)†	92 (26.2)†	<0.0001
Late splenic artery embolization (%)	6 (4.4)	17 (10.6)*	24 (6.8)	0.036
Outcomes				
Successful nonoperative management (%)	105 (77.2)†	151 (94.4)	340 (96.9)	<0.0001
Mortality (%)	8 (5.8)	1 (0.6)	5 (1.4)	<0.01
Length of stay (d)	11.4 ± 0.8	9.5 ± 0.7	9.5 ± 0.6	NS
Splenic salvage (%)	110 (80.9)†	155 (96.9)	342 (97.4)	<0.0001

Data presented as ± standard error of the mean.

* Significant compared with group I.

† Significant compared with all the other groups.

NS, not significant.

Sabe 2009 J Trauma

Trauma centers with higher rates of angiography have a lesser incidence of splenectomy in the management of blunt splenic injury

ne guidelines

Characteristic	Low ANGIO centers (n = 2,715)	High ANGIO centers (n = 2,618)	P value
Age mean (y)	38.8 ± 20.1	40.7 ± 20.8	.001
Injury Severity Score (mean)	23.7 ± 13.8	23.5 ± 14.6	NS
Revised Trauma Score (mean)	7.1 ± 1.7	7.2 ± 1.7	NS
TRISS (Trauma Injury Severity Score)	0.86 ± 0.26	0.87 ± 0.26	NS
Sex (%)			

Maggiore impiego Embolizzazione Splenica
=
Riduzione Splenectomie

IV	12.3	11.4	
V	7.6	8.1	
Not further specified	29.2	29.6	
Level of trauma center (%)			
I	55.5	78.7	<.001
II	44.5	19.8	
III	0	1.5	
No. of BSI admissions (%)			
Low (<260)	46.4	59.4	<.001
High (>260)	53.6	40.6	
Splenectomy (%)	23.6	18.6	<.001
ANGIO (%)	7.7	18.8	<.001
Admission to an ICU	73.0	50.7	<.001
Age > 55 (%)	22.6	24.6	.08
Hospital days (median)	5 (IQR 3–11)	5 (IQR 3–11)	NS
ICU days (median)	2 (IQR 0–4)	2 (IQR 1–4)	NS

ANGIO, Angiography; BSI, blunt splenic injury; ED, emergency department; ICU, intensive care unit; IQR, interquartile range; PEC, preexisting condition.

Surgery 2015

Clinica: Stabilità Emodinamica

Grading della lesione splenica

Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline Stassen et al. J Trauma Acute Care Surg 2012

Stabilità Emodinamica

Raccomandazione livello I

Pazienti con segni di peritonismo diffuso o
emodinamicamente instabili devono essere sottoposti a
laparotomia in urgenza

Raccomandazione livello I

Presenza o sospetto di lesioni addominali associate che
richiedano trattamento chirurgico

Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline Stassen et al. J Trauma Acute Care Surg 2012

Trauma Splenico Grading

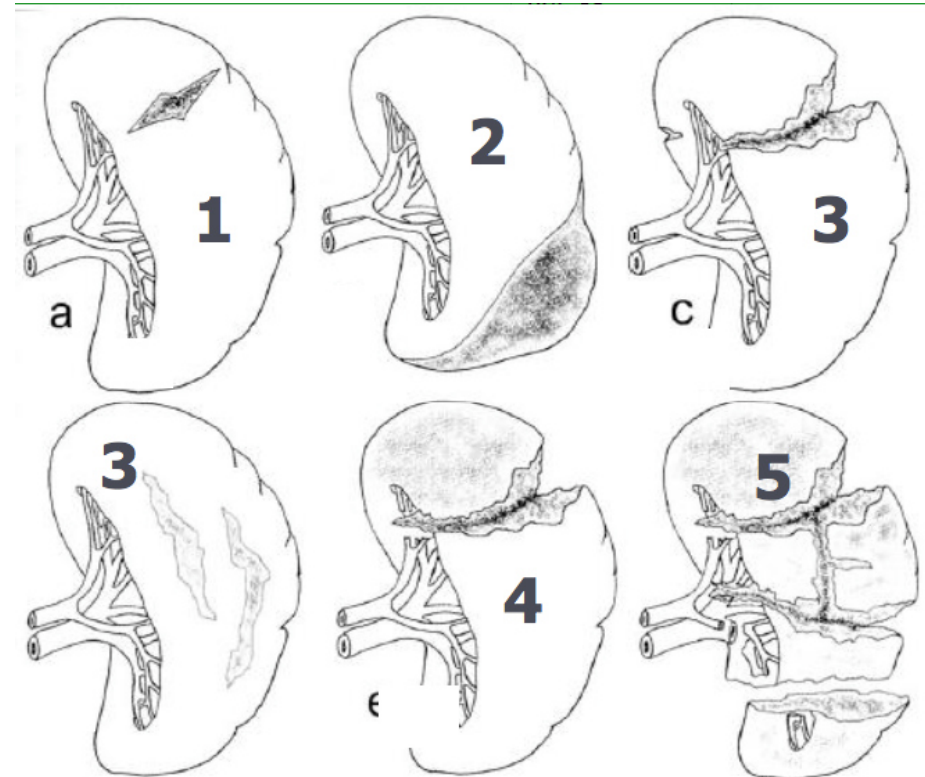
American Association for the Surgery of the Trauma AAST 1994 revised

Spleen injury scale (1994 revision)

Grade*	Injury type	Description of injury
I	Hematoma	Subcapsular, <10% surface area
	Laceration	Capsular tear, <1cm parenchymal depth
II	Hematoma	Subcapsular, 10%-50% surface area intraparenchymal, <5 cm in diameter
	Laceration	Capsular tear, 1-3cm parenchymal depth that does not involve a trabecular vessel
III	Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma $\geq$ 5 cm or expanding
	Laceration	>3 cm parenchymal depth or involving trabecular vessels
IV	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
	Vascular	Hilar vascular injury with devascularizes spleen
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury with devascularizes spleen

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

From Moore et al. [4]; with permission



Trauma Splenico Grading

Parametri TC

Emoperitoneo (+3 aree)

Lacerazioni o devascularizzazione >50%

Blush >1cm

Pseudoaneurisma /Fistola AV

Stravaso attivo intracapsulare

Stravaso attivo extracapsulare(fMNO x24)

↑ Lesioni Vascolari
Insuccesso MNO

Multidetector CT-based Splenic Injury Grading System

Grade	Injury	Size (cm)
Grade 1	Subcapsular hematoma thickness	<1
	Laceration parenchymal depth	<1
	Parenchymal hematoma diameter	<1
Grade 2	Subcapsular hematoma thickness	1-3
	Laceration parenchymal depth	1-3
	Parenchymal hematoma diameter	1-3
Grade 3	Subcapsular hematoma thickness	>3
	Laceration parenchymal depth	>3
	Parenchymal hematoma diameter	>3
	Splenic capsule disruption	...
Grade 4a	Active intraparenchymal and/or subcapsular bleeding	...
	Splenic vascular injury (pseudoaneurysm or arteriovenous fistula)	...
	Shattered spleen	...
Grade 4b	Active intraperitoneal bleeding	...

Novel Computed Tomography Scan Scoring System Predicts the Need for Intervention after Splenic Injury Burke T. et al. J Trauma. 2006;60:1083-1086.

Nitima Saksobhavit Blunt splenic injury: Use of a Multidetector CT-based Splenic Injury Grading System and Clinical Parameters for Triage of Patients at Admission Radiology: 1st International Radiologist under 40 Meeting Volume 274, Number 3—March 2015

Emergencies in Interventional Radiology

Ruolo Embolizzazione Splenica

Raccomandazione 10:

L' embolizzazione prossimale o selettiva della milza può preservare la potenzialità immunitaria dell' organo e deve essere utilizzata in caso di emorragia arteriosa attiva e nel trattamento di pseudoaneurismi.

(Raccomandazione C, livello 3)

CIRSE Guidelines: Quality Improvement Guidelines for Endovascular Treatment of Traumatic Hemorrhage Sam Chakraverty et al. Cardiovasc Intervent Radiol (2012) 35:472–482

L' Angiografia dovrebbe essere considerata per pazienti con grado di lesione AAST ≥ 3 , presenza di contrast blush, emoperitoneo moderato o evidenza di sanguinamento attivo.

Raccomandazione livello II

Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline Stassen et al. J Trauma Acute Care Surg 2012

MNO

Linee guida EAST 2013 ampliamento e modifiche

1996-2010:

Classe I: Studi Prospettici randomizzati :(nessuna referenza)

Classe II: Studi Prospettici. non comparativi, retrospettivi con controllo: 19 referenze

Classe III: Analisi retrospettive: Case series, database, registri a review di casi: 105

Trauma Splenico Linee Guida AAST

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Pazienti emodinamicamente Stabili

Gradi I-II AAST
(non lesioni vascolari associate)

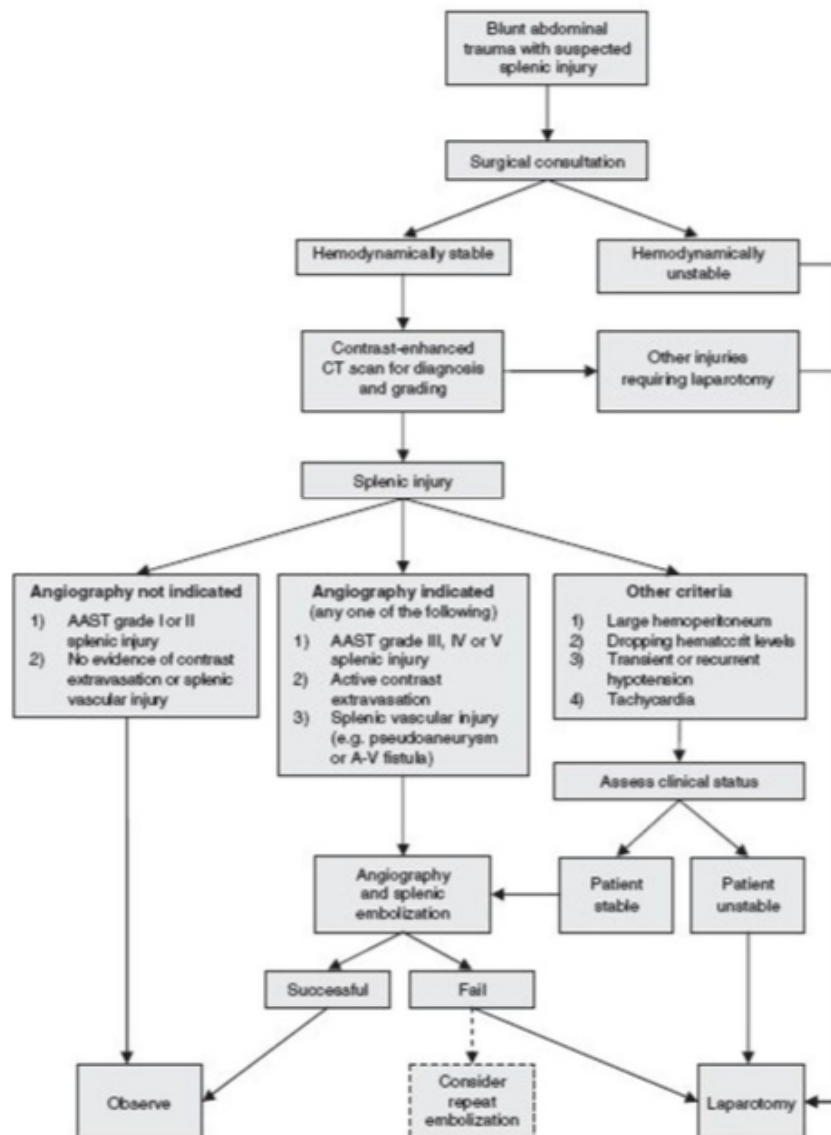
Osservazione

Gradi $\geq$ III AAST
(lesioni vascolari associate)

Embolizzazione

Fallimento

Laparotomia



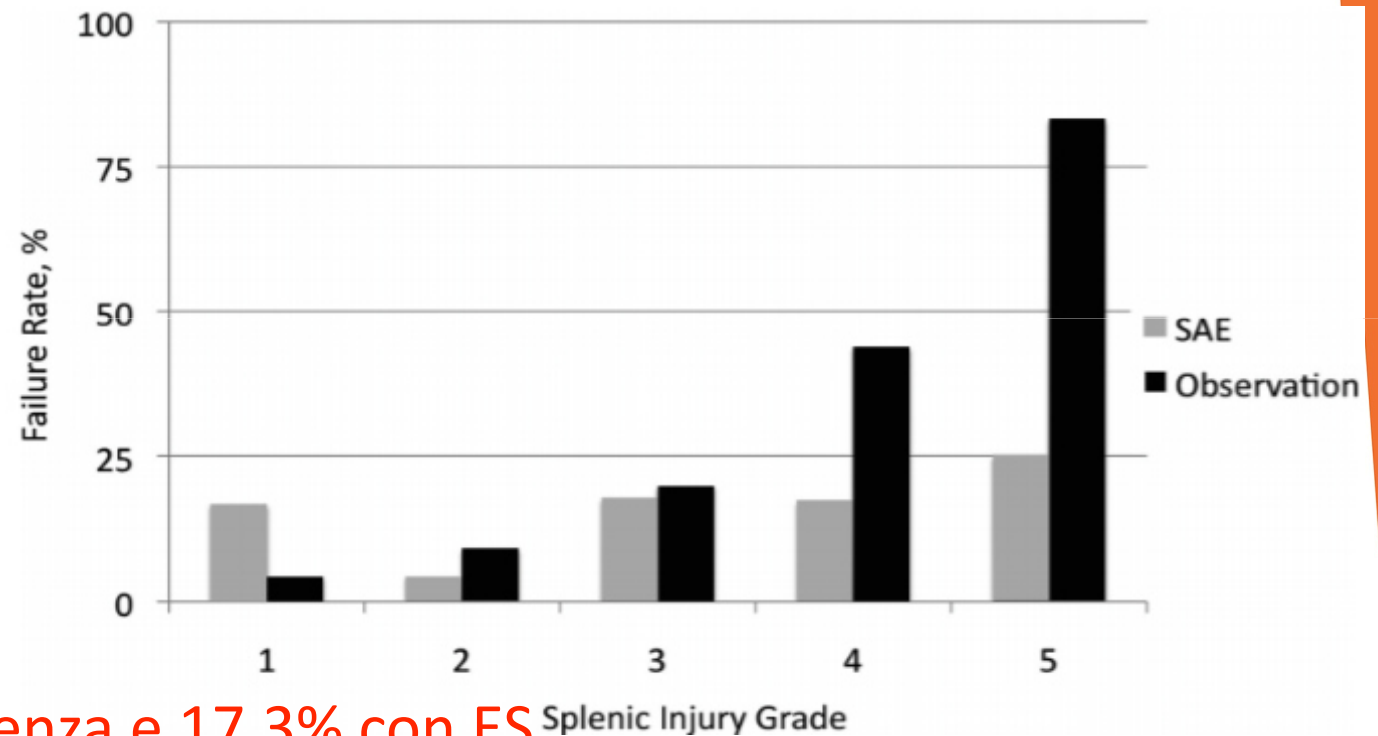
Ruolo Embolizzazione Splenica

Assenza di consenso sui criteri
indicazione ad embolizzazione splenica

Gradi di Trauma?
Sanguinamento Attivo/Lesioni
Vascolari associate?

Nonoperative Management of Adult Blunt Splenic Injury With and Without Splenic Artery Embolotherapy: A Meta-Analysis

10.157 pts: 6947 NOM.
Osservazione Vs ES.
Stratificazione risultati per gradi AAST
Fallimento MNO: 8.3%



Fallimento MNO:
grado IV 43.7% senza e 17.3% con ES
grado V 83.1% senza e 25.0% con ES

Requarth JA, et al J Trauma 2011

Prospective Trial of Angiography and Embolization for All Grade III to V Blunt Splenic Injuries: Nonoperative Management Success Rate Is Significantly Improved

Studio Prospettico con confronto Vs corte storica:

Protocollo di angiografia ed embolizzazione in Paz emodinamicamente stabili III,IV,V 113pts selezionati per ES

97 nel protocollo (fallimento MNO 5%)

16 deviazione dal protocollo(discrezione angiografista) fallimento 25% (P0.02)

Fallimento maggiore nel gruppo controllo (15% P0.04) (angiografia non di routine)

Variable	Early (n = 153)	Late (n = 168)	p Value
Male/female, n	113/40	112/56	0.20
Age, y, mean $\pm$ SD	38 $\pm$ 15	38 $\pm$ 18	0.68
Admission lactate, mmol/L, mean $\pm$ SD	2.8 $\pm$ 2.5	2.5 $\pm$ 2.2	0.38
Injury Severity Score, mean $\pm$ SD	29 $\pm$ 24	24 $\pm$ 10	0.0007
Splenic injury grade, n (%)			
III	74 (48)	94 (56)	0.21
IV	57 (37)	61 (36)	0.95
V	22 (14)	13 (8)	0.08
Mortality, n (%)	23 (15)	7 (4)	0.0009
Nonoperative management mortality, n (%)	5/80 (6)	2/113 (2)	0.13

Gruppo Early AngioEmbolizzazione a discrezione dell' Operatore

Gruppo Late AngioEmbolizzazione di Routine

Miller et al J Am Coll Surg 2014

The splenic injury outcomes trial: An American Association for the Surgery of Trauma multi-institutional study

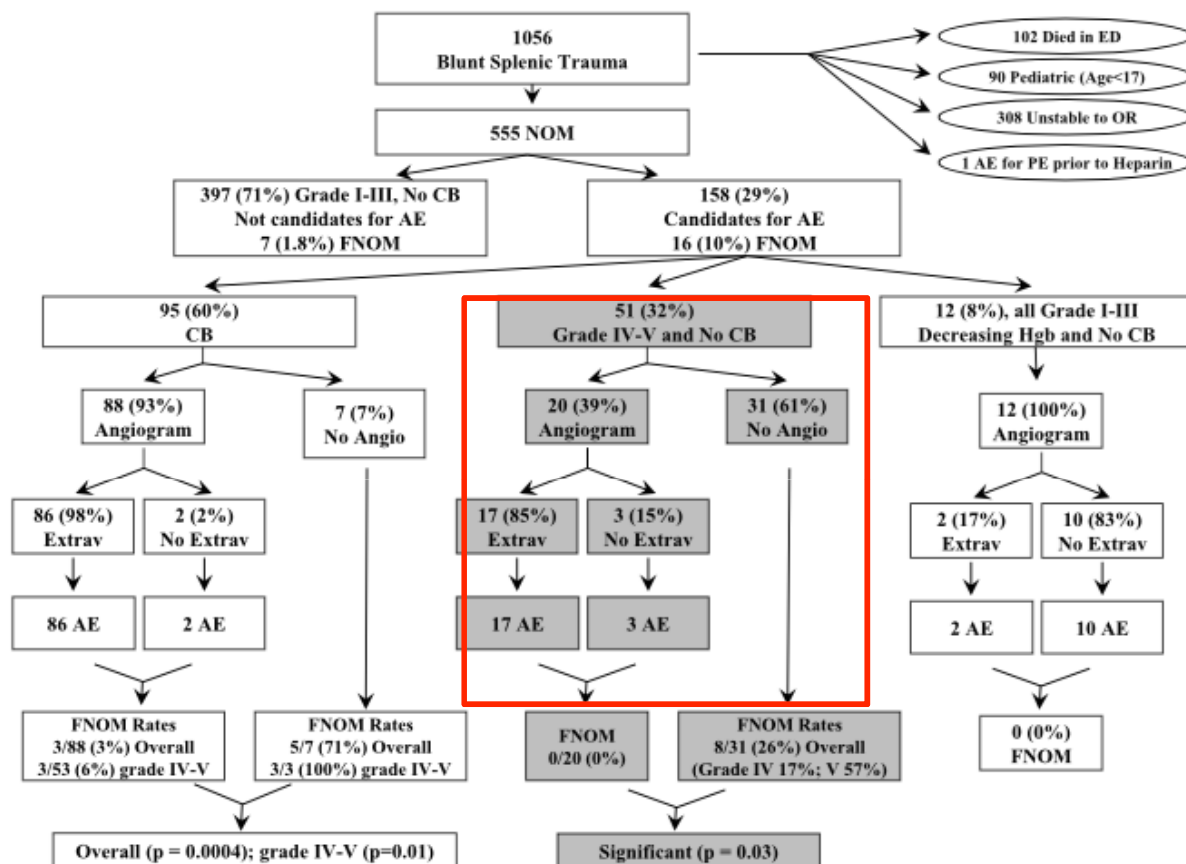
Variable	Entire Cohort n = 383	Splenic injury		p
		No n = 370	Yes n = 13	
Age, y	36 (25–52)	35 (25–52)	47 (40–56)	0.1217
Male, %	65.3	64.9	76.9	0.5552
Body mass index, kg/m ²	26.7 (23.2–31.6)	26.8 (23.2–31.6)	25.1 (23.3–32.3)	0.9099
ISS	22 (14–27)	22 (14–27)	22 (21–26)	0.167
Admission systolic blood pressure < 90 mm Hg, %	5.5	5.5	8.3	0.5007
Admission hematocrit, g/dL	39 (35–42)	39 (35–42)	41 (32–42)	0.7891
Admission international normalized ratio, IU	1.04 (1.00–1.12)	1.00 (1.00–1.12)	1.00 (0.95–1.05)	0.2992
Spleen injury grade, %				0.0502
1–2	57.2	58.1	41.9	
3–5	42.8	30.8	69.2	
Admission PSA, %	8.4	8.5	8.3	0.9889
Admission blush, %	12.9	12.2	33.3	0.0548
Other solid organ injury, %	28.5	27.8	46.2	0.2072
Hollow viscus injury, %	4.2	4.1	7.7	0.431
ANGIO with EMBO, %	18.7	3.5	2.8	0.7485
Intensive care length of stay, d	3 (1–6)	3 (1–6)	6 (3–13)	0.0278
Hospital length of stay, d	6 (3–11)	6 (3–10)	12 (6–15)	0.0304
Mortality, %	1.04	1.1	0	0.7063

Conclusioni:

CB correlato ad outcome sfavorevole (splenectomia)

ES non ha modificato outcome in pts con CB (Possibile beneficio limitato ES in alti gradi trauma)

At first blush: Absence of computed tomography contrast extravasation in Grade IV or V adult blunt splenic trauma should not preclude angioembolization



Bhullar

J Trauma 2013

98% pazienti con Sanguinamento attivo all' ANGIO tra i CB = ES

33% dei pazienti senza CB avevano sanguinamento attivo all' ANGIO

Conclusioni:

Assenza CB in IV-V grado lesione non esclude sanguinamento attivo e indicazione a ES

Ruolo Angiografia

Assenza di Indicazione univoca sui criteri
scelta della TECNICA:

Embolizzazione Prossimale

Embolizzazione distale

Embolizzazione combinata

Materiali?

Razionale Embolizzazione splenica

Embolizzazione Curativa

Trattamento di sanguinamento attivi/ Lesioni vascolari associate valutati con TCMDC in pazienti emodinamicamente stabili

Embolizzazione Preventiva

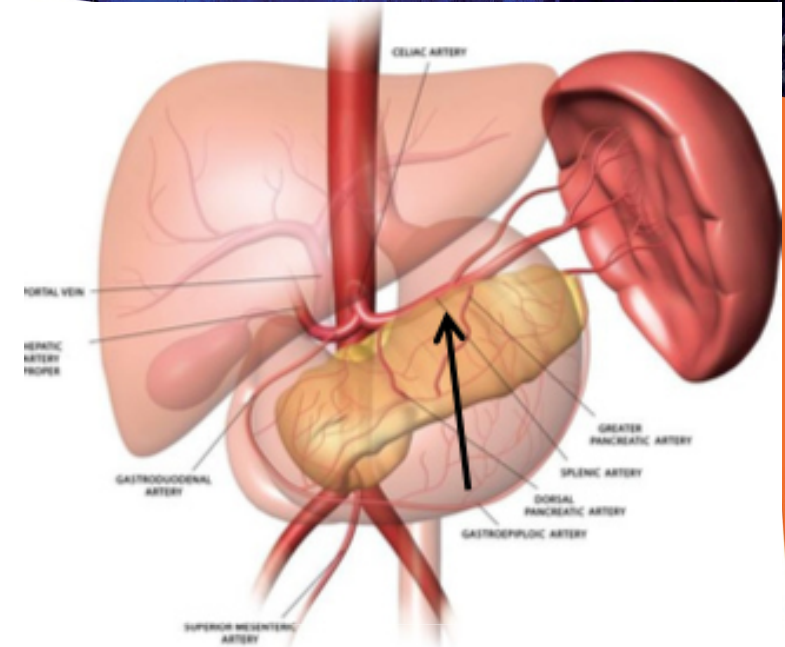
Contenere emorragia parenchima e prevenire rottura secondaria in pazienti con lesioni alto grado (AAST ≥ 3)

Tecnica di embolizzazione

The dark side of the guidelines

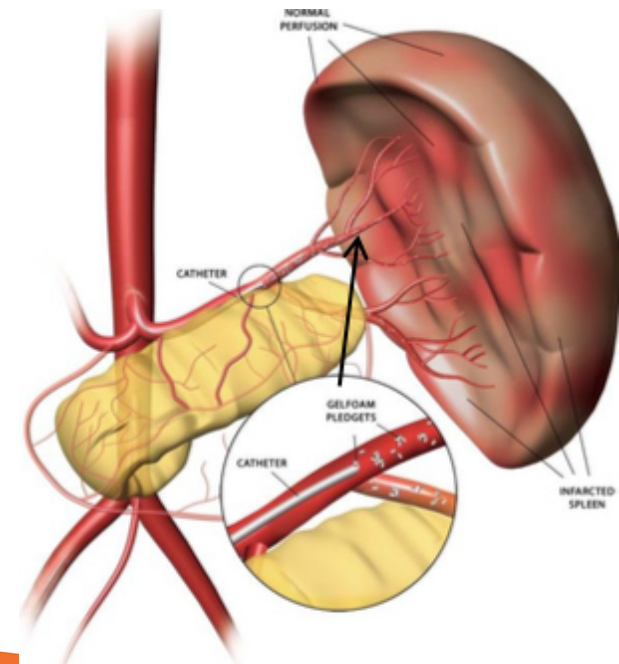
Embolizzazione Prossimale

Embolizzazione del ramo principale dell'arteria splenica (prossimale delle branche delle divisione principali)



Embolizzazione Distale(selettiva/non selettiva)

Embolizzazione delle diramazioni segmentarie dell'arteria splenica.



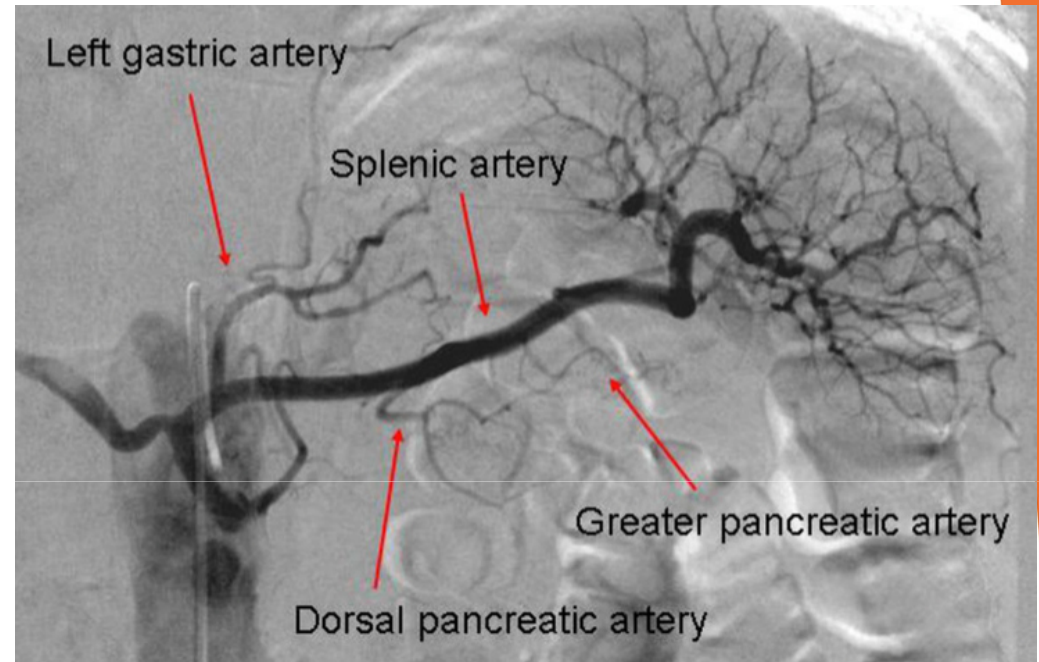
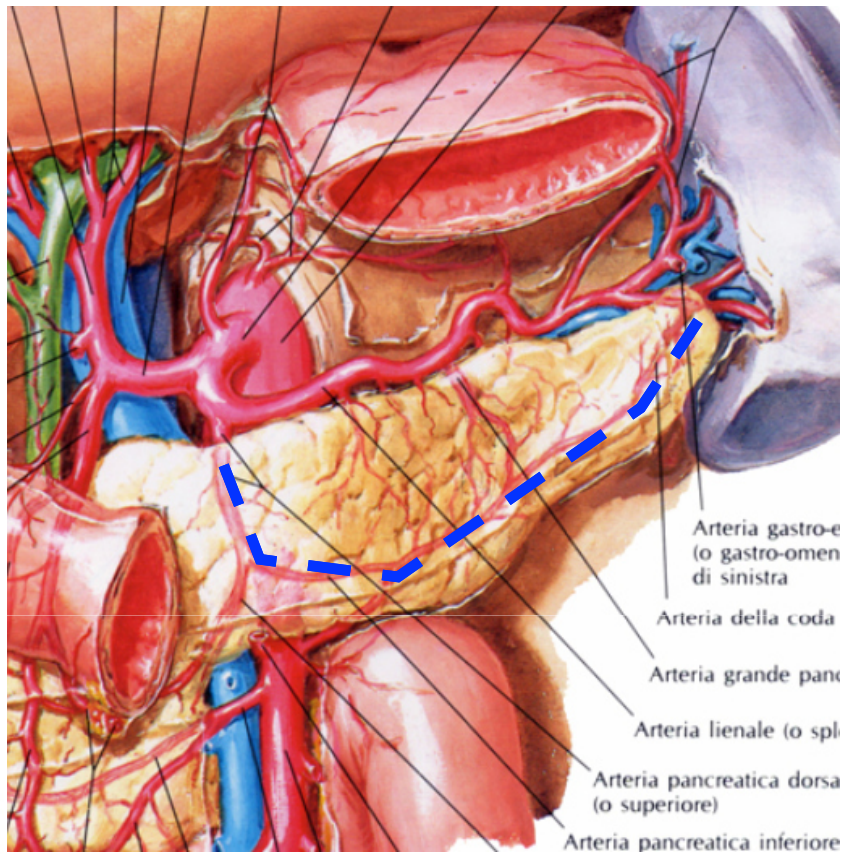
Embolizzazione Combinata

Tecnica di embolizzazione

Embolizzazione Prossimale

- Riduce la pressione arteriosa intrasplenica ($\sim 50\%$)*
- Limita la possibilità di infarti splenici (collateralità)
- Non trattamento diretto della sede di sanguinamento
- Rischio teorico di sanguinamento a distanza

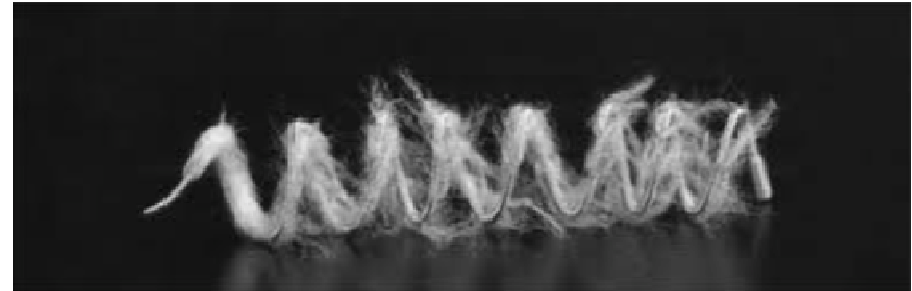
*Main splenic artery embolization using coils in blunt splenic injuries: effects on the intrasplenic blood pressure Bessoud Eur Radiol (2004)



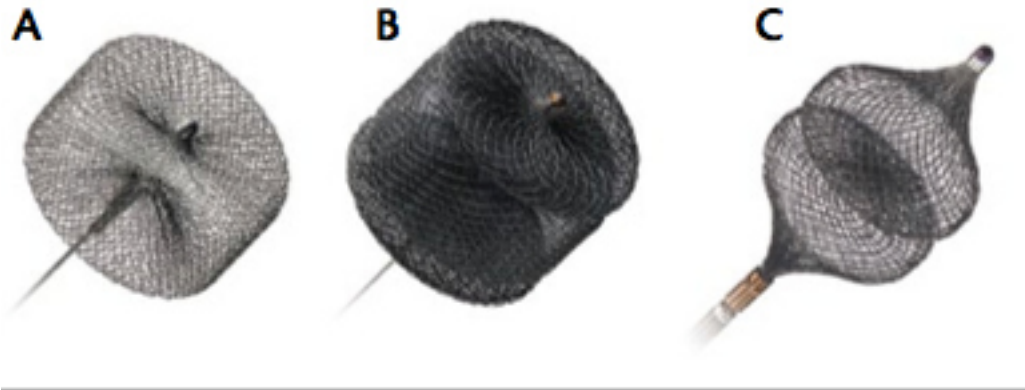
- Arcata Gastroepiploica (AGD)
- VV Gastrici Brevi e posteriori (AGS)
- A. Pancreatica Dorsale

Materiale Embolizzante

Spirali:
Pushable
Detachable



Vascular Plug



Materiale Embolizzante Coils

Vaso ad alto flusso (rischio migrazione)

Appropriata scelta del diametro

Scaffold Technique

Anchor Technique



Spirali distacco controllato
(riposizionabili)



CLINICAL INVESTIGATION

Utility of the Amplatzer Vascular Plug in Splenic Artery Embolization: A Comparison Study with Conventional Coil Technique

CVIR 2011

Xiaoli Zhu · Matthew D. B. S. Tam · Gregory Pierce ·

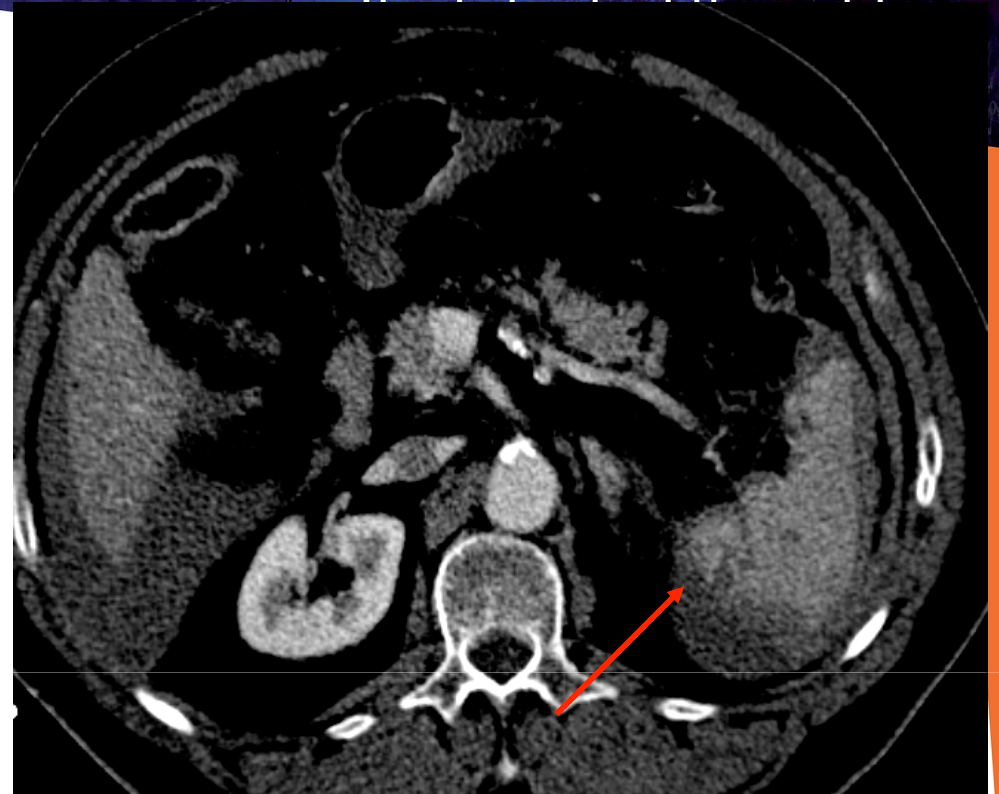
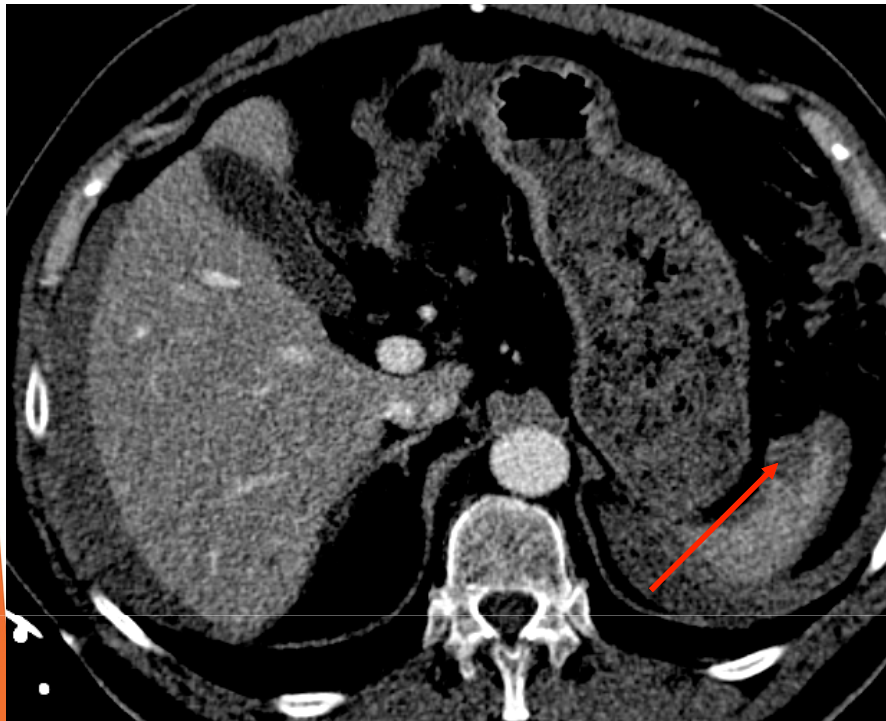
Gelfoam-Assisted Amplatzer Vascular Plug Technique for Rapid Occlusion in Proximal Splenic Artery Embolization

AJR 2013

Proximal Embolization of the Splenic Artery with a Penumbra Occlusion Device (POD): A Novel Occlusion Technique for Blunt Splenic Injuries

CVIR 2016

F. Petitpierre¹ · A. S. Lasserre¹ · E. Tricaud¹ · Y. Le Bras¹ ·
V. Dubuisson² · N. Grenier¹ · F. Cornelis¹



74aa

Trauma da caduta.

Lacerazioni spleniche multiple

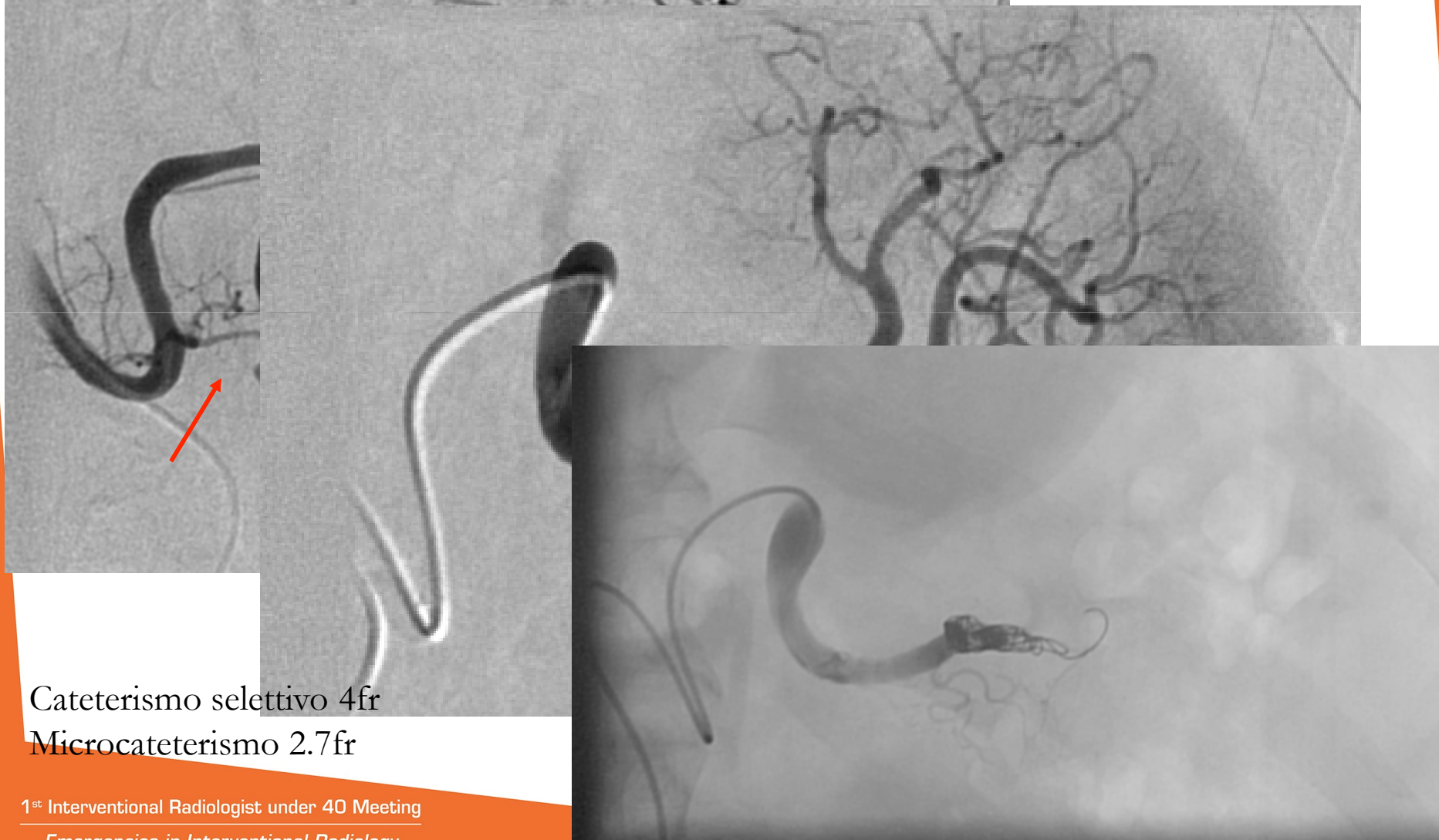
AAST grado III

Emoperitoneo

the dark side of the guidelines

Rami gastrici
Rami pancreatici

Embolizzazione prossimale
con spirali a distacco

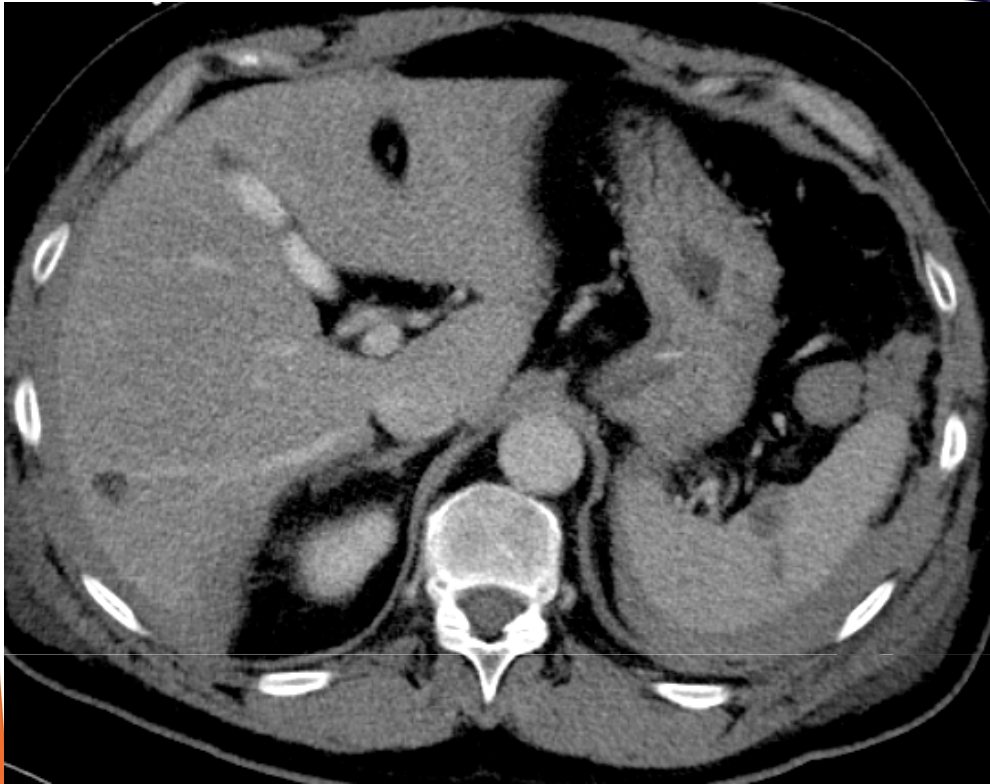


Cateterismo selettivo 4fr
Microcateterismo 2.7fr

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Decorso stabile
MDCT VI GPO
Preservazione della perfusione splenica



1
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L
H

A

Emoperitoneo
Contrast Blush

Tecnica di embolizzazione

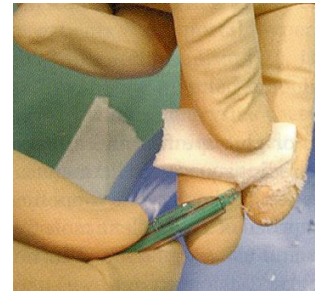
Embolizzazione Distale

- Embolizzazione selettiva del vaso lesionato (Sanguinamenti focali)
- Non riduce la pressione arteriosa splenica
- Produce un area infartuale (moderata-estesa)
- Tempo procedura ↑

Materiale Embolizzante

Coils: Fibered/Detachable

Gelfoam



Particelle (PVA)



Agenti embolizzanti fluidi (colle)



Trauma domestico

Hb 9.2 gr/dl

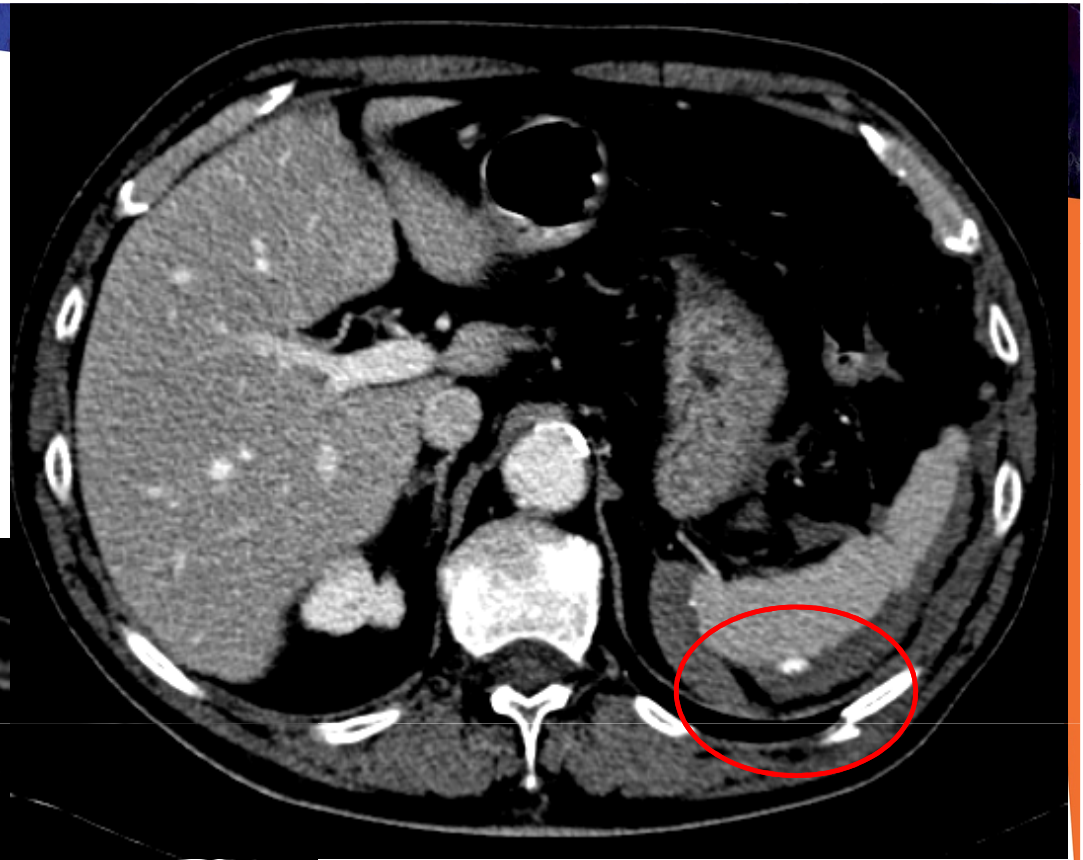
Stabilità emodinamica PA 135/80

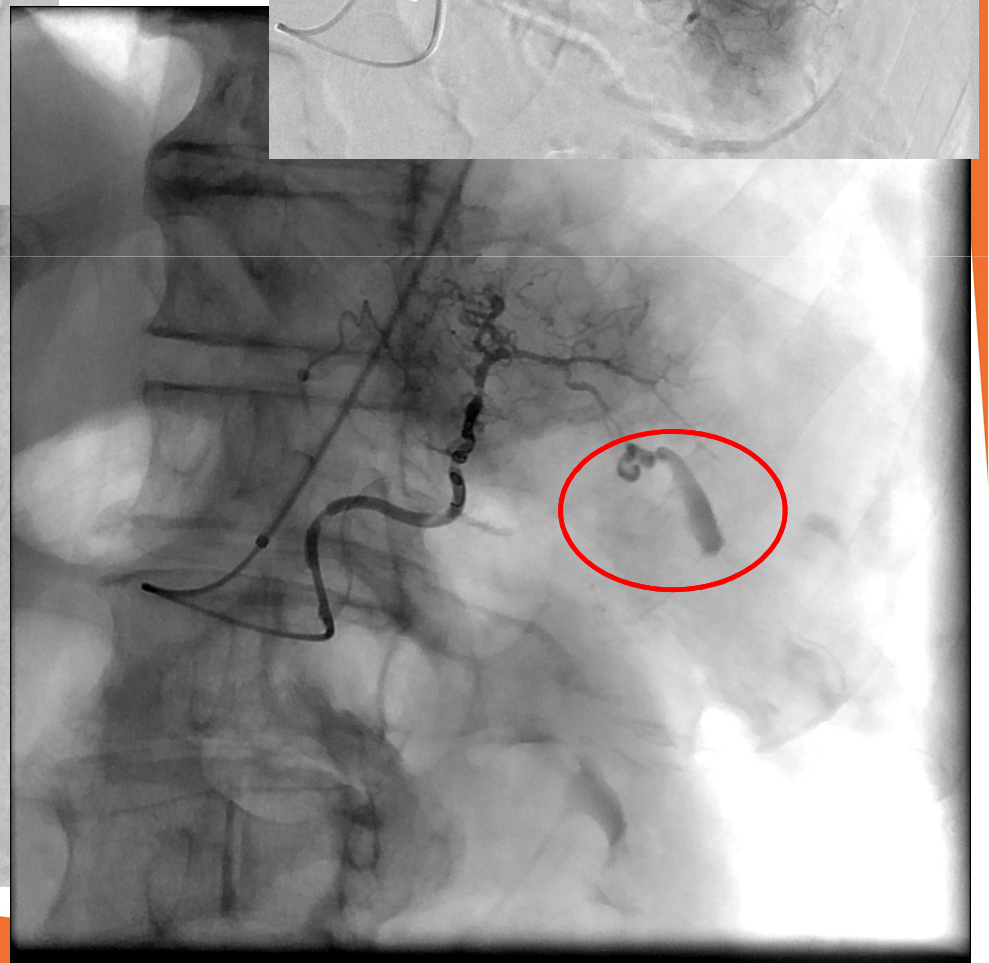
TC: Fratture costali

Ematoma subcapsulare

Lesione splenica AAST I-II

+ spandimento attivo subcapsulare

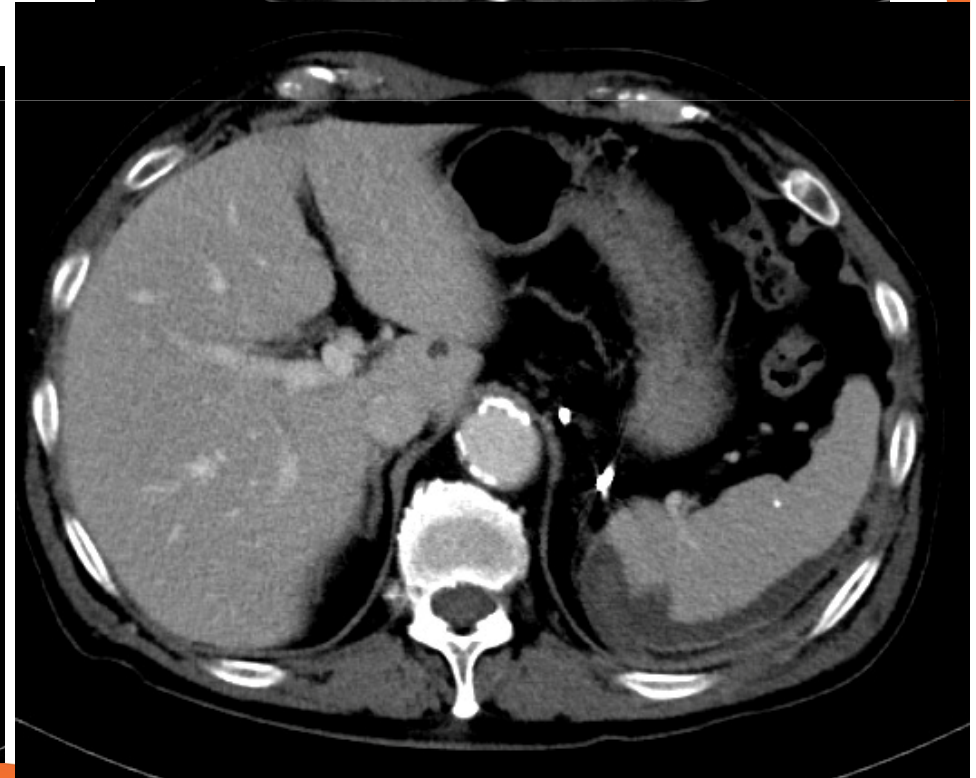
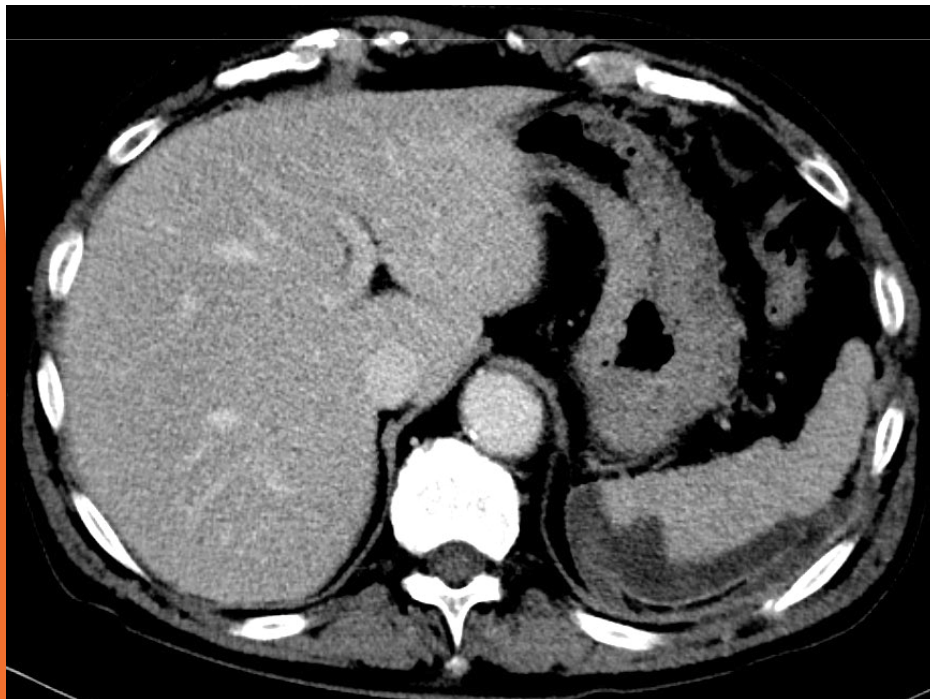
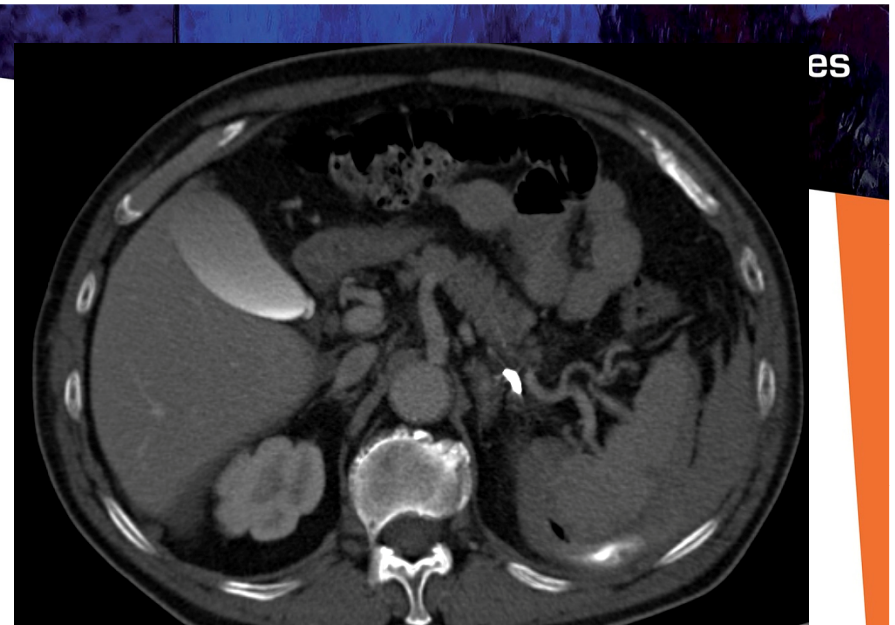




1st Interventional Radiologist under 40 Meeting

Emergencies in Interventional Radiology

TC 24 ore e 14gg
Focale area ischemica



Tecnica di embolizzazione

Embolizzazione Combinata

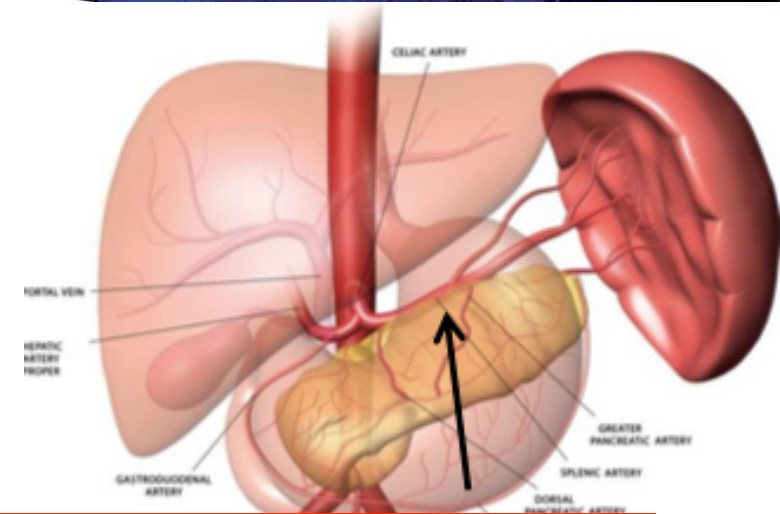
- Embolizzazione selettiva del vaso lesionato (stravaso attivo/PA)
- Riduzione della pressione arteriosa splenica
- Tempo procedura ↑
- Lesioni AAST alto grado e spandimento attivo

Tecnica di embolizzazione

The dark side of the guidelines

Embolizzazione Prossimale

Embolizzazione del ramo principale dell'arteria splenica (prossimale delle branche delle divisione principali)

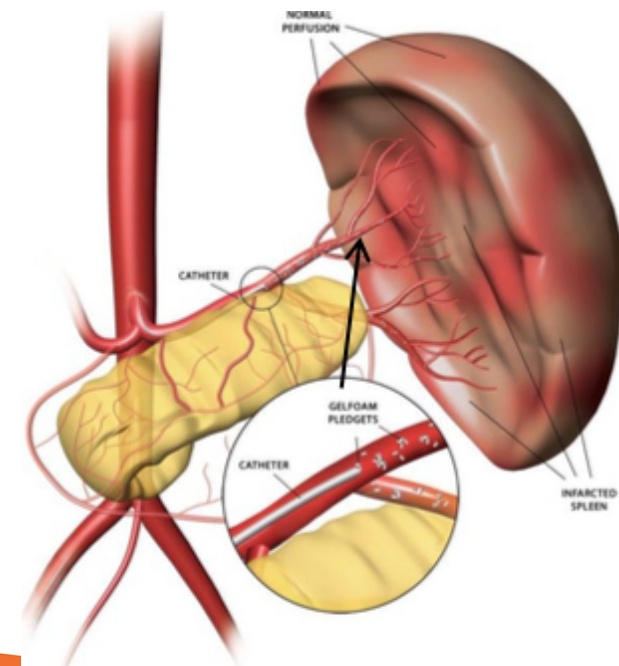


No Trial Prospettici Randomizzati

Embolizzazione Distale (selettiva/non selettiva)

Embolizzazione delle diramazioni segmentarie dell'arteria splenica.

Embolizzazione Combinata



Tecnica di embolizzazione

- Selettiva per sanguinamento attivo/lesioni vascolari associate
- Prossimale se non lesioni vascolari documentabili
- Combinata Lesioni AAST alto grado e spandimento attivo

No linee guida

No consenso

Non dati definitivi

Nonoperative Management of Traumatic Splenic Injuries: Is There a Role for Proximal Splenic Artery Embolization?

of the guidelines

Patient Characteristic	Nonoperative Management TPSAE (n = 37)	Standard Nonoperative Management (n = 30)	Patient Characteristic	Nonoperative Management TPSAE (n = 37)	Standard Nonoperative Management (n = 30)	p
Age (yr)			Age (yr)			0.8726
Mean ± SD	40 ± 17	37 ± 15	Mean ± SD	40 ± 17	37 ± 15	
Sex			Sex			0.0946
No. of males / no. of females	28 / 9	27 / 3	No. of males / no. of females	28 / 9	27 / 3	
Injury severity score			Injury severity score			0.4039
Mean ± SD	28.8 ± 2.9	25.1 ± 3.1	Mean ± SD	28.8 ± 2.9	25.1 ± 3.1	
CT grade ^a			CT grade ^a			< 0.0001
Mean ± SD	3.7 ± 0.7	2 ± 0.8	Mean ± SD	3.7 ± 0.7	2 ± 0.8	
Contrast extravasation			Contrast extravasation			0.0005
No. (%) of patients	14 (38)	1 (3)	No. (%) of patients	14 (38)	1 (3)	
Volume of hemoperitoneum ^b			Volume of hemoperitoneum ^b			0.0006
Mean grade ± SD	1.6 ± 0.8	0.8 ± 0.7	Mean grade ± SD	1.6 ± 0.8	0.8 ± 0.7	
Transfusion (units)			Transfusion (units)			0.3024
Mean ± SD	1 ± 1.9	1.7 ± 3.4	Mean ± SD	1 ± 1.9	1.7 ± 3.4	
Treatment failure			Treatment failure			0.3179
No. (%) of patients	1 (2.7)	3 (10)	No. (%) of patients	1 (2.7)	3 (10)	

1 Fallimento NOM+ES Persistenza sanguinamento alla laparotomia

Confronto tra MNO vs MNO+ES

The dark side of the guidelines

TABLE 2. Demographic Characteristics of Embolized Patients, Grade of Splenic Injuries, and Indications for Embolization

Author	Total Patients	Mechanism of Injury	ISS (Mean $\pm$ SD)	Age (Mean $\pm$ SD)	Male (%)	Grade of Splenic Injury (Mean $\pm$ SD)	Contrast Extravasation Beyond or Within Parenchyma or Pseudoaneurysm (%)	Large Hemoperitoneum (%)	Grade of Splenic Injury ≥ 3 (%)
Bessoud et al. ¹⁶	37	Blunt	29 $\pm$ 3	40 $\pm$ 17	76	3.7 $\pm$ 0.7	36	—	100
Cooney et al. ¹⁷	9	Blunt	24 $\pm$ 3	39 $\pm$ 7	67	3.1 $\pm$ 0.4	67	—	100
Davis et al. ¹⁸	20	Blunt	—	—	—	2.8	100	—	—
Dent et al. ¹⁹	13	Blunt	26 $\pm$ 13	41	—	3.7 $\pm$ 0.6	69	—	92
Ekeh et al. ²⁰	15	Blunt	24 $\pm$ 12	36 $\pm$ 21	73	3.5 $\pm$ 0.7	53	47	93
Gaarder et al. ⁸	27	Blunt	31 $\pm$ 12	31	77	3.5 $\pm$ 0.7	51	—	—
Haan et al. ²¹	140	Blunt	20	33	76	3.5	44	83	57
Hagiwara et al. ²²	15	Blunt	33 $\pm$ 11	36	75	4.0 $\pm$ 0.5	100	75	100
Kaseje, et al. ³⁵	11	Blunt	27	33	—	4.4 $\pm$ 0.5	100	—	100
Liu et al. ²³	6	Blunt	—	42	67	3.5 $\pm$ 0.5	—	—	—
Sclafani et al. ²⁴	60	Blunt	18	—	—	—	—	—	—
Smith et al. ²⁵	41	Blunt	—	—	—	—	—	—	—
Wei et al. ²⁶	51	Blunt	29 $\pm$ 11	41	—	—	—	—	—
Widlus et al. ²⁷	13	Blunt	—	—	—	—	—	—	—
Wu et al. ²⁸	21	Blunt	26 $\pm$ 13	41	—	—	—	—	—
Total	479	Blunt	24	—	—	—	—	—	—
p†			0.142						

* Forty-four percent had a contrast extravasation and 33% pseudoaneurysm (not clarified).

† One-way ANOVA for continuous variables, χ^2 test for proportions.

TABLE 1. Studies Included Into the Analysis

Author	Embolized Trauma Patients	Proximal	Distal	Combination	Material	Failure, % (n)	Radiological Follow-up	Major Complications Reported	Minor Complications Reported
Bessoud et al. ¹⁶	37	37	0	0	Coils	2.7 (1)	CT	Yes	Yes
Cooney et al. ¹⁷	9	6	3	0	Coils/gelatin particles	33.3 (3)	—	Yes	No
Davis et al. ¹⁸	20	0	20	0	Coils/polyvinyl alcohol particles	0.0 (0)	—	Yes	No
Dent et al. ¹⁹	13	0	13	0	Coils/polyvinyl alcohol particles	7.7 (1)	—	Yes	No
Ekeh et al. ²⁰	15	10	1	4	Coils/gelatin particles	6.7 (1)	CT	Yes	Yes
Gaarder et al. ⁸	27	21	2	4	Coils/gelatin particles	3.7 (1)	CT	Yes	Yes
Haan et al. ²¹	140	83	48	9	—	12.9 (18)	CT	No	Yes
Hagiwara et al. ²²	15	9	1	5	Coils/gelatin particles	0.0 (0)	CT/scintigraphy	Yes	Yes
Kaseje et al. ³⁵	11	8	3	0	—	18.2 (2)	—	Yes	No
Liu et al. ²³	6	0	6	0	Coil/gelatin particles	16.7 (1)	CT/scintigraphy	Yes	Yes
Sclafani et al. ²⁴	60	58	0	2	Coils/gelatin particles	6.7 (4)	CT	Yes	Yes
Smith et al. ²⁵	41	27	9	5	Coils/gelatin particles	22.0 (9)	CT	Yes	Yes
Wei et al. ²⁶	51	14	37	0	—	2.0 (1)	CT	Yes	Yes
Widlus et al. ²⁷	13	13	0	0	Amplatzer vascular plug	15.4 (2)	CT	Yes	Yes
Wu et al. ²⁸	21	3	16	2	Coils/gelatin particles	23.8 (5)	CT/sonography	Yes	Yes
Total	479	287 (60.1%)	102 (21.3%)	31 (6.5%)		10.2 (49)			

CT, computed tomography.

Schnüriger et al. Journal of Trauma 2011
Systematic Review and metanalysis

TABLE 3. Major Complications

Author	Patients Embolized Proximally	Major Complications Requiring Splenectomy or Splenorrhaphy			Patients Embolized Distally	Major Complications Requiring Splenectomy or Splenorrhaphy		
		Bleeding	Infarction	Infection		Bleeding	Infarction	Infection
Bessoud et al. ¹⁶	37	1	0	0	0	—	—	—
Cooney et al. ¹⁷	6	1	0	0	3	0	2	0
Davis et al. ¹⁸	0	—	—	—	20	0	0	0
Dent et al. ¹⁹	0	—	—	—	13	1	0	0
Ekeh et al. ²⁰	10	0	0	1	1	0	0	0
Gaarder et al. ⁸	21	1	0	0	2	0	0	0
Hagiwara et al. ²²	9	0	0	0	1	0	0	0
Kaseje et al. ³⁵	8	0	0	0	3	2	0	0
Liu et al. ²³	0	—	—	—	6	1	0	0
Scalfani et al. ²⁴	58	1*	1†	2	0	—	—	—
Smith et al. ²⁵	27	6	0	0	9	3	0	0
Wei et al. ²⁶	14	0	0	1	37	0	0	0
Widlus et al. ^{27*}	13	2	0	0	0	—	—	—
Wu et al. ²⁸	3	1	0	0	16	3	1†	0
Total	206	13 (6.3%)	1 (0.5%)	4 (1.9%)	111	10 (9.0%)	3 (2.7%)	0 (0.0%)

* This was a Jehovah's Witness patient who died due to ongoing bleeding after embolization and refusing transfusion and splenectomy.

† Distally dislodged proximal coil that caused a splenic infarct requiring splenectomy.

TABLE 4. Minor Complications not Requiring Splenectomy

Author	Patients Embolized Proximally	Minor Complications After Proximal Embolization			Patients Embolized Distally	Minor Complications After Distal Embolization		
		Bleeding	Infarction	Infection		Bleeding	Infarction	Infection
Bessoud et al. ¹⁶	37	1*	0	0	0	—	—	—
Ekeh et al. ²⁰	10	1	0	0	1	0	1	0
Gaarder et al. ⁸	21	1†	0	0	2	0	0	0
Haan et al. ²¹	83	3†	16	0	48	4†	13	1
Hagiwara et al. ²²	9	0	0	0	1	0	0	0
Liu et al. ²³	0	—	—	—	6	0	0	0
Scalfani et al. ²⁴	58	0	0	0	0	—	—	—
Smith et al. ²⁵	27	0	0	0	9	0	0	0
Wei et al. ²⁶	14	0	0	0	37	1†	0	0
Widlus et al. ²⁷	13	0	0	0	0	—	—	—
Wu S et al. ²⁸	3	0	0	0	16	0	8	0
Total	275	6 (2.2%)	16 (5.8%)	0 (0.0%)	120	5 (4.2%)	22 (18.3%)	1 (0.8%)

* Possibly old hematoma because of initial trauma.

† Treated with reembolization.

Successo Tecnico >90%.

Complicanze maggiori (infarti ed infezioni) (splenectomia). Non differenze significative

Complicanze minori (non splenectomia) più frequenti in distale vs prossimale.

Infarti clinicamente non rilevanti.

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Emergencies in Interventional Radiology

Proximal Versus Distal Splenic Artery Embolisation for Blunt Splenic Trauma: What is the Impact on Splenic Immune Function?

Table 5 IgM Memory B cells as percentage of total B cells in the different groups

Group	Geometric mean (95 % CI) (IgM memory B cells as % of total B cells)	Post-hoc comparisons	Adjusted <i>P</i> value
Control	10.75 (9.58–12.06)	Control versus distal	1.00
Distal	9.97 (6.75–14.75)	Control vs proximal	0.02
Proximal	7.55 (6.11–9.31)	Control versus splenectomy	<0.0001
Splenectomy	2.97 (2.54–3.48)	Distal versus proximal	1.00
		Distal versus splenectomy	<0.0001
		Proximal versus splenectomy	<0.0001

ES preserva funzione splenica vs Splenectomia
Distale sembra mantenere migliore funzione

CVIR 2015

Conclusioni

- Embolizzazione Splenica (ES) rappresenta uno strumento che consente di incrementare il tasso di successo del MNO
- Le linee guida e le recenti evidenze supportano l' utilizzo dell' ES in caso di lesioni di alto grado $>III$ (evidenza maggiore per gradi IV-V), presenza di CB, lesioni vascolari associate (PA e FAV) e sanguinamento attivo.
- Studi Prospettici sono auspicabili per migliorare evidenza di indicazioni e selezione delle caratteristiche dei pazienti da sottoporre ad embolizzazione splenica

Conclusioni

- In assenza di studi prospettici, la scelta della tecnica (Prossimale/Distale) e del materiale embolizzante non è standardizzata e (probabilmente) deve essere selezionata in base alle caratteristiche delle lesioni.
- Le tecniche di embolizzazione Prossimale e Distale non differenziano significative in termini di successo tecnico e complicanze
- Le complicanze delle due tecniche sono sovrapponibili anche se sembra nell' embolizzazione distale vi sia una frequenza maggiore di complicanze minori (ascessi) con impatto clinico non rilevante.
- Ruolo embolizzazione splenica sulla funzione immunitaria da definire

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NON traumatiche



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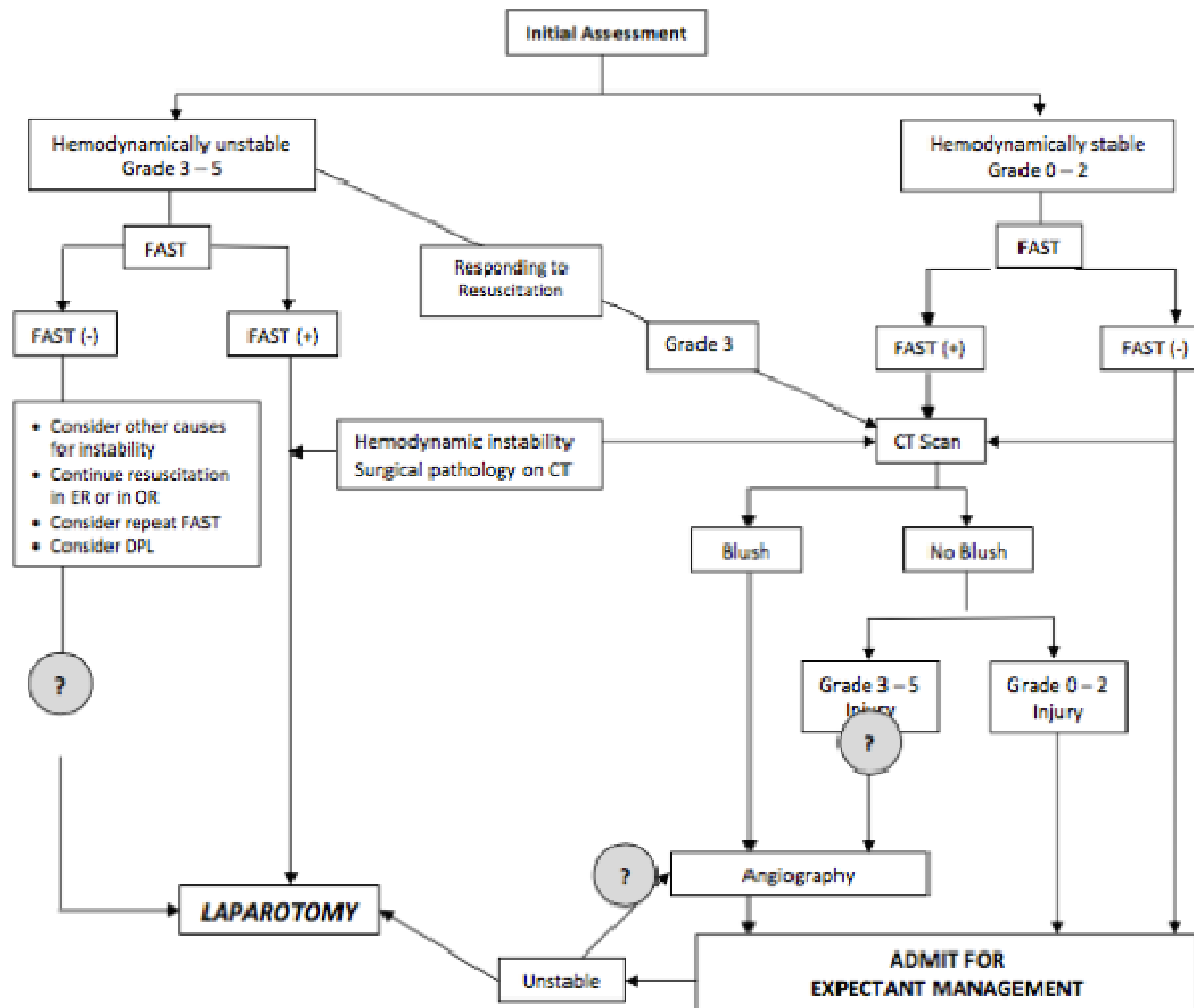
Proximal Splenic Angioembolization Does Not Improve Outcomes in Treating Blunt Splenic Injuries Compared With Splenectomy: A Cohort Analysis

Table 2 Comparison of Outcomes in Group I vs. Group II With Grade of Splenic Injury

	Grade of Splenic Injury					Totals
	Grade I	Grade II	Grade III	Grade IV	Grade V	
Group I (N = 78)	(n = 5)	(n = 7)	(n = 21)	(n = 29)	(n = 16)	78
Average transfusion (PRBC units)	4.4	5	8.2	4.6	3.6	5.1
ARDS	0	0	2 (9.5)*	1 (3.4)	1 (6.2)	4 (5)
Sepsis	0	0	1 (4.7)	1 (3.4)	2 (12.5)	4 (5)
Mortality	0	0	4 (19)	6 (20.6)	4 (25)	14 (18)
Average hospital LOS (d)	8.6	10.8	23.1	17.2	20.7	16.1
Group II (N = 76)	(n = 10)	(n = 16)	(n = 25)	(n = 19)	(n = 6)	76
Avg. transfusion (PRBC units)	4.5	9.6	9.9	11.7	4	7.9
ARDS	1 (10)	3 (18.7)	5 (20)	6 (31.5)	2 (33.3)	17 (22)
Sepsis	0	0	2 (8)	5 (26)	2 (33.3)	9 (12)
Mortality	0	0	5 (20)	4 (21)	2 (33.3)	11 (14)
Average hospital LOS (d)	9.2	12.3	14.1	18.6	16.3	14.1
SAE failure	0	0	6 (24)	10 (52)	6 (100)	22 (28.9)

Outcomes	Group I Low Grade n = 12 (%)	Group II Low Grade n = 26 (%)	p	Group I High Grade n = 66 (%)	Group II High Grade n = 50 (%)	p
ARDS	0	4	0.29	4	13	0.003
Sepsis	0	0	1.0	4	9	0.04
Mortality	0	0	1.0	14	11	0.91

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Fallimento NOM

Management of the Most Severely Injured Spleen

*A Multicenter Study of the Research Consortium of New England
Centers for Trauma (ReCONNECT)*

Velmahos 2010 Arch Surg. 2010;145(5):456-460

2001-08, analisi retrospettiva. 14 trauma center New England; 388 pts trauma grado IV/V Management operativo Vs NOM .
(224 NOM pts) Fallimento: 38% (mortalità x7 dei pazienti con fallimento NOM vs Successo NOM.

30% dei centri coinvolti nel database dell' EAST ha protocolli scritti sulla management e decision making del MNO.

2/3 hanno affermato che seguono generalmente o sempre il protocollo.

EAST protocolli

Delphi study

Peitzman 2005 .

Failure of observation of blunt splenic injury in adults: variability in practice and adverse consequences

Trauma splenico

Incremento Progressivo Trattamento conservativo

Incremento utilizzo Embolizzazione Splenica (ES) in aggiunta al NOM

4. Angiographic embolization is an adjunct in the nonoperative management of the hemodynamically stable patient with hepatic and splenic injuries and evidence of ongoing bleeding.

Successo MNO + ES > 90%

Rajani et al. Improved outcome of adult blunt splenic injury: a cohort analysis. *Surgery* 2006;

Banerjee et al. Trauma center variation in splenic artery embolization and spleen salvage: a multicenter analysis. *J Trauma Acute Care Surg* 2013

Emorragie spleniche

Indicazione al NOM viene posta nel 85% pazienti con trauma chiuso splenico. Tasso di fallimento riportato 8-38%.

Pazienti con contrast blush, pseudoaneurisma grado $\geq$ III sono ritenuti ad alto rischio di fallimento NOM

Management of the Most Severely Injured Spleen

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EAST Practice Management Guidelines Work Group: Survey

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