

**Midnight Journal Club**

**鈍的外傷に対する**

**治療アルゴリズム**

**大阪府済生会千里病院 千里救命救急センター**

**橋高弘忠**

# 本日の論文



## Blunt splenic injury, Emergency Department to discharge: A Western Trauma Association critical decisions algorithm

**David V. Shatz, MD, Marc de Moya, MD, Karen J. Brasel, MPH, MD, Carlos V.R. Brown, MD, Jennifer L. Hartwell, MD, Kenji Inaba, MD, Eric J. Ley, MD, Ernest E. Moore, MD, Kimberly A. Peck, MD, Anne G. Rizzo, MD, Nelson G. Rosen, MD, Jason L. Sperry, MPH, MD, Jordan A. Weinberg, MD, Alexis M. Moren, MD, Raul Coimbra, MD, PhD, and Matthew J. Martin, MD, Sacramento, California**

**J Trauma Acute Care Surg. 2023. 94 (3). 448-454.**

# 背景

- 鈍的脾損傷に対する初期治療は循環動態で決定されることが多い
- 開腹手術→通常の開腹手術に準じた術後管理
- NOM→入院後の管理についての報告が少ない

Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline

J Trauma Acute Care Surg 2012; 73: S294-300

Class I: Prospective randomized studies (no references).

Class II: Prospective, noncomparative studies; retrospective series with controls (19 references).

Class III: Retrospective analyses (case series, databases or registries, and case reviews) (105 references).

**Unanswered questions**

There was not enough literature available to make recommendations regarding the following:

1. Frequency of hemoglobin measurements
2. Frequency of abdominal examinations
3. Intensity and duration of monitoring
4. Is there a transfusion trigger after which operative or angiographic intervention should be considered?
5. Time to reinitiating oral intake
6. The duration and intensity of restricted activity (both in-hospital and after discharge)
7. Optimum length of stay for both the intensive care unit (ICU) and hospital
8. Necessity of repeated imaging
9. Timing of initiating chemical deep venous thrombosis (DVT) prophylaxis after a splenic injury
10. Should patients with severe injuries/or embolized injuries receive postsplenectomy vaccines?
11. Is there an immunologic deficiency after splenic embolization?

経口摂取再開時期

安静期間

画像フォローの必要性

DVT予防の開始時期

・・・etc

検証報告が少ない

# 背景

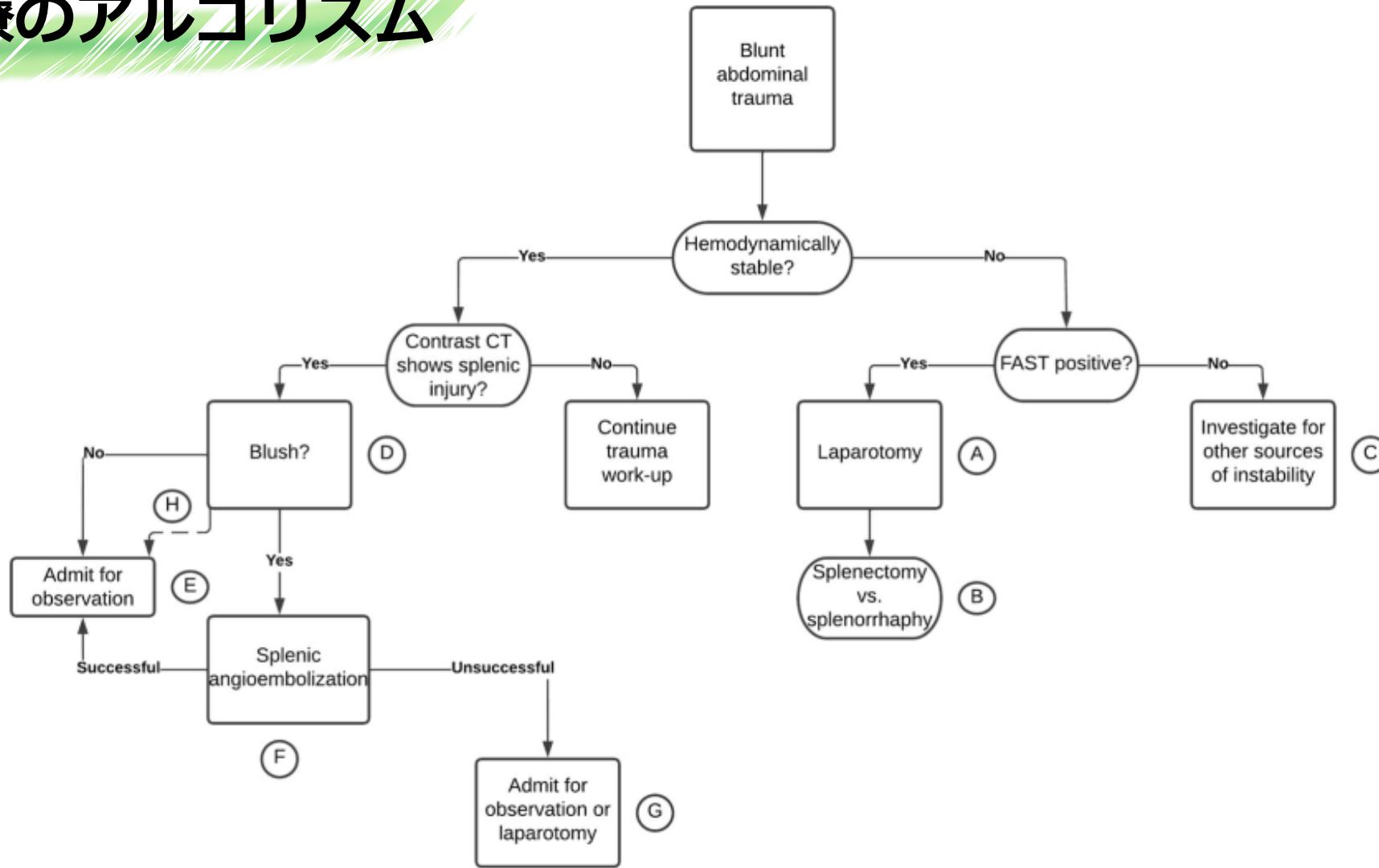
- 本論文は初期診療のみでなく、**入院後治療、退院後フォロー**についても言及した治療ガイド
- Class I に該当する前向きランダム化研究がない
  - **前向きor 後ろ向きコホート研究**および**WTA memberのexpert opinion**を参考に推奨文を決定

# 著者からの前置き

**アルゴリズムに関して賛否あるであろう**

**今回提示するアルゴリズムを大まかな骨組みとして、  
施設毎に応じてより改変することを奨める**

# 初期治療のアルゴリズム



**Figure 1.** Western Trauma Association algorithm for the initial evaluation and management of patients with BSI. Circled letters correspond to sections in the associated article.

# 初期治療のアルゴリズム

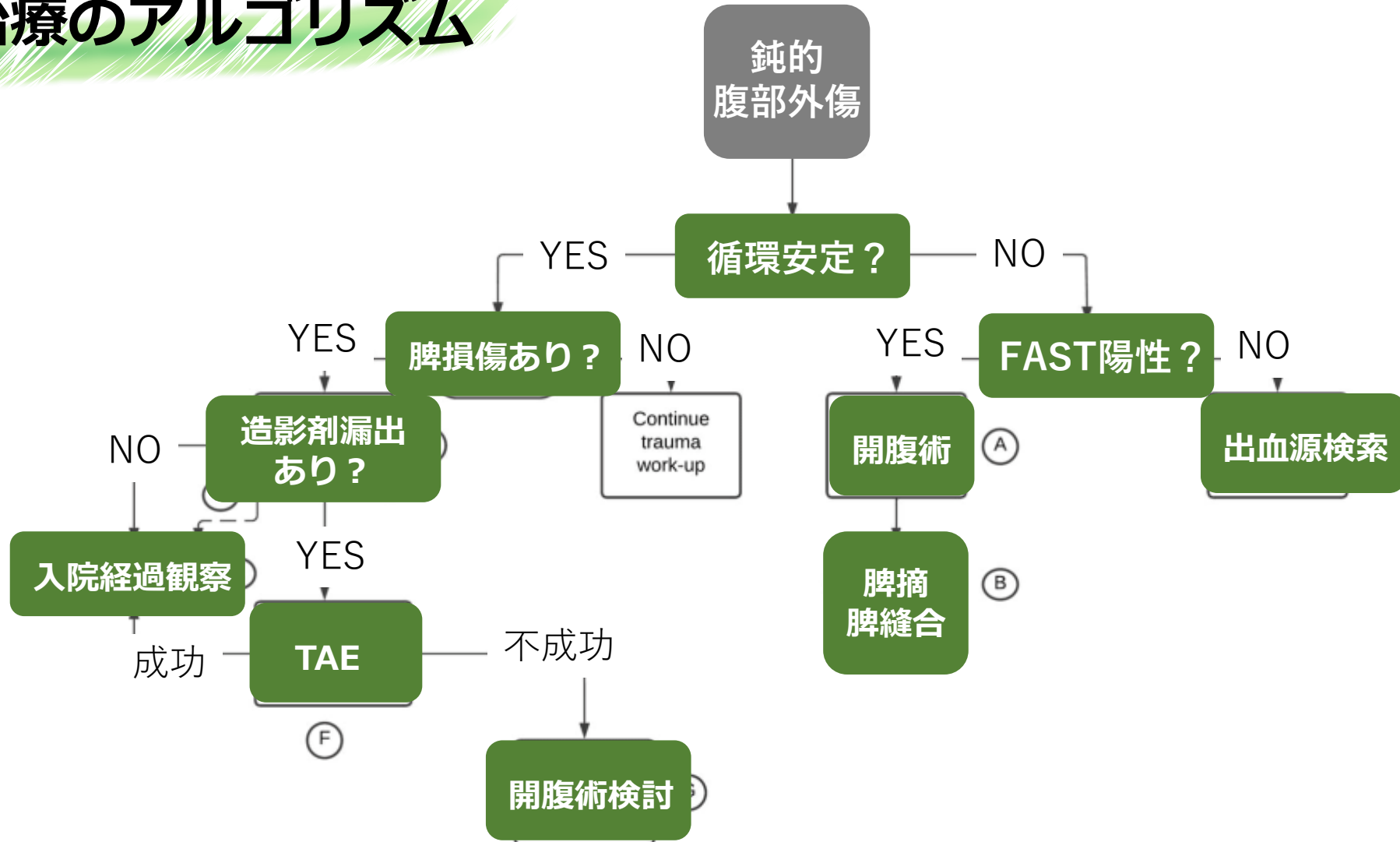


Figure 1. Western Trauma Association algorithm for the initial evaluation and management of patients with BSI. Circled letters correspond to sections in the associated article.



# 入院後の治療ガイドライン

**TABLE 1.** Management Guidelines for Nonoperative BSI Patients in the Days Following Admission

AAST Grade	BSI Management Guideline Nonoperative and Post-SAE	
	Low Grade	High Grade
	I and II	III, IV, and V
ICU	No	Yes—24 hours minimum
Labs (Hemoglobin-Hgb)	Every 2 hours until stable ×2	Every 6 hours until stable ×2
Monitoring	Vital signs every 4 hours	Continuous heart rate and every 2 hour blood pressures
Diet	Clear liquid diet ×12 hours	NPO ×12 hours
DVT prophylaxis	Start within 24 hours in the absence of a major hemorrhagic component	Start within 24–72 hours of stable Hgb
Follow-up CT scan	Clinical change or decrease in Hgb only	3–5 days after injury
Discharge criteria (minimum admission time)	Stable Hgb, 24 hours from injury and tolerating a diet	Stable CT, stable Hgb, 72 hours from injury and tolerating a diet
Return to normal activity	2 weeks (6 weeks for all sports and strenuous activity)	4 weeks (minimum 6 weeks for all sports and strenuous activity based on clinical judgment)

AAST, American Association for the Surgery of Trauma; NPO, not be fed.

Grade <sup>a</sup>	Injury Description	ICD-9	AIS-90
I	Hematoma Subcapsular, <10% surface area	865.01	2
		865.11	
Laceration	Capsular tear, <1 cm parenchymal depth	865.02	2
		865.12	
		865.12	
II	Hematoma Subcapsular, 10–50% surface area; intraparenchymal, <5 cm in diameter	865.01	2
		865.11	
Laceration	1–3 cm parenchymal depth which does not involve a trabecular vessel	865.02	
		865.12	
III	Hematoma Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma Intraparenchymal hematoma >5 cm or expanding		3
Laceration	>3 cm parenchymal depth or involving trabecular vessels	865.03	3
		865.13	
IV	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)		4
V	Laceration Completely shattered spleen	865.04	5
		865.14	
Vascular	Hilar vascular injury which devascularizes spleen		5

<sup>a</sup> Advance one grade for multiple injuries

**TABLE 1. Spleen Organ Injury Scale—2018 Revision**

AAST Grade	AIS Severity	Imaging Criteria (CT findings)	Operative Criteria	Pathologic Criteria
I	2	<ul style="list-style-type: none"> <li>– Subcapsular hematoma &lt;10% surface area</li> <li>– Parenchymal laceration &lt;1 cm depth</li> <li>– Capsular tear</li> </ul>	<ul style="list-style-type: none"> <li>– Subcapsular hematoma &lt;10% surface area</li> <li>– Parenchymal laceration &lt;1 cm depth</li> <li>– Capsular tear</li> </ul>	<ul style="list-style-type: none"> <li>– Subcapsular hematoma &lt;10% surface area</li> <li>– Parenchymal laceration &lt;1 cm depth</li> <li>– Capsular tear</li> </ul>
II	2	<ul style="list-style-type: none"> <li>– Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma &lt;5 cm</li> <li>– Parenchymal laceration 1–3 cm</li> </ul>	<ul style="list-style-type: none"> <li>– Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma &lt;5 cm</li> <li>– Parenchymal laceration 1–3 cm</li> </ul>	<ul style="list-style-type: none"> <li>– Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma &lt;5 cm</li> <li>– Parenchymal laceration 1–3 cm</li> </ul>
III	3	<ul style="list-style-type: none"> <li>– Subcapsular hematoma &gt;50% surface area; ruptured subcapsular or intraparenchymal hematoma ≥5 cm</li> <li>– Parenchymal laceration &gt;3 cm depth</li> </ul>	<ul style="list-style-type: none"> <li>– Subcapsular hematoma &gt;50% surface area or expanding; ruptured subcapsular or intraparenchymal hematoma ≥5 cm</li> <li>– Parenchymal laceration &gt;3 cm depth</li> </ul>	<ul style="list-style-type: none"> <li>– Subcapsular hematoma &gt;50% surface area; ruptured subcapsular or intraparenchymal hematoma ≥5 cm</li> <li>– Parenchymal laceration &gt;3 cm depth</li> </ul>
IV	4	<ul style="list-style-type: none"> <li>– Any injury in the presence of a splenic vascular injury or active bleeding confined within splenic capsule</li> <li>– Parenchymal laceration involving segmental or hilar vessels producing &gt;25% devascularization</li> </ul>	<ul style="list-style-type: none"> <li>– Parenchymal laceration involving segmental or hilar vessels producing &gt;25% devascularization</li> </ul>	<ul style="list-style-type: none"> <li>– Parenchymal laceration involving segmental or hilar vessels producing &gt;25% devascularization</li> </ul>
V	5	<ul style="list-style-type: none"> <li>– Any injury in the presence of splenic vascular injury with active bleeding extending beyond the spleen into the peritoneum</li> <li>– Shattered spleen</li> </ul>	<ul style="list-style-type: none"> <li>– Hilar vascular injury which devascularizes the spleen</li> <li>– Shattered spleen</li> </ul>	<ul style="list-style-type: none"> <li>– Hilar vascular injury which devascularizes the spleen</li> <li>– Shattered spleen</li> </ul>

## CURRENT OPINION

# Organ injury scaling 2018 update: Spleen, liver, and kidney

**Rosemary A. Kozar, MD, PhD, Marie Crandall, MD, Kathirkamanthan Shanmuganathan, MD, Ben L. Zarzaur, MD, Mike Coburn, MD, Chris Cribari, MD, Krista Kaups, MD, Kevin Schuster, MD, Gail T. Tominaga, MD, and the AAST Patient Assessment Committee, Baltimore, Maryland**

# 食事開始時期

保存的加療失敗→緊急開腹術の可能性を考慮

Low grade injury : 入院後12時間は飲水のみ。

(OIS I, II)                      その後食事開始。

High grade injury : 入院12時間は絶飲食。

(OIS III, IV, V)                      再出血がないことを確認後、食事開始。

# CTフォロー

- **被膜化血腫破裂や仮性動脈瘤破裂がNOM失敗の原因**
- **入院後のフォローCTあるいは造影USが推奨されるが、有用性についての検証研究はない**

**A Survey of EAST Member Practices in Blunt Splenic Injury:  
A Description of Current Trends and Opportunities for  
Improvement**

*Paola Fata, MD, FRCSC, Linda Robinson, RN, MS, MA, and Samir M. Fakhry, MD, FACS*

**J Trauma.2005.59(4).836-41.**

**EAST memberへのアンケート調査**

**損傷gradeに関わらずCT followを行う→14.5%のみ**

**残り85.5%は、初回CT所見、損傷grade、経過に応じて判断**

# *Follow-Up Abdominal CT Is not Necessary in Low-Grade Splenic Injury*

JAMES M. HAAN, M.D., F.A.C.S., SHARON BOSWELL, C.R.N.P., DEBORAH STEIN, M.D., M.P.H.,  
THOMAS M. SCALEA, M.D., F.A.C.S.

*From the R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine,  
Baltimore, Maryland*

Am Surg 2007; 73: 13-18

単施設後方視的観察研究

NOMで加療した脾損傷（AAST grade I, IIかつ血管損傷所見がない） 140例

フォローCT 135/140例

仮性動脈瘤 2/135例

いずれもCT前にHct低下あり

**Low grade injury**では臨床経過に変化なければ**フォローCTは不要**

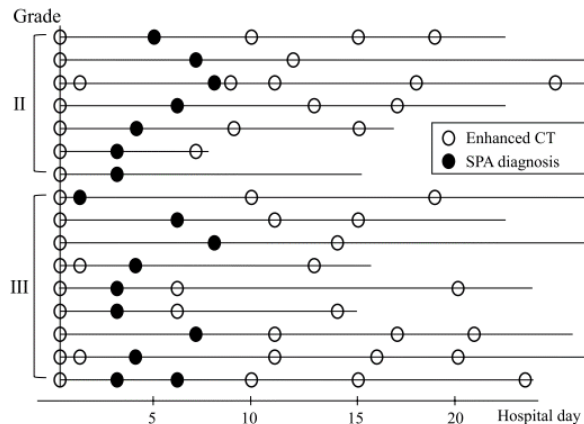
# Delayed formation of splenic pseudoaneurysm following nonoperative management in blunt splenic injury: Multi-institutional study in Osaka, Japan

Takashi Muroya, MD, Hiroshi Ogura, MD, PhD, Kentaro Shimizu, MD, PhD, Osamu Tasaki, MD, PhD, Yasuyuki Kuwagata, MD, PhD, Takashi Fuse, MD, Yasushi Nakamori, MD, PhD, Yusuke Ito, MD, Hiroshi Hino, MD, and Takeshi Shimazu, MD, PhD, Suita, Osaka, Japan

J Trauma Acute Care Surg.2013.75(3).417-20.

**NOMを選択した104例の後方視的観察研究**

**全例が入院中にフォローCT撮像**



**16/104例 (15.4%) (Grade II ; 7、Grade III ; 9) に遅発性仮性動脈瘤**

**入院後 平均4.6日 (range; 1-8) 後の造影CTで検出**

**受傷1週間以内の造影CTが仮性瘤検出に有用**

# 引用文献には含まれていないけども . . .

## Delayed splenic pseudoaneurysm identification with surveillance imaging

Taylor E. Wallen, MD, Katherine Clark, RN, BSN, Matthew R. Baucom, MD, Rebecca Pabst, RN, BSN, Jennifer Lemmink, RN, MSN, Timothy A. Pritts, MD, PhD, Amy T. Makley, MD, and Michael D. Goodman, MD, Cincinnati, Ohio

2018-2020年 鈍的脾損傷の後方視的観察研究 J Trauma Acute Care Surg 2022; 93: 113-117

TABLE 2. Description of BSI Management by Grade

Grade of Splenic Injury	Total (n)
Grades I and II	297
Grade III	123
Grade IV	61
Grade V	58
Total	539

Grade III以上ではほぼ全例フォローCT⇒16.2%に仮性動脈瘤  
入院-フォローCT : 5±4.4 days



# CTフォロー

TABLE 1. Management Guidelines for Nonoperative BSI Patients in the Days Following Admission

AAST Grade	BSI Management Guideline Nonoperative and Post-SAE	
	Low Grade	High Grade
	I and II	III, IV, and V
Follow-up CT scan	Clinical change or decrease in Hgb only	3–5 days after injury

**Grade I, II**

**→ 臨床的に変化がなければ不要**

**Grade III, IV, V**

**→ 受傷3-5日目に撮像**

# 薬物的DVT予防

Open access

Guidelines/Algorithms

Trauma Surgery  
& Acute Care Open

Venous thromboembolism prophylaxis in the trauma intensive care unit: an American Association for the Surgery of Trauma Critical Care Committee Clinical Consensus Document

Trauma Surg Acute Care Open 2021; 6: e000643

## SOLID ORGAN INJURY

What timing and agent is appropriate for VTE prophylaxis after blunt solid organ injury?

Recommendation

In patients with blunt solid organ injury (SOI) undergoing non-operative management, VTE prophylaxis with LMWH should be initiated within 48 hours from time of injury in the absence of ongoing bleeding or other contraindications.

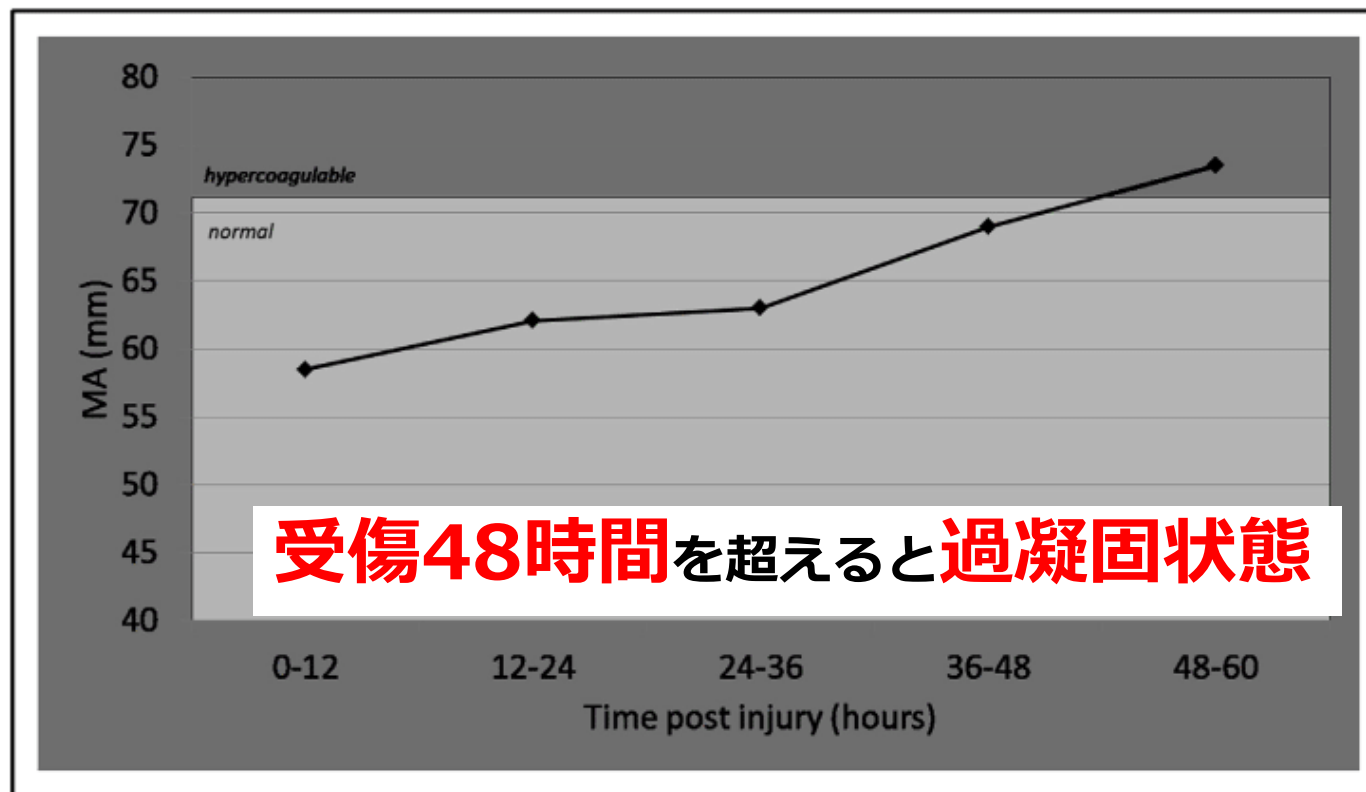
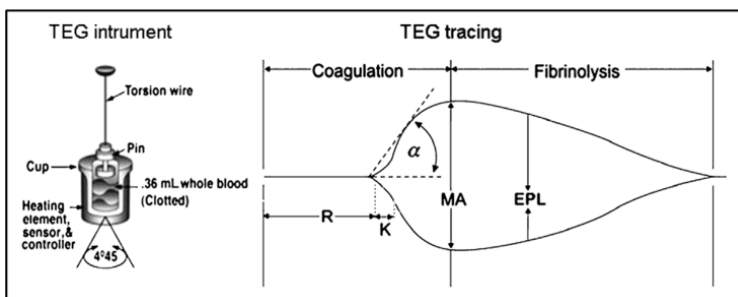
腹部実質臓器損傷に対するNOM症例では  
**受傷から48時間以内**にLMWHによる  
**VTE予防を開始**

Southwestern Surgical Congress

## Hypercoagulability following blunt solid abdominal organ injury: when to initiate anticoagulation

Am J Surg 2013; 206: 917-922;

### -TEGを用いた腹部実質臓器損傷後の凝固状態の検証-



ORIGINAL ARTICLE

Timing of thromboprophylaxis in patients with blunt abdominal solid organ injuries undergoing nonoperative management

## 腹部実質臓器鈍的損傷に対してNOM施行した3223例の後方視的観察研究

(頭部外傷、骨盤骨折、脊髄損傷、腹部以外の領域にAIS $\geq$ 3の外傷合併は除く)

### 抗凝固薬開始時期により

Early群 ; 48hr以内

Immediate群 ; 48-72hr

Late群 ; 72hr以降

VTE発症率、出血について比較

## VTEの比較

TABLE 3. Results of Univariate and Multivariate Analysis for VTE

Variables	Univariate		Multivariate	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
TP				
Early	Reference		Reference	
Intermediate	1.58 (0.87–2.85)	0.130	1.67 (0.91–3.06)	0.098
Late	3.91 (2.42–6.29)	<0.001	3.38 (2.05–5.56)	<0.001

## 出血の比較

TABLE 4. Risk Factors Associated With Any Bleeding Events After NOM

Variables	Univariate		Multivariate	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
TP				
Early	1.76 (0.96–3.22)	0.068	2.05 (1.11–2.18)	0.023
Intermediate	0.98 (0.45–2.13)	0.956	0.99 (0.45–3.81)	0.986
Late	Reference		Reference	

**Late群**ではEarly群の**3倍**のVTE発症

**Early群**ではLate群の**2倍**の出血イベント

# 薬物的DVT予防

TABLE 1. Management Guidelines for Nonoperative BSI Patients in the Days Following Admission

AAST Grade	BSI Management Guideline Nonoperative and Post-SAE	
	Low Grade	High Grade
	I and II	III, IV, and V
DVT prophylaxis	Start within 24 hours in the absence of a major hemorrhagic component	Start within 24–72 hours of stable Hgb

**Grade I , II**

**→出血がなければ24hr以内に開始**

**Grade III, IV, V**

**→Hb低下なければ24-72hrに開始**

# 退院基準

**退院に伴う遅発性出血のリスク**を考慮しながら決定すべき



退院後の安静度制限が遵守できるかも判断基準の一つ

至適入院期間についての文献的根拠は乏しい

# Early discharge after nonoperative management for splenic injuries: increased patient risk caused by late failure?

**Surgery.2007.142(3).337-42.**

**NOM failure 36/499 (7%)**

**Table II.** Comparison between early and late failures

	<i>Age &gt;65 years</i>	<i>Hematocrit upon admission</i>	<i>Grade of splenic injury on CT</i>	<i>ISS</i>	<i>Preoperative blood transfusion &gt;2 units</i>	<i>Hospital stay after operation (days)</i>
EF (n = 26)	11 (42%)	36 ± 5	3.8 ± 1	29 ± 12	8 (32%)	20 ± 22
LF (n = 10)	1 (10%)	37 ± 6	3.5 ± 1	24 ± 10	6 (60%)	18 ± 26
<i>P-value</i>	.07	.86	.31	.28	.13	.82

EF ; 入院3日以内にOP 26例 (5%)

LF ; 入院4日以降にOP 10例 (2%) うち9例は入院中

他損傷のため入院が必要でない限り、**3日を超えての入院経過観察は不要**





# 安静度制限

退院後、再入院・脾摘を要したのは自宅退院した症例の1.4%

JTrauma. 2009;66(6):1531-1538.

 簡単な家事、オフィスワーク、軽い有酸素運動

**Table 2** Return to **Light Activity** Recommendations

Percent Response By Injury Grade

Recommendation	I-II	III	IV-V
No instruction	2.5	1.6	2.7
Immediate	9.3	2.1	1.3
<2 weeks	53.1	29.6	22.4
4-6 weeks	30.22	50.8	48
2 months	3.7	8.9	10.4
>3 months	1.1	6.9	15

J Trauma.2005.59(4).836-41.

# 安静度制限

退院後、再入院・脾摘を要したのは自宅退院した症例の1.4%

JTrauma. 2009;66(6):1531-1538.

 ランニング、20ポンド以上の重量物を持ち上げる、建築作業

**Table 3** Return to **Strenuous Activity**  
Recommendations

Recommendation	Percent Response By Injury Grade		
	I-II	III	IV-V
No instruction	1.6	1	3.6
<4 weeks	74	48.6	35.2
2 months	22.3	42.7	44.3
>3 months	1.8	7.5	16.9

J Trauma.2005.59(4).836-41.

# 安静度制限

退院後、再入院・脾摘を要したのは自宅退院した症例の1.4%

JTrauma. 2009;66(6):1531-1538.



コンタクトスポーツを含む

**Table 4** Return to **Full Activity** Recommendations

Percent Response By Injury Grade

Recommendation	I-II	III	IV-V
No instructions	1.9	1.6	3.7
<6 weeks	37.6	19.8	14.6
2-3 months	39.3	56.04	45.8
4-6 months	19.66	19.2	31
>6 months	1.5	3.3	4.87

# 安静度制限

TABLE 1. Management Guidelines for Nonoperative BSI Patients in the Days Following Admission

AAST Grade	BSI Management Guideline Nonoperative and Post-SAE	
	Low Grade	High Grade
	I and II	III, IV, and V
Return to normal activity	2 weeks (6 weeks for all sports and strenuous activity)	4 weeks (minimum 6 weeks for all sports and strenuous activity based on clinical judgment)

**Grade I, II**

**→ 2週間安静**

**スポーツ・激しい活動は6週間**

**Grade III, IV, V**

**→ 4週間安静**

**スポーツ・激しい活動は6週間以上**

# MY OPINIION

- ✓ 鈍的脾損傷に対するNOMの入院管理については不透明な部分が多い
- ✓ 引用文献のevidence levelも低いものばかり
- ✓ 実臨床における一つの指標として参考にしても良さそう