When is it safe to start VTE prophylaxis after blunt solid organ injury?

A prospective study from a Level I Trauma center

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ORIGINAL SCIENTIFIC REPORT

When is It Safe to Start VTE Prophylaxis After Blunt Solid Organ Injury? A Prospective Study from a Level I Trauma Center

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01

Introduction

Initial evaluation of blunt trauma injury

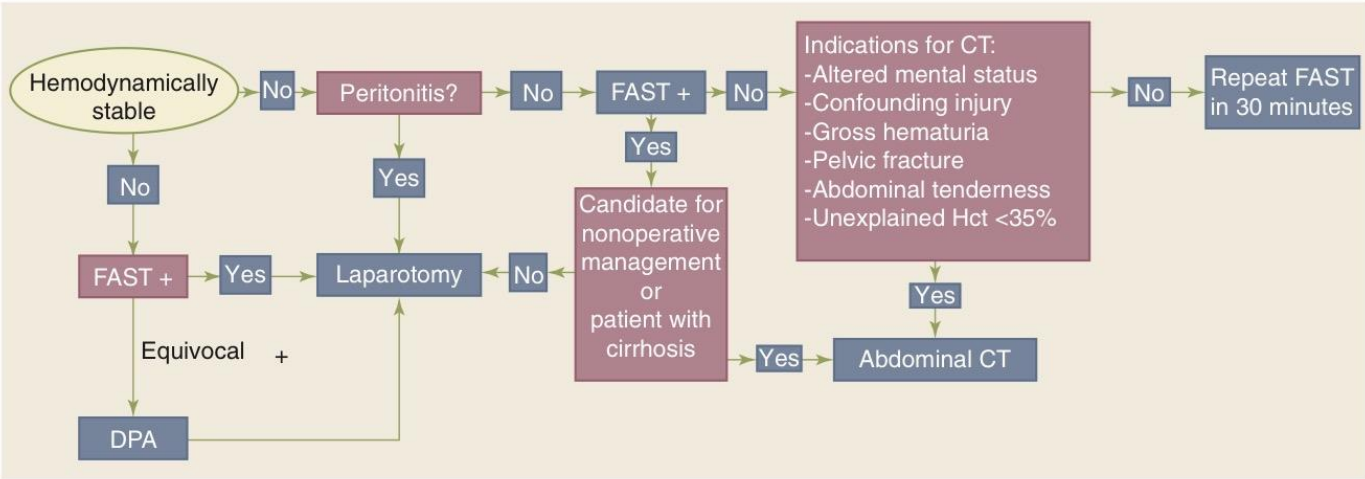


Figure 7-26. Algorithm for the initial evaluation of a patient with suspected blunt abdominal trauma. CT = computed tomography; DPA = diagnostic peritoneal aspiration; FAST = focused abdominal sonography for trauma; Hct = hematocrit.

Schwartz's Principles of Surgery

Introduction

Timing of venous thromboembolism prophylaxis initiation in patients who have blunt intra-abdominal solid organ injuries (liver, spleen, kidney) which are frequently managed non-operative and therefore carry risk of bleeding remains controversial

The optimal timing for VTE prophylaxis initiation among patients with blunt solid organ injury is not well defined by the current literature, although a small number of retrospective studies suggest that initiation within 48 hr may be safe.

Primary objective

Prospectively determine the optimal timing of VTE prophylaxis initiation among patients with blunt solid organ injury managed nonoperatively

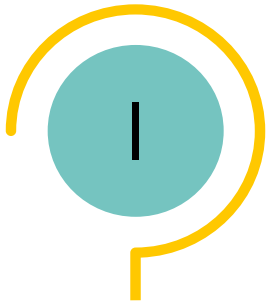
Hypothesis

Initiation within 48 hr would result in a lower rate of VTE without an increased risk of bleeding or failure of nonoperative management

Clinical question

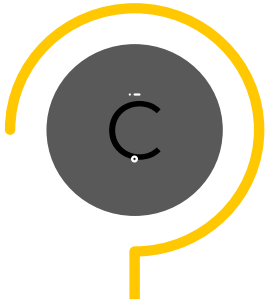
Patients

>15years
Blunt Trauma patients
Solid Organ injury



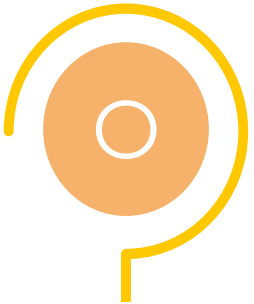
Intervention

Early
VTEs prophylaxis
(=< 48 hr)



Comparator

Late
VTE prophylaxis
(> 48 hr)



Outcomes

- Primary
  - VTE : DVT PE
- Secondary
  - LOS, ICU LOS

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Materials & Methods

Inclusion and Exclusion criteria

- Total patient = 118 divided into 2 groups
- Single-center prospective observational study
- Dichotomized into study groups based on VTE prophylaxis initiation time:
    - Early (Before 48 h) vs Late (48 h after admission)

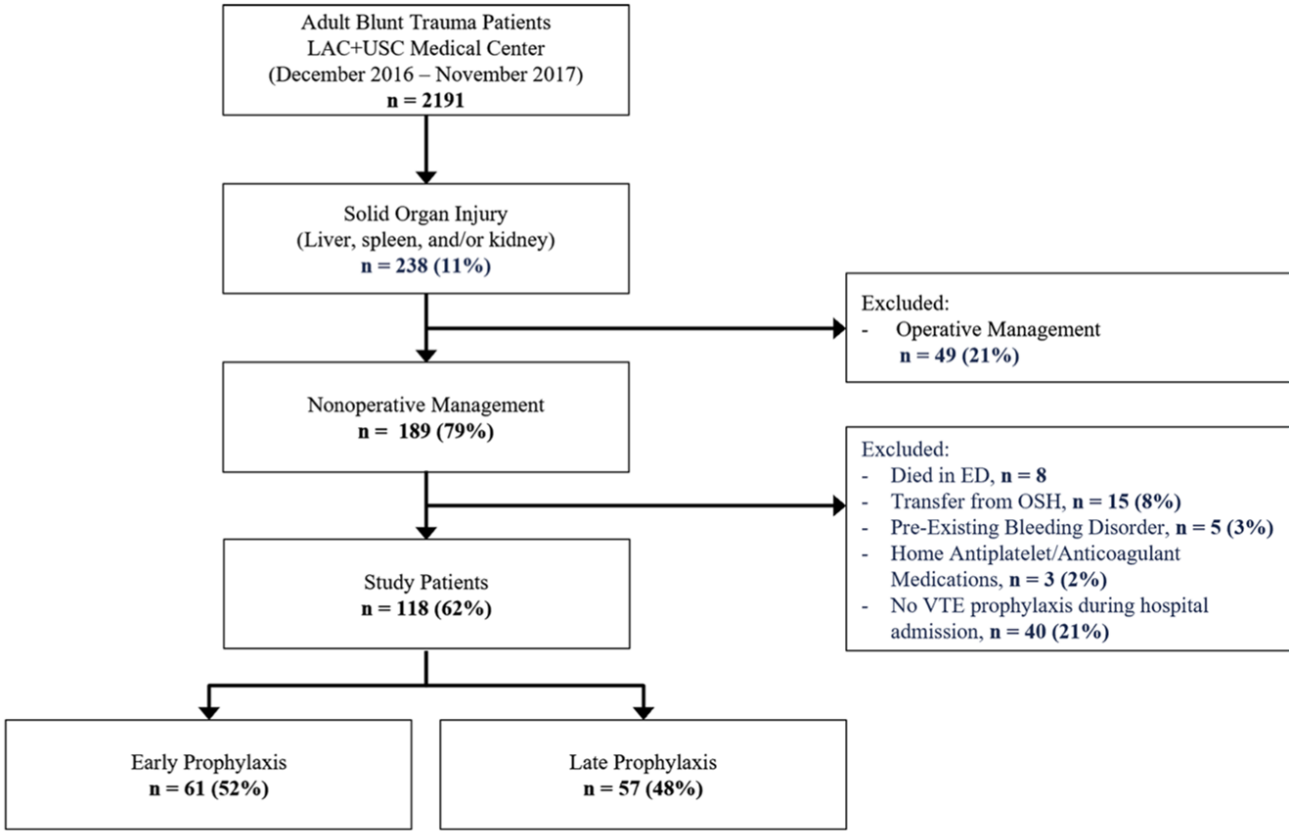
Inclusion Criteria

- All adult (>15years)
- Blunt Trauma patients
- Solid Organ injury (liver,spleen,kidney) managed nonoperatively
- LAC+USC medical center between December 1,2016 and November 30,2017

Exclusion Criteria

- Transferred from an outside hospital, died in the emergency department (ED)
- had a pre-existing bleeding disorder
- on home anticoagulant or antiplatelet medication
- No VTEs prophylaxis during hospital administration

Flow chart of the Trial



Outcomes

Primary Outcomes

- VTE event rate
- deep vein thrombosis (DVT)
  - Symptomatic patients with DVT were diagnosed with duplex ultrasonography
- pulmonary embolism (PE)
  - diagnosed with computed tomographic pulmonary angiography (CTPA)

Secondary Outcomes

- hospital length of stay (LOS)
- intensive care unit (ICU) LOS,
- need for and volume of post-prophylaxis blood transfusion
- need for delayed (post- prophylaxis) interventional radiology (IR) or operative intervention
- failure of nonoperative management

All patients without contraindication [e.g., lower extremity fracture] received sequential compression devices to bilateral lower extremities until ambulation.

03

Appraisal

04

Result

Patient demographic data and clinical data

Table 1 Patient demographics, clinical data, and injury data

	All patients (n = 118)	Early prophylaxis (n = 61, 52%)	Late prophylaxis (n = 57, 48%)	p
Demographics				
Age, years	36 [27–55]	36 [27–54]	36 [27–56]	0.631
Male	78 (66%)	39 (64%)	39 (68%)	0.698
Clinical data on admission				
SBP, mmHg	127 [112–146]	126 [105–144]	129 [115–149]	0.250
SBP < 90 mmHg	13 (11%)	8 (13%)	5 (9%)	0.561
HR, bpm	96 [79–108]	95 [79–107]	97 [79–113]	0.465
HR > 120 bpm	17 (14%)	5 (8%)	12 (21%)	0.066
GCS	15 [14–15]	15 [14–15]	14 [13–15]	0.009
Injury severity				
ISS	22 [14–26]	17 [14–22]	22 [17–27]	0.002
AIS head/neck	0 [0–2]	0 [0–0]	0 [0–3]	0.368
AIS face	0 [0–0]	0 [0–0]	0 [0–0]	0.395
AIS chest	2 [0–3]	3 [1–3]	2 [2–3]	0.522
AIS abdomen/pelvis	3 [2–3]	3 [2–3]	2 [2–3]	0.920
AIS extremities	2 [0–2]	2 [0–2]	2 [0–2]	0.101
AIS external	1 [0–1]	1 [0–1]	1 [0–1]	0.689
Solid organ injury				
Liver	57 (48%)	31 (51%)	26 (46%)	0.586
Spleen	43 (36%)	22 (36%)	21 (37%)	1.000
Kidney	34 (29%)	17 (28%)	17 (30%)	0.841
>1 Solid organ injury	19 (16%)	12 (20%)	7 (12%)	0.323
Associated injuries				
TBI	23 (19%)	5 (8%)	18 (32%)	0.002
Pelvic fracture	42 (36%)	22 (36%)	20 (35%)	1.000
LE fracture	26 (22%)	9 (15%)	17 (30%)	0.074
Need for angioembolization	22 (19%)	10 (16%)	12 (21%)	0.637

ASST grade of solid organ injury

Table 2 AAST grade of solid organ injuries

	All patients	Early prophylaxis	Late prophylaxis	*p*
Liver	57 (48%)	31 (51%)	26 (46%)	0.586
Median	2 [2–3]	2 [2–3]	2 [2–3]	0.955
I	11 (19%)	7 (23%)	4 (15%)	
II	23 (40%)	13 (42%)	10 (38%)	
III	14 (25%)	6 (19%)	8 (31%)	
IV	5 (9%)	5 (16%)	0 (0%)	
V	4 (7%)	0 (0%)	4 (15%)	
Spleen	43 (36%)	22 (36%)	21 (37%)	1.000
Median	2 [1–3]	2 [2–3]	2 [1–2]	0.089
I	7 (16%)	2 (9%)	5 (24%)	
II	22 (51%)	12 (55%)	10 (48%)	
III	11 (26%)	7 (32%)	4 (19%)	
IV	2 (5%)	0 (0%)	2 (9%)	
V	1 (2%)	1 (5%)	0 (0%)	
Kidney	34 (29%)	17 (28%)	17 (30%)	0.841
Median	3 [2–3]	2 [1–3]	3 [3–3]	0.150
I	7 (21%)	4 (24%)	3 (18%)	
II	6 (18%)	5 (29%)	1 (6%)	
III	13 (38%)	4 (24%)	9 (53%)	
IV	7 (21%)	4 (24%)	3 (18%)	
V	1 (3%)	0 (0%)	1 (6%)	

AAST grading

Liver Injury Scale

Grade*		Description	AIS-90
I	Hematoma	Subcapsular, <10% surface area	2
	Laceration	Capsular tear, <1 cm parenchymal depth	2
II	Hematoma	Subcapsular, 10-50% surface area	2
		Intraparenchymal, <10 cm in diameter	2
	Laceration	Capsular tear, 1-3 cm parenchymal depth, <10 cm length	2
III	Hematoma	Subcapsular, >50% surface area or expanding	3
		Ruptured subcapsular or parenchymal hematoma	3
		Intraparenchymal hematoma >10 cm or expanding	3
	Laceration	>3 cm parenchymal depth	3
IV	Laceration	Parenchymal disruption involving 25-75% of hepatic lobe or 1-3 Couinaud's segments within a single lobe	4
V	Laceration	Parenchymal disruption involving >75% of hepatic lobe or >3 Couinaud's segments within single lobe	5
	Vascular	Juxtahepatic venous injuries; i.e., retrohepatic vena cava/central major hepatic veins	5
	Vascular	Hepatic avulsion	6

* Advance one grade for multiple injuries up to grade III

AAST grading

Spleen Injury Scale

Grade*		Description	AIS-90
I	Hematoma	Subcapsular, <10% surface area	2
	Laceration	Capsular tear, <1 cm parenchymal depth	2
II	Hematoma	Subcapsular, 10-50% surface area	2
		Intraparenchymal, <5 cm in diameter	2
	Laceration	Capsular tear, 1-3 cm parenchymal depth which does not involve a trabecular vessel	2
III	Hematoma	Subcapsular, >50% surface area or expanding	3
		Ruptured subcapsular or parenchymal hematoma	3
		Intraparenchymal hematoma >5 cm or expanding	3
	Laceration	>3 cm parenchymal depth or involving trabecular vessels	3
IV	Laceration	Laceration involving segemental or hilar vessels producing major devascularization (>25% of spleen)	4
V	Laceration	Completely shattered spleen	5
	Vascular	Hilar vascular injury which devascularizes spleen	5

* Advance one grade for multiple injuries up to grade III

AAST grading

Kidney Injury Scale

Grade*		Description	AIS-90
I	Contusion	Microscopic or gross hematuria	2
	Hematoma	Subcapsular, nonexpanding without parenchymal laceration	2
II	Hematoma	Nonexpanding perirenal hematoma confined to renal retroperitoneum	2
	Laceration	<1 cm parenchymal depth of renal cortex without urinary extravasation	2
III	Laceration	<1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation	3
IV	Laceration	Parenchymal laceration extending through the renal cortex, medulla, and collecting system	4
	Vascular	Main renal artery or vein injury with contained hemorrhage	4
V	Laceration	Completely shattered kidney	5
	Vascular	Avulsion of renal hilum which devascularizes kidney	5

* Advance one grade for multiple injuries up to grade III

Primary and secondary Outcomes

Table 3 Univariate analysis of outcomes

	All patients (n = 118)	Early prophylaxis (n = 61, 52%)	Late prophylaxis (n = 57, 48%)	p
VTE*	8 (7%)	2 (3%)	6 (11%)	0.153
DVT*	5 (4%)	0 (0%)	5 (9%)	0.024
PE*	5 (4%)	2 (3%)	3 (5%)	0.672
Hospital LOS	9 [5–21]	6 [4–11]	14 [7–35]	<0.001
Need for ICU admission	104 (88%)	52 (85%)	52 (91%)	0.398
ICU LOS	4 [3–9]	3 [2–6]	7 [4–12]	<0.001
Mortality	3 (3%)	2 (3%)	1 (2%)	1.000
Need for post-prophylaxis transfusion	31 (26%)	13 (21%)	18 (31%)	0.058
Volume of post-prophylaxis transfusion	0 [0–0]	0 [0–0]	0 [0–0]	0.180

Continuous variables presented as median [interquartile range] and compared using the Mann–Whitney U test. Categorical variables presented as

Independent factor of late VTE prophylaxis

Table 4 Multivariate analysis of risk factors for late (>48 h) initiation of VTE prophylaxis

	Univariate OR	Adjusted OR	95% CI	*p*
Pelvic fracture	1.04	1.45	0.55–3.82	0.456
TBI	0.19	0.22	0.07–0.74	0.015
Gender (male)	1.22	1.35	0.50–3.63	0.554
Lower extremity fracture	0.41	0.36	0.12–1.05	0.063
ICU LOS	0.93	0.95	0.89–1.00	0.071
ISS	0.93	0.96	0.90–1.03	0.260

Logistic regression. *VTE* venous thromboembolism, *TBI* traumatic brain injury, *ICU* intensive care unit, *LOS* length of stay, *ISS* injury severity score, *OR* odds ratio, *CI* confidence interval

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Discussion

DISCUSSION

Initiation of VTE prophylaxis within 48 h of admission

- a significantly lower rate of DVT among blunt trauma patients with solid organ injury
- without increasing the need for post-prophylaxis transfusion or failure rates of nonoperative management
- no patient required operative intervention or angioembolization for bleeding after initiation of prophylaxis

DISCUSSION

Potential Cofounder

- The presence of TBI was independently associated with late initiation of VTE prophylaxis

- withhold prophylaxis for a period of time after an interval CT scan of the head demonstrates stability of the intracranial bleeding

Limitation

1. Single-center study : limit study size and event detection rate >> possible to have been underpowered and type II error
2. Do not routinely screen for DVTs
3. Capture fews patients with grade IV-V injuries, reflecting an increase for operative management
4. Not capture missed dose of VTE prophylaxis
5. Captured only VTEs that were diagnosed in hospital
6. Selection bias by trauma surgeon : injury at low risks of bleeding were initiated on prophylaxis earlier

“

War is the only proper School of the surgeon

-Hippocrates

Question and Comments