

The Evaluation of Pediatric Blunt Abdominal Trauma

Eastern Association for the Surgery of
Trauma

January 17, 2013

Sang-Woo Pak, MD

This work was supported by the pediatric ad hoc committee of
EAST in conjunction with the pediatric trauma society.

Committee

Kathryn Bass

Bracken Burns

Ritha Belzaire

Becky Cook

Michelle Caruso

James Cain

Peter Ehrlich

Philip Ewing

Richard Falcone

David Gourlay

Elliot Haut

David Juang

Nathaniel Kreykes

Stan Kurek

Karen Lidsky

Robert Letton

Vivian Lane

Mark MacEachern

Katy Mandeville

Shannon Manzi

Michael Myer

Chet A. Morrison

David Mooney

Bindi Naik-mathuria

John Petty

Toni Petrillo

Elizabeth Renaud

Stancie Rhodes

Dylan Stewart

Wolfgang Stehr

Chris Streck

Ginger Wilkins

Chad Wallis

Susan Ziegfeld

Disclosure

- None

Introduction

- Blunt abdominal trauma (BAT) is different in children than in adults
 - Physiology
 - Age range
 - Risks associated with radiation exposure
- Evaluation of pediatric BAT (pBAT) is not clearly defined

Evaluation Modalities

- CT is the gold standard for solid organ injury
- Other:
 - Ultrasound
 - Labs
 - Exam

Questions

- In the evaluation of pBAT, when can CT safely be avoided?
- Not asked:
 - Criteria for transfer
 - Management of pBAT

PICO

- In pBAT, are the following diagnostic tools useful in identifying intraabdominal injuries (IAI) and limiting the use of CT:
 - Ultrasound
 - Labs (ALT/AST, hematuria)
 - Physical exam
- Other outcomes considered included:
 - Radiation exposure
 - Cost

Methodology

- Literature search
 - 900 papers identified and screened by title
 - 450 papers screened by abstract
 - 280 papers reviewed
 - 136 papers accepted
- Reviews at every stage conducted by at least 2 reviewers
- Papers cleared to next stage if “approved” by at least 1 reviewer

In pBAT, is U/S useful for identifying IAI and avoiding CT?

# Studies	Design	Bias	Inconsistency	Indirectness	Imprecision	Other
42	Retrospective	Serious	Yes	No	Yes	No

- Level of evidence: low

Literature U/S

Author	Year	N	Sens Spec	PPV NPV
Emery	2001	160	45 88	59 81
Fox	2011	357	52 96	48 97
Holmes	2001	224	82 95	73 97
Partrick	1998	230	71 100	-
Richards	2002	744	56 97	82 91
Soudack	2004	313	93 97	-
Suthers	2004	120	70 100	100 92

In pBAT, is U/S useful for identifying IAI and avoiding CT?

# Studies	Design	Bias	Inconsistency	Indirectness	Imprecision	Other
42	Retrospective	Serious	Yes	No	Yes	No

- Recommendation: In pBAT, U/S can be useful for identifying IAI
- Strength of recommendation: Weak

In pBAT, are labs useful for identifying IAI and avoiding CT?

# Studies	Design	Bias	Inconsistency	Indirectness	Imprecision	Other
35	Retrospective	Serious	Yes	Yes	Yes	No

- Level of evidence: low
- Higher quality with ALT/AST, hematuria
- Lower quality with amylase, hematocrit

Literature ALT/AST

Author	Year	N	ALT AST	Sens Spec	PPV NPV	Method
Haftel	1988	90	45 65	24 79	40 64	Std
Holmes	2002	1095	125 200	50 96	54 95	Literature
Capraro	2006	382	ALT 30 AST 40	52 71 63 48	48 75 38 71	Std
Bevan	2009	116	ALT 104	96 80	79 96	ROC
Karam	2009	147	ALT 25 AST 60	48 85 61 76	47 86 40 88	ROC

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Karam	2009	147	ALT 25	48 85	47 86	ROC
			AST 60	61 76	40 88	

Literature Hematuria

Author	Year	N	Cut-offs	Sens Spec	PPV NPV
Haftel	1988	90	Gross	30 98	91 71
Taylor	1990	375	Gross	-	OR 5.8
Capraro	2006	382	+ Heme	52 50	36 66
Holmes	2002	1095	>5 RBC/hpf	50 89	32 94
Karam	2009	147	# RBC	-	-

In pBAT, are labs useful for identifying IAI and avoiding CT?

# Studies	Design	Bias	Inconsistency	Indirectness	Imprecision	Other
35	Retrospective	Serious	Yes	Yes	Yes	No

- Recommendation: In pBAT, labs can be useful for identifying IAI
- Strength of recommendation: weak

In pBAT, is physical exam useful for identifying IAI and avoiding CT?

# Studies	Design	Bias	Inconsistency	Indirectness	Imprecision	Other
61	Retrospective	Serious	Yes	Yes	Yes	No

Level of evidence: moderate

Literature Physical Exam

Author	Year	N	S/Sx	Sens Spec	PPV NPV
Jerby	1997	32	Seatbelt mark	21	-
Kurkchubasche	1997	22	Ab pain or tenderness	89	-
Holmes	2002	1095	Tenderness	58 71	18 94
Lutz	2004	148K	Ab wall bruising	73.5 98.8	11.5 99.9
Miller	2006	50	Abnl exam	100 39	34 100
Karam	2009	147	Pain	94 31	27 95

Literature Physical Exam

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In pBAT, is physical exam useful for identifying IAI and avoiding CT?

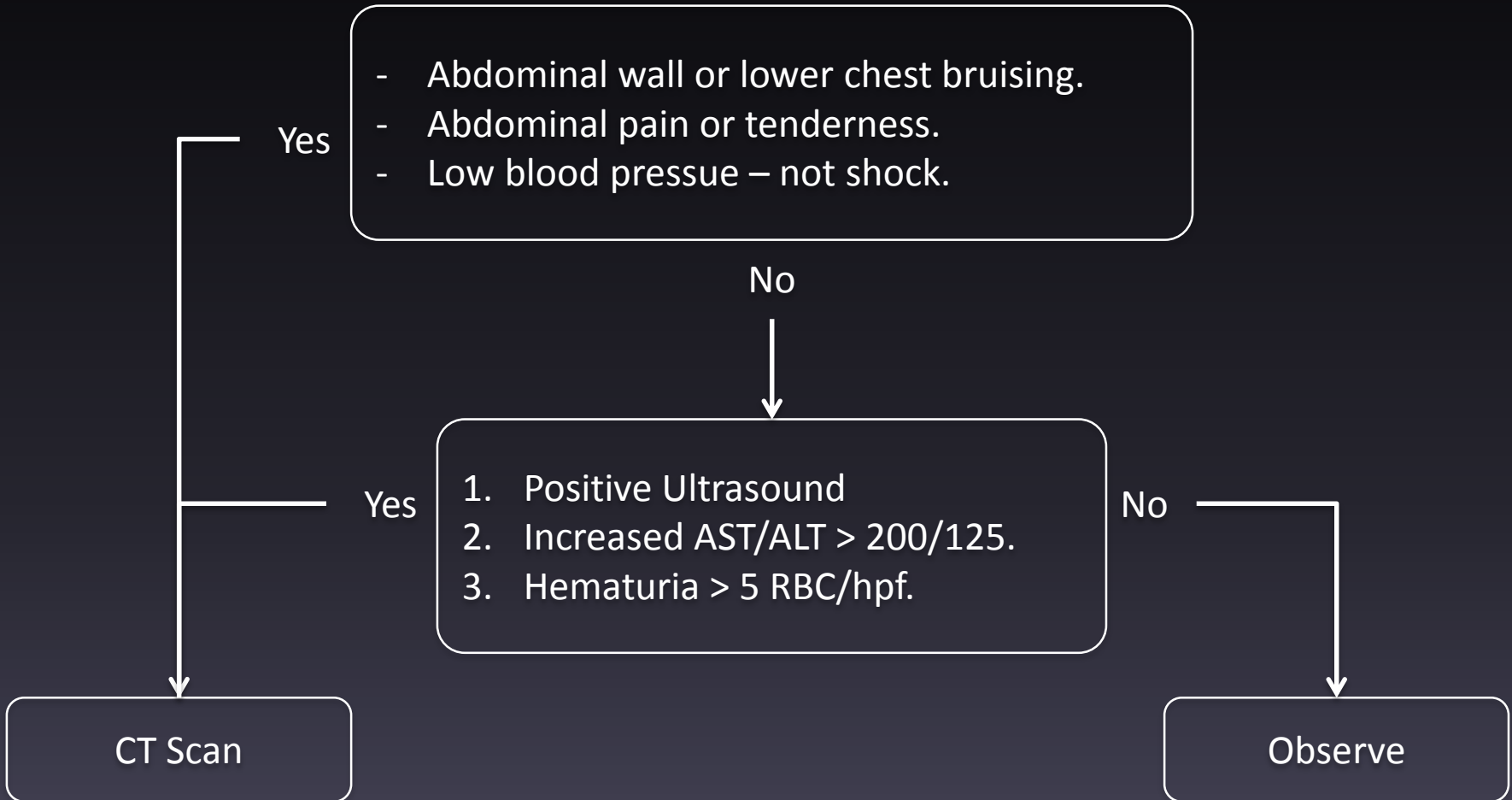
# Studies	Design	Bias	Inconsistency	Indirectness	Imprecision	Other
61	Retrospective	Serious	Yes	Yes	Yes	No

- Recommendation: In pBAT, physical exam can be useful for identifying IAI
- Strength of recommendation: strong

Multivariable

Taylor 1991	Holmes 2002	Cotton 2004	Karam 2009
> 3 indications Gross hematuria Lap belt injury Assault/abuse as MOI Ab tenderness Trauma score<13	Low SBP Ab tenderness Femur fracture Initial HCT<30 ALT>125 or AST>200 UA>5RBC/hpf	MVC MOI Ab tenderness Ab abrasions Ab ecchymosis ALT HCT	Abnl ab U/S Ab pain Signs of peritoneal irritation HD instability AST>60 ALT>25 WBC>9.5 LDH>330 Lipase>30 Cr>50
OR 4.6 - > 3 ind OR 5.8 - Hematuria	Sens 98 Spec 49	Sens 100 Spec 87	Sens 91 Spec 84
OR 12.2 - Lap belt OR 5.1 - Abuse	PPV 17 NPV 99.6	- -	PPV 64 NPV 97

Proposed Algorithm



Limitations

- Most studies are retrospective
- Inherent selection bias
- Variation in study methodologies

Issues Going Forward

- Difficulty of identifying bowel injury
- Distinction between any injury and clinically significant injury
- Influence of conservative management on evaluation – Is it necessary to identify all injuries?
- PECARN study in press

Summary

- Based on a low quality body of evidence, we can weakly recommend that U/S and labs (ALT/AST, hematuria) are useful in identifying injuries in pBAT Pts and can help minimize the use of CT scanning.
- With body of evidence of moderate quality, we strongly recommend physical exam for the evaluation of pBAT.