PATIENTS UNDER FIRE: HELICOPTER TRANSFER IN A DISASTER

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Transfer of critical patients via helicopter is of great advantage and need especially in times of disaster, and should be a part of every major disaster plan

(Bristow A, Baskett P, Dalton M et al. **Medical helicopter systems – recommended minimum standards for patient management**. J R Soc Med 1991; 84: 242-4)

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Patients transported by helicopter stood a better chance of survival than those transported by road

(Thibaut Desmettre, Jean-Michel Yeguiayan, Hervé Coadou, Claude Jacquot, Mathieu Raux, Benoit Vivien, Claude Martin, Claire Bonithon-Kopp, Marc Freysz and French Intensive care Recorded in Severe Trauma. **Impact of emergency medical helicopter transport directly to a university hospital trauma center on mortality of severe blunt trauma patients until discharge**. *Critical Care*, (in press))

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State of Sabah

Lahad Datu

Myanmar (Burma)
Thailand
Andaman Sea
Vietnam
South China Sea
Philippines
Gulf of Thailand
Malaysia
Indonesia
Banda Sea
Arafura Sea
Papua New Guinea
Coral Sea
NT
QLD
WA
Australia
SA
NSW
Great Australian Bight
VIC
ACT
Tasman Sea
TAS
New

Kudat
Kota Belud
Tuaran
Kota Kinabalu
Penampang
Ranau
Beluran
Turtle Islands Park
Sandakan
Papar
Tambunan
Kuala Penyu
Labuan
Beaufort
Keningau
Kota Kinabatangan
Kinabatangan
Tabin Wildlife Reserve
Lahad Datu
Bandar Seri Begawan
Sipitang
Tenom
Lawas
Danum Valley Conservation Area
Kunak
Maliau Basin Conservation Area
Nabawan
Tawau
Semporna
Limbang

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Flashpoints: situation in the east coast of Sabah

SANDAKAN
One army battalion is on standby.

LAHAD DATU
Tanjung Batu and Tanjung Labian are still 'red zones'. Hospital is on standby.

KUNAK
VAT 69 commandos are still hunting for a group of foreign gunmen believed to be hiding there. Most of the shops closed early as no one was coming out of their homes.

SEMPORNA
Commandos were seen getting into boats and heading out to sea in the morning. Later, helicopters were hovering over the town.

TAWAU
One army battalion is on standby. Schools open as usual.

SABAH
SARAWAK
Tanjung Labian
Tanjung Batu
Kampung Tanduo
Kampung Dasar Lama
Kampung Seri Jaya, Simunul

All villagers evacuated
Massive security forces offensive
Recently attacked

The Star, March 2013

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Temporary evacuation centre

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Kinabatangan

Tabin Wildlife Reserve

Lahad Datu

H

130 KM

6 KM

Pulau Sakar

A5

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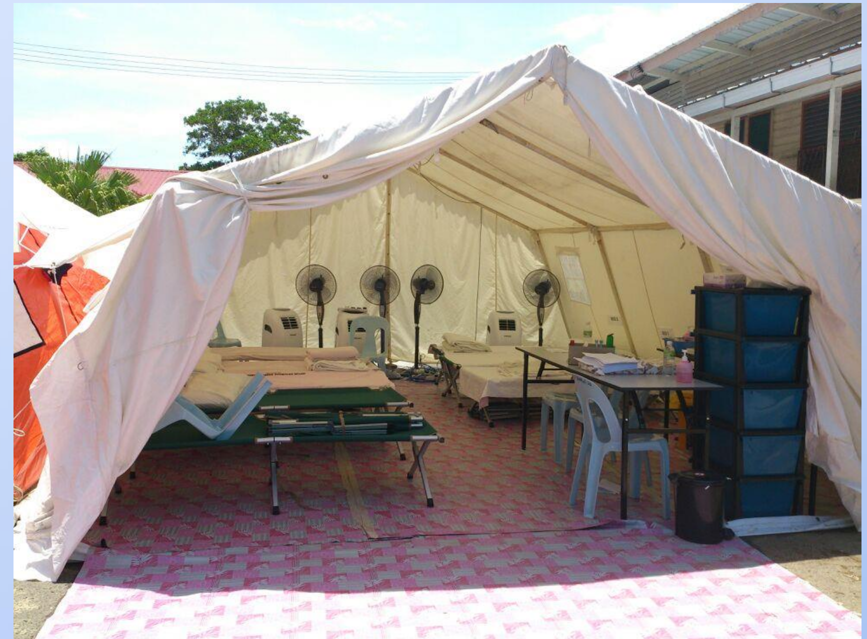
Ambulances escorted by security forces towards an area where the stand-off with Filipino Sulu gunmen and Malaysian security forces was taking place in Tanduo village. AFP PHOTO / MOHD RASFAN

Temporary Field Hospital



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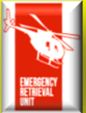

Case Report No. 1

6:00pm → 6:30pm

16 y.o., girl; trauma case

MOI: motobike rider vs a moving car, unhelmeted, was thrown into a 3 feet depth dry drain

Brought in unconscious, GCS: E1, V1, M4

BP: 87/50

HR: 126

SpO_2: 98%

Other positive finding, bruises over right flank

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What else we need here?

ULTRASOUND

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Does This Adult Patient Have a Blunt Intra-abdominal Injury?

Daniel K. Nishijima, MD, MAS
David L. Simel, MD, MHS
David H. Wisner, MD
James F. Holmes, MD, MPH

Context Blunt abdominal trauma often presents a substantial diagnostic challenge. Well-informed clinical examination can identify patients who require further diagnostic evaluation for intra-abdominal injuries after blunt abdominal trauma.

Objective To systematically assess the precision and accuracy of symptoms, signs, laboratory tests, and bedside imaging studies to identify intra-abdominal injuries in patients with blunt abdominal trauma.

Data Sources We conducted a structured search of MEDLINE (1950-January 2012) and EMBASE (1980-January 2012) to identify English-language studies examining the identification of intra-abdominal injuries. A separate, structured search was conducted for studies evaluating bedside ultrasonography.

Study Selection We included studies of diagnostic accuracy for intra-abdominal injury that compared at least 1 finding with a reference standard of abdominal computed tomography, diagnostic peritoneal lavage, laparotomy, autopsy, and/or clinical course for intra-abdominal injury. Twelve studies on clinical findings and 22 studies on bedside ultrasonography met inclusion criteria for data extraction.

Data Extraction Critical appraisal and data extraction were independently performed by 2 authors.

Data Synthesis The prevalence of intra-abdominal injury in adult emergency department patients with blunt abdominal trauma among all evidence level 1 and 2 studies was 13% (95% CI, 10%-17%), with 4.7% (95% CI, 2.5%-8.6%) requiring therapeutic surgery or angiographic embolization of injuries. The presence of a seat belt sign (likelihood ratio [LR] range, 5.6-9.9), rebound tenderness (LR, 6.5; 95% CI, 1.8-24), hypotension (LR, 5.2; 95% CI, 3.5-7.5), abdominal distention (LR, 3.8; 95% CI, 1.9-7.6), or guarding (LR, 3.7; 95% CI, 2.3-5.9) suggest an intra-abdominal injury. The absence of abdominal tenderness to palpation does not rule out an intra-abdominal injury (summary LR, 0.61; 95% CI, 0.46-0.80). The presence of intraperitoneal fluid or organ injury on bedside ultrasound assessment is more accurate than any history and physical examination findings (adjusted summary LR, 30; 95% CI, 20-46); conversely, a normal ultrasound result decreases the chance of injury detection (adjusted summary LR, 0.26; 95% CI, 0.19-0.34). Test results increasing the likelihood of intra-abdominal injury include a base deficit less than −6 mEq/L (LR, 18; 95% CI, 11-30), elevated liver transaminases (LR range, 2.5-5.2), hematuria (LR range, 3.7-4.1), anemia (LR range, 2.2-3.3), and abnormal chest radiograph (LR range, 2.5-3.8). Symptoms and signs may be most useful in combination, particularly in identification of patients who do not need further diagnostic workup.

Conclusions Bedside ultrasonography has the highest accuracy of all individual findings, but a normal result does not rule out an intra-abdominal injury. Combinations of clinical findings may be most useful to determine which patients do not require further evaluation, but the ideal combination of variables for identifying patients without intra-abdominal injury requires further study.

JAMA. 2012;307(14):1517-1527 www.jama.com

CLINICAL SCENARIOS

Case 1

A 25-year-old man was a restrained passenger in a high-speed motor vehicle collision. He reports abdominal pain, which he attributes to his lap restraint belt. He is hemodynamically stable with a blood pressure of 120/75 mm Hg and a pulse of 88/min. Physical examination reveals a transverse area of erythema and ecchymosis consistent with the lap restraint belt, and the patient has mild suprapubic tenderness on abdominal palpation (FIGURE 1).

Case 2

A 55-year-old man fell 8 ft from a ladder onto the ground. He is hemodynamically stable with a blood pressure of 132/72 mm Hg and a pulse of 76/min. Physical examination reveals bruising and tenderness to the right costal margin and abrasions along the right flank but no tenderness with palpation over his abdomen. Laboratory testing demonstrates normal hematocrit, white blood cell (WBC) count, and liver transaminases and absence of hematuria.

WHY IS THIS QUESTION IMPORTANT?

Trauma is the leading cause of death in those younger than 45 years in the

CME available online at www.jamaarchivescme.com and questions on p 1526.

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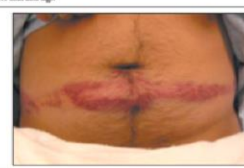
Figure 1. Seat Belt Sign



Linear abrasion and ecchymosis across abdominal wall from lap portion of safety restraint.

United States.[1] Intra-abdominal injuries (any injury to intraperitoneal and retroperitoneal organs including the presence of hemoperitoneum) following blunt (80%) or penetrating (20%) trauma cause a substantial proportion of traumatic deaths.[2] Motor vehicle collisions and falls are the most common causes of blunt trauma, whereas gunshot and stab wounds are the most common causes of penetrating trauma.[2] Penetrating abdominal trauma has a relatively straightforward diagnostic evaluation, but blunt abdominal trauma often presents a substantial diagnostic challenge. Patients with severe injuries and ongoing hemorrhage require immediate recognition and treatment (laparotomy or angiographic embolization). Patients with seemingly less severe trauma or no apparent injury on initial examination may still have clinically significant intra-abdominal injuries, and delayed diagnosis of such injuries is an important cause of preventable morbidity and mortality.[3-5] The anatomical features of the abdominal organs and the physiological events following abdominal injuries produce the signs and symptoms that direct the initial examination (eAppendix; available at http://www.jama.com) and allow categorization of patients into those who are hemodynamically unstable (persistent hypotension despite crystalloid resuscitation) or hemodynamically stable.

Hemodynamically Unstable Patients

Although all trauma patients undergo a primary and secondary survey (a trauma-focused history and physical examination; see eAppendix),[6] the abdominal examination for detecting intra-abdominal injury in unstable patients is often unreliable because of the frequency of concomitant factors including distracting injuries, endotracheal intubation, and altered level of consciousness from neurological injuries or intoxication.[7,8] Because these patients are often too unstable for transportation from the trauma resuscitation area to obtain computed tomography (CT) imaging, conventional algorithms for hemodynamically unstable patients make use of bedside diagnostic testing such as ultrasonography or diagnostic peritoneal lavage (DPL) to rapidly determine the need for exploratory laparotomy.[6]

Hemodynamically Stable Patients

In hemodynamically stable patients, abdominal CT is the reference standard diagnostic imaging test to identify abdominal injuries.[9-12] Helical abdominal CT is both sensitive (97%-98%) and specific (97%-99%) for abdominal injuries.[13,14] Current trauma guidelines recommend abdominal CT imaging in patients with unreliable physical examinations; physical examination findings including abdominal tenderness, abdominal wall contusions, or multiple rib fractures; or intraperitoneal fluid on ultrasound.[6] However, less than 20% of abdominal CT scans obtained in patients with blunt trauma are positive for intra-abdominal injury,[15,16] while less than 3% have injuries that require surgical intervention.[17] When overused, abdominal CT scans contribute to increased health care costs and prolonged emergency department (ED) stays and add to the risk of contrast-induced nephropathy and lifetime risk of radiation-induced malignancy.[18,19] A 20-year-old patient undergoing abdominal CT imaging has an estimated 1 in 500 lifetime risk of developing a radiation-induced cancer.[20]

We reviewed the evidence for clinical history, physical examination, laboratory studies, and bedside imaging to assess the likelihood of intra-abdominal injury in adults who had blunt abdominal trauma. We included bedside abdominal ultrasonography (Focused Assessment With Sonography for Trauma [FAST] examination) (FIGURE 2; see videos of all 4 FAST ultrasound views at http://www.jama.com) because when performed by an ED physician, it may be part of the initial clinical evaluation for an intra-abdominal injury.

METHODS

Literature Search Strategy

A structured search of MEDLINE (1950–January 2012) and EMBASE (1980–January 2012) was conducted by a librarian to identify English-language studies that examine the identification of intra-abdominal injuries (eAppendix). Key words in the search included *physical examination*, *medical history taking*, *palpation*, *diagnosis*, *laboratory testing*, *imaging studies*, *sensitivity*, *specificity*, *observer variation*, *reproducibility*, *decision support*, *abdomen*, *non penetrating wounds*, and *blunt abdominal trauma*. Additional articles were identified from searching the bibliographies of relevant studies.

Because the FAST examination has been evaluated in a large number of studies, we searched for high-quality systematic reviews (search terms in

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Bedside ultrasonography has the highest accuracy of all individual findings, ...

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In case of suspected intra-abdominal injury, fast transport of the patient to a suitable hospital is of high priority

Nast-Kolb D, Bail HJ, Taeger G. **[Current diagnostics for intra-abdominal trauma].** Chirurg. 2005 Oct;76(10):919-26

DECISION?

1) To keep & ventilate until next morning
2) To send by road without police escort in two ambulances
3) To send immediately by air using undesignated helicopter

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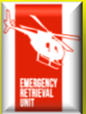

Case Report No. 2

9:00pm → 12:00am

59 y.o. Gentleman, 80 kg bwt

Atrial fibrillation with heart failure

IV Digoxin ~ 111

IVI Dopamine & Dobutamine ~ 110/65

Intubated & Ventilated with SIMV mode

V_t 560; PEEP 5; *f* 12, I:E 1:2, FiO_2: 1.0 ~ 97-98%

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Problem?

OXYGEN SUPPLY

5 tanks of E-cylinder

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O_2 Tank Duration Calculation

$$\frac{Tank\ capacity\ (L)}{Service\ pressure\ (psi)} = Conversion\ factor$$

$$\frac{Conversion\ factor \times psi\ on\ gauge}{Flow\ rate\ (L/min)} = Time\ left\ (min)$$

Nagelhout, J. J., & Zaglaniczy, K., L. (2001). **Nurse anesthesia (2nd ed.)**. Philadelphia: W.B. Saunders Co.

O_2 Tank Duration Calculation

$$\frac{Tank\ capacity\ (L)}{Service\ pressure\ (psi)} = Conversion\ factor$$

<u>Oxygen cylinder size E</u>

680 L / 2200 psi = 0.3

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O_2 Tank Duration Calculation

$$\frac{Conversion\ factor \times psi\ on\ gauge}{Flow\ rate\ (L/min)} = Time\ left\ (min)$$

(0.3 x 1900 psi) / 10L/min = 57 mins

57 mins x 5 tanks = 285 mins

4.75 hours

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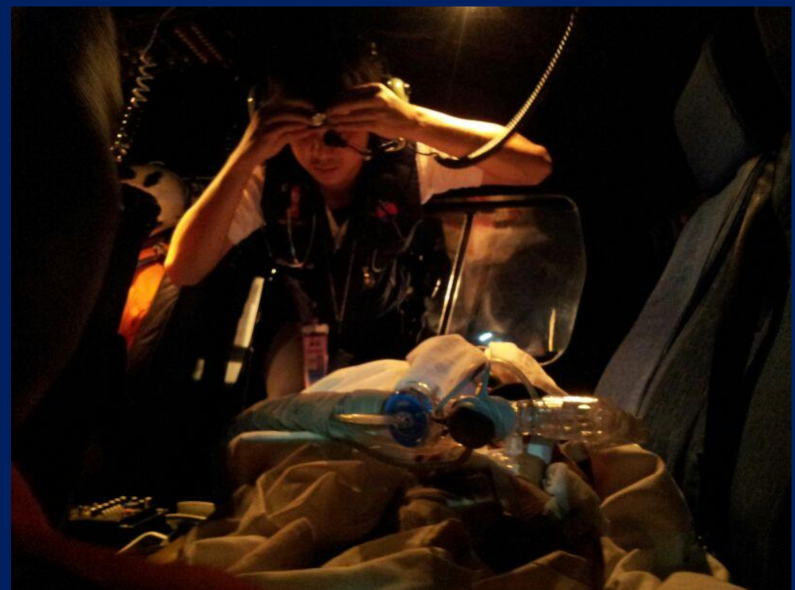
DECISION?

1) To send oxygen tank from the nearest hospital (130km) with police escort-in
2) To keep & ventilate until next morning (6-9 hours)
3) To send by road without police escort in two ambulances
4) To send immediately by air using undesignated helicopter



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QUESTION?

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CONCLUSION

- Multi-agency cooperation is strongly warranted
- Safety, safety, safety...but in a crisis???

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References

1. Bristow A, Baskett P, Dalton M et al. **Medical helicopter systems – recommended minimum standards for patient management**. J R Soc Med 1991; 84: 242-4
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6. Thibaut Desmettre, Jean-Michel Yeguiayan, Hervé Coadou, Claude Jacquot, Mathieu Raux, Benoit Vivien, Claude Martin, Claire Bonithon-Kopp, Marc Freysz and French Intensive care Recorded in Severe Trauma. **Impact of emergency medical helicopter transport directly to a university hospital trauma center on mortality of severe blunt trauma patients until discharge**. *Critical Care*, (in press)

Terima Kasih

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