Trauma Service Guidelines

Title: Blunt Abdominal Trauma

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Introduction

In Australia blunt trauma accounts for 90% of admitted trauma cases, 22% of whom sustain a blunt abdominal trauma (BAT) [1]. At the Royal Melbourne Hospital in 2016, BAT accounted for 15% of all major trauma cases, of these 30% required a laparotomy and 18% required angioembolisation [2].

The most common mechanisms are:

- motor vehicle crashes (45%)
- motorcycle driver (22%)
- pedestrian (10%),
- fall greater > 1 metre (7%)
- assault (6%)

The organs most commonly injured organs are:

- liver (24%)
- spleen (22%)
- kidney (9%)
- mensentery/omentum (7%)
- colon (6%)

Through better understanding of blunt abdominal trauma and advancements in diagnostics and non-operative management techniques including angioembolisation, more conservative approaches are utilised for treatment of BAT. Therefore, the morbidity associated with laparotomies has reduced.

Diagnosis of an abdominal injury:

Diagnosis of BAT remains a challenge as injuries commonly occur in patients with multisystem injuries and no obvious external signs of trauma. Management should be aimed at identification of injury and determining the best course of treatment.

Identification of an abdominal injury begin with the initial assessment conducted using EMST principles including adjuncts[3]:

- Chest and pelvic x-rays: looking for gross abnormalities
- Focused Assessment with Sonography in Trauma (FAST) to identify abdominal free fluid which may indicate intraabdominal haemorrhage.

Physical examination specifically relating to BAT

Perform the primary and secondary surveys

EMST principles [3]:

Inspection

The anterior and posterior abdomen, as well as the lower chest and perineum for:

- Abrasions
- Contusions from restraint devices (e.g. seat belt sign)
- Lacerations
- Penetrating wounds
- Impaled foreign objects
- Evisceration of omentum and small bowl
- Pregnant state

Percussion

- Abdominal pain
- Signs of peritonism

Note: If positive for peritonism, further palpation of the abdomen is not necessary

Palpation

- Guarding
- Superficial versus deep tenderness
- Determine age of pregnancy if appropriate

Other

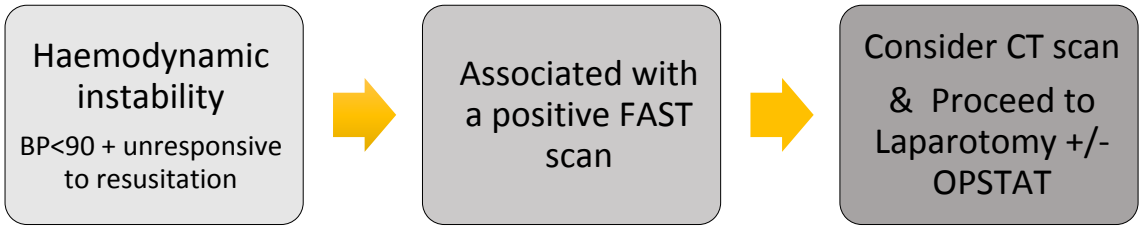
- Ensure pregnancy test performed in females
- Determine pelvic stability (this should only be conducted once; only if PXR is clear)
- Urethral, perineal and rectal exam:
- Blood at the urethral meatus
- Swelling, bruising or laceration of the perineum, vagina, rectum, or buttocks is suggestive of an open pelvic fracture which is associated with a more severe abdominal injury [4]

Decision making in BAT:

Management of haemodynamically unstable patients SBP <90mmHg

If the patient is haemodynamically unstable **(BP<90mmhg and not responding to resuscitation)** and has a positive FAST, an urgent trauma laparotomy may be required [3]. If the patient is stable enough it is recommended an urgent CT scan is considered.

A negative FAST in haemodynamically unstable patient reliably excludes the abdomen as the source of haemodynamic instability[5]. If FAST results are negative, other causes of haemodynamic instability must be searched during the secondary survey.



Management of haemodynamically stable patients

For haemodynamically stable patients, the key decision is whether the patient requires CT scan, or a period of observation with serial abdominal examinations.

Patients who do not require urgent operative management should then undergo further diagnostic testing if indicated [3, 6].

Evidence-based predictive factors, in conjunction with clinical judgement, assist in the identification of patients who may benefit from abdominal CT evaluation, while reducing the number of unnecessary CT scans

Predictors of abdominal injuries post blunt trauma who may require CT: [4, 7-9]

- **Traumatic mechanism**: i.e. motorcyclist accident and pedestrian versus vehicle
- **Haemodynamic instability**: defined as SBP<90mmHg
- **Abdominal tenderness** and **clinical evidence** of blunt abdominal trauma
- **Evidence of a head injury** ± **low or fluctuating GCS**: i.e. evidence of head strike including loss of consciousness, intracranial haemorrhage, skull fractures, CSF leak and/or neurological symptoms.
- **Severe injuries to the pelvis, chest and/or extremities** including severe pelvic, rib and limb fractures.
- **Low haemoglobin**: haematocrit level less than 30%.

All patients with suspected BAT should be followed closely with repeated physical examinations to detect any signs of peritonitis [10]. If intraabdominal injury is suspected, a more definitive assessment such as CT scans is required. Equivocal or positive results from FAST or abdominal exam warrant further investigation and management according to the patients clinical and physiological status

Serial Abdominal Examinations

Evaluation of the abdomen includes inspection, looking for external signs of injury such as open wounds, or significant bruising and/or abrasions of the abdominal wall. Palpation of the abdomen is used to assess for tenderness, rigidity, and guarding. Many, although not all, patients with an abdominal injury complain of tenderness, and peritoneal signs may be present if there is injured bowel. Auscultation to assess for presence or absence of bowel sounds.

Imaging

Multi-detector computed tomography (MDCT) scanning with intravenous contrast is the gold standard diagnostic modality for both solid and non-solid organ injury [8, 11-15].

Patients with no findings on CT

The negative predictive value for CT for diagnosis of intraabdominal injuries is 99.8%, therefore the majority of haemodynamically stable patients with no findings on CT may be discharged after a period of observation and serial abdominal examination [16, 17].

Hollow organ injury is an uncommon event (1-3.2 % of blunt trauma admissions [18]). Missed hollow organ injuries account for up to 58% of delayed laparotomy due to blunt trauma[19].
The sensitivity of CT in the diagnosis of small intestine injury has been reported by as low as 75% and 64% for bowel or mesenteric injury therefore serial abdominal examination is of high importance[20 21 22].

Patients who are not clinically evaluable (GCS<15) with a potential abdominal injury require CT scanning [23, 24].

Patients with isolated intraperitoneal fluid found on CT

CT findings of unexplained free fluid in the absence of significant solid organ injuries was present in 93.5% of patients with confirmed hollow organ injury [25 26]. Isolated intraperitoneal fluid findings raise a high suspicion of hollow organ injury. Management decisions for these patients can be aided by determining the amount of free fluid on CT scans.

In patients with haemoperitoneum, the presence of active extravasation and the rate of bleeding have a more prominent influence on patient care decisions than does the volume of free blood in the abdomen [27].

Operative management:

Laparotomy

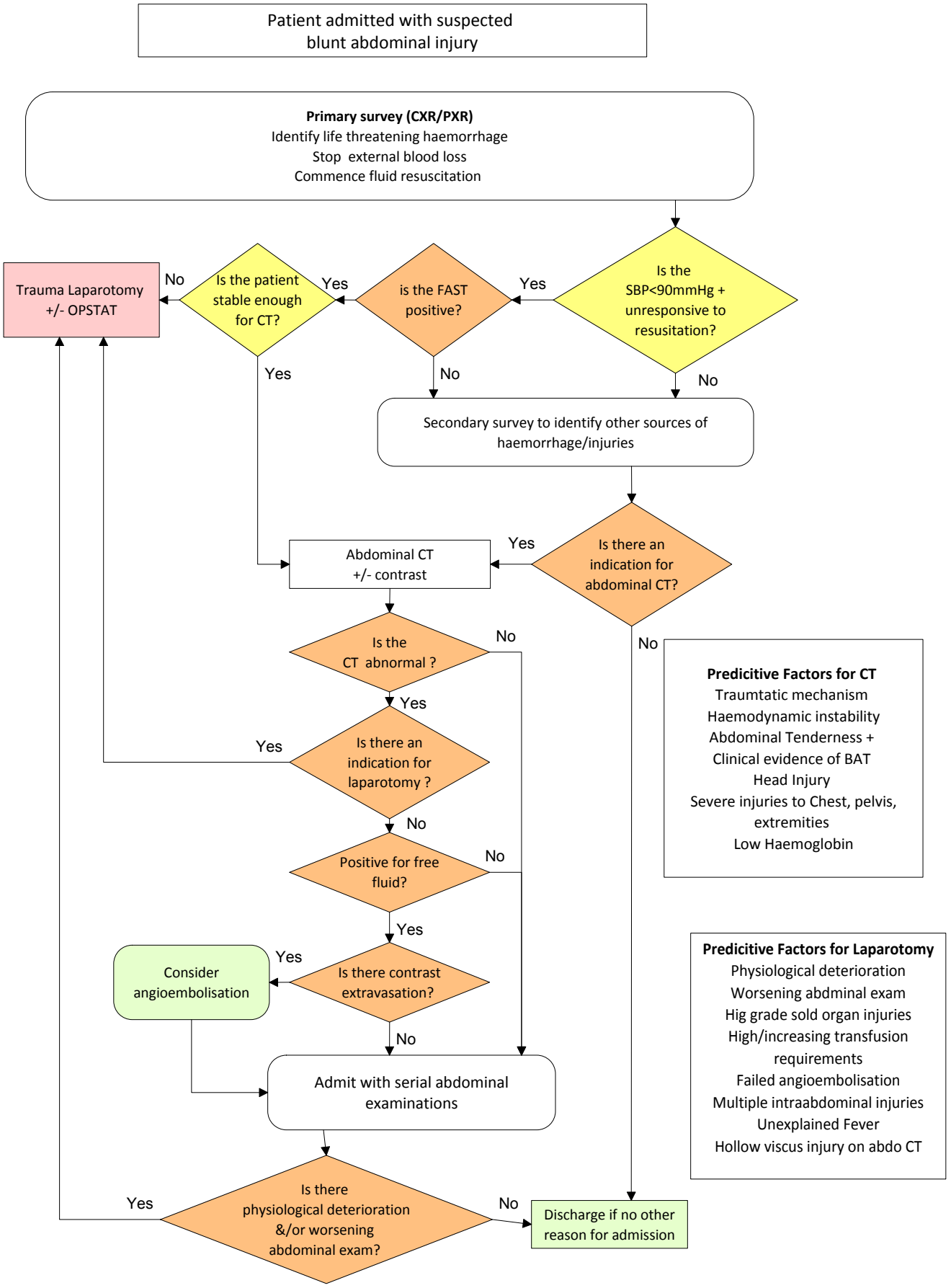
However trauma laparotomy should be performed if indicated using the damage control approach which has reduced mortality in patients with severe abdominal injuries [28].

Indications/predictors for laparotomy [10,29 30, 31]:
• **Haemodynamic instability** • **Evidence of Peritonitis** to achieve control of haemorrhage and control of spillage • **Traumatic diaphragmatic injury** with herniation • **Severe solid organ injury** (e.g. kidney and spleen) • **Infarction due to post traumatic occlusion of the blood supply** • **Mesenteric tear/s** • **Unexplained Moderate to large amounts of free fluid** (200-≥500mls) • **Failed non-operative management**

Angioembolisation

Angioembolisation has revolutionised non-operative management in BAT [32]. In all haemodynamically stable patients with evidence of active extravasation on CT scanning, modern clinical practice guidelines recommend the use of angiography with embolisation if possible [32]. The complexity of decision making increases when active bleeding is detected on the initial CT scan, but no active bleeding noted on the subsequent angiogram [32]. Active bleeding and high grade splenic injuries require immediate consultation with Surgeon on call and radiology. Activate radiology ASAP as they require 45 mins out business hours.

BLUNT ABDOMINAL TRAUMA GUIDELINE



PIT FALLS IN BAT

Pancreatic injuries

Pancreatic injuries include transections, contusions or lacerations [27]. These injuries may not be apparent on initial CT scanning[27]. Indirect signs of pancreatic injury include fluid in the peri pancreatic fat or in the plane separating the pancreas from the splenic vein and thickening of the left anterior renal fascia[(30)]. A repeat CT scan should be obtained after 24-48 hours in patients with a normal pancreatic CT on admission who subsequently developed abdominal signs or symptoms.[33]. Increased morbidity and mortality is reported if there is involvement of the pancreatic duct due to complications including infected pseudocyst, abscess, fistulae, or sepsis [33-35].

Adrenal gland injuries

Adrenal injuries generally appear as focal hyper attenuating hematomas or as glandular enlargements with haemorrhage confined to or extending outside of the adrenal gland into the retroperitoneal or periadrenal fat on CT scans [27]. Unilateral adrenal hematomas tend to self-resolve without complications[27]. Conversely, adrenal insufficiency occasionally develops following bilateral haemorrhage [27]. Due to the difficulty in differentiating between a pre-existing mass and a traumatic adrenal hematoma, a repeat CT (or MRI) scan may be indicated 8-10 weeks later [27].

Diaphragmatic injuries

While the diagnostic accuracy of CT for detecting diaphragmatic trauma has traditionally been considered low, especially in the case of right-sided injuries, improvements in multi-detector technology (higher spatial resolution, improved multi-planar reformations) allow for improved preoperative diagnoses [36]. CT findings include direct visualisation of diaphragmatic discontinuity, herniation of abdominal viscera into the thorax, and the collar sign, a waist like constriction of herniated abdominal contents through a diaphragmatic rent [36]. Diaphragmatic injuries are generally managed operatively.

Major Vascular Injuries

Timely diagnosis and immediate therapy are required when there are injuries to the aorta and other major abdominal and pelvic vessels (inferior vena cava, renal vessels, celiac axis, superior mesenteric vessels, lumbar vessels, and iliac vessels) in order to increase the chance of survival due to the potential for rapid fatal exsanguination [27]. CT Findings include large hematomas, active extravasation of contrast-enhanced blood, pseudoaneurysms, intimal flaps and thrombosis[27]. Urgent referral to the vascular surgery unit is required.

References

1. AIHW P. Trends in hospitalised injury, Australia: 1999–00 to 2012–13. *Injury research and statistics series no 95 Cat no INJCAT 171 Canberra: AIHW*. 2015.
2. Santos R. Abdominal Trauma Data Trauma Registry. Melbourne: The Royal Melbourne Hospital. 2017.
3. ATLS/EMST Course Manual 9th Edition 2012.
4. Farrath S, Parreira JG, Perlingeiro JA, Solda SC, Assef JC. Predictors of abdominal injuries in blunt trauma. *Revista do Colegio Brasileiro de Cirurgioes*. 2012;39(4):295-301.
5. Farahmand N, Sirlin CB, Brown MA, et al. Hypotensive patients with blunt abdominal trauma: performance of screening US. *Radiology*. 2005;235(2):436-443.
6. Chiu W, Cushing B, Rodriguez A, et a. Abdominal injuries without hemoperitoneum: a potential limitation of focused abdominal sonography for trauma (FAST). *J Trauma* 1997;42(4):617–623.
7. Parreira JG, Malpaga JM, Olliari CB, Perlingeiro JA, Solda SC, Assef JC. Predictors of "occult" intra-abdominal injuries in blunt trauma patients. *Revista do Colegio Brasileiro de Cirurgioes*. Sep-Oct 2015;42(5):311-317.
8. Sharples A, Brohi K. Can clinical prediction tools predict the need for computed tomography in blunt abdominal? A systematic review. *Injury*. 2016;47(8):1811-1818.
9. Holmes JF, Panacek EA, Miller PQ, Lapidis AD, Mower WR. Prospective evaluation of criteria for obtaining thoracolumbar radiographs in trauma patients. *The Journal of Emergency Medicine*. 1// 2003;24(1):1-7.
10. Luo T, Lu Z, Zhi K, et al. Surgical experience of delayed intestinal necrosis following blunt abdominal trauma: 19 consecutive cases in 10 years. *International Journal of Clinical and Experimental Medicine*. 2016;9(2):4083-4088.
11. Cokkinos D, Antypa E, Stefanidis K, et al. Contrast-enhanced ultrasound for imaging blunt abdominal trauma - indications, description of the technique and imaging review. *Ultraschall in der Medizin*. 2012;33(1):60-67.
12. Shojaee M, Faridaalaee G, Yousefifard M, et al. New scoring system for intra-abdominal injury diagnosis after blunt trauma. *Chinese Journal of Traumatology*. 2014;17(1):19-24.
13. Ali HI. Role of multislice computed tomography in assessment of non-solid organ injury in patients with blunt abdominal trauma. *Egyptian Journal of Radiology and Nuclear Medicine*. 01 Sep 2016;47(3):749-756.
14. Karki OB. The Role of Computed Tomography in Blunt Abdominal Trauma. *Jnma, Journal of the Nepal Medical Association*. 2015;53(200):227-230.
15. Gamanagatti S, Rangarajan K, Kumar A, Jineesh. Blunt Abdominal Trauma: Imaging and Intervention. *Current Problems in Diagnostic Radiology*. 2015;44(4):321-336.
16. Hom J. The risk of intra-abdominal injuries in pediatric patients with stable blunt abdominal trauma and negative abdominal computed tomography. *Academic Emergency Medicine*. 2010;17(5):469-475.
17. Awasthi S, Mao A, Wooton-Gorges SL, Wisner DH, Kuppermann N, . HJ. Is hospital admission and observation required after a normal abdominal computed tomography scan in children with blunt abdominal trauma? *Acad Emerg Med*. 2008;15(10):895-899.
18. Malinoski DJ, Patel MS, Yakar DO, et al. A diagnostic delay of 5 hours increases the risk of death after blunt hollow viscus injury. *Journal of Trauma injury infection and critical care*. 2010;69(1):84-87.
19. Sorensen VJ, Mikhail JN, Karmy-Jones RC. Is delayed laparotomy for blunt abdominal trauma a valid quality improvement measure in the era of nonoperative management of abdominal injuries? *J Trauma*. 2002;52(3):426-433.
20. Salimi J, Bakhtavar K, Solimani M, Khashayar P, Meysamie AP, . ZM. Diagnostic accuracy of CT scan in abdominal blunt trauma. *Chin J Traumatol*. 2009;12(2):67-70.
21. Salimi J, Bakhtavar K, Solimani M, Khashayar P, Meysamie AP, Zargar M. Diagnostic accuracy of CT scan in abdominal blunt trauma. *Chin J Traumatol*. 2009 2009;12(2):67-70.
22. Butela ST, Federle MP, Chang PJ, et al. Performance of CT in detection of bowel injury. *AJR Am J Roentgenol*. 2001;176(1):129-135.
23. Hoff W, Holevar M, Nagy K, et al. Practice management guidelines for the evaluation of blunt abdominal trauma: the East practice management guidelines work group. *Journal of Trauma-Injury Infection and Critical Care*. 2002;53(3):602-615.
24. Soyuncu S, Cete Y, Bozan H, Kartal M, Akyol A. Accuracy of physical and ultrasonographic examinations by emergency physicians for the early diagnosis of intraabdominal haemorrhage in blunt abdominal trauma. *Injury*. 2007;38(5):564-569.
25. Tan K-K, Bang S-L, Vijayan A, M-T. C. Hepatic enzymes have a role in the diagnosis of hepatic injury after blunt abdominal trauma. *Injury*. 2009;40(9):978-983.
26. Tan K-K, Liu JZ, Go T-S, Vijayan A, Chiu M-T. Computed tomography has an important role in hollow viscus and mesenteric injuries after blunt abdominal trauma. *Injury*. 2010;41(5):475-478.
27. Soto JA, Anderson SW. Multidetector CT of blunt abdominal trauma. *Radiology*. 2012;265(3):678-693.
28. Groven S, Gaarder C, Eken T, Skaga NO, Naess PA. Abdominal injuries in a major Scandinavian trauma center - performance assessment over an 8 year period. *J Trauma Manag Outcomes*. 2014;8:9.
29. Dharap SB, Noronha J, Kumar V. Laparotomy for blunt abdominal trauma-some uncommon indications. *J*. Jan-Mar 2016;9(1):32-36.
30. Gonser-Hafertepen LN, Davis JW, Bilello JF, et al. Isolated free fluid on abdominal computed tomography in blunt trauma: Watch and wait or operate? *Journal of the American College of Surgeons*. 2014;219(4):599-605.
31. Butela ST ea. Performance of CT in detection of bowel injury. *AJR Am J Roentgenol* 2001;176(1):129-135.
32. Alarhayem AQ, Myers JG, Dent D, et al. "Blush at first sight": significance of computed tomographic and angiographic discrepancy in patients with blunt abdominal trauma. *American Journal of Surgery*. 2015;210(6):1104-1110.
33. Gupta A SJ, Fleming KW, Lucey BC, Soto JA. . Blunt trauma of the pancreas and biliary tract: a multimodality imaging approach to diagnosis. . *Radiographics*. 2004;24(5):1381–1395.
34. Teh SH SB, Mullins RJ, Sch- reiber MA, Mayberry JC. . Diagnosis and management of blunt pancreatic ductal inury in the era of high-resolution computed axial tomography. *Am J Surg* 2007;193(5):641–643.
35. Wong YC WL, Lin BC, Chen CJ, Lim KE, Chen RJ. . CT grading of blunt pancreatic injuries: prediction of ductal disruption and surgical correlation. . *J Comput Assist Tomogr* 1997;21(2):246–250.
36. Desser TS EB, Hunt S, Rosenberg J, Purtill MA, Jeffrey RB. . The dangling diaphragm sign: sensitivity and comparison with existing CT signs of blunt traumatic diaphragmatic rupture. *Emerg Radiol* 2010;17(1):37–44.