Management of Penetrating Abdominal Trauma

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Outline

- Discuss basic maneuvers of damage control
- Tricks that maybe able to get you out of a tough situation
- Develop strategies to anticipate the problems as well as solution
- Discuss the literature of how to manage these patients
- A lot of controversy still exists in caring for these patients

Recommendations:

- HD unstable patients to OR stat
- HD stable but unreliable exam should get more evaluation (head injury, spinal injury..)
- SW in stable patient do not need routine laparotomy
- GSW that are tangential does not mandate OR

Practice Management Guidelines for Selective Nonoperative Management of Penetrating Abdominal Trauma

John J. Como, MD, Parun Kohli, MD, William C. Chiu, MD, Therese M. Duane, MD, Michele R. Holovesi, MD, Margaret A. Tedall, MD, Raul R. Ivatury, MD, and Thomas M. Scalisi, MD

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J Trauma 2010;68:721-733
Selective NOM in Penetrating Trauma

- PE is reliable in stable patient who are not impaired that can be followed clinically
- CT scan is useful in determining selective NOM
- Patients with RUQ penetrating injury who are HD with no tenderness can be managed with NOM
- Reliable PE and serial exams pts can be D/C after 24 hours of observation
- Laparoscopy is useful in evaluating abdominal and diaphragmatic injuries
- Still controversial  

J Trauma 2010;68:721-733

Penetrating Anterior Abdominal Injury at EVMS (Sentara Norfolk General Hospital)

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>No. of Laparotomies</th>
<th>NL*, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunshot wounds</td>
<td>442</td>
<td>94 (21)</td>
</tr>
<tr>
<td>Shotgun wounds</td>
<td>1</td>
<td>2 (29)</td>
</tr>
<tr>
<td>Stab wounds</td>
<td>212</td>
<td>48 (23)</td>
</tr>
</tbody>
</table>

LD Britt 7-2011

evisceration

LD Britt, MD 7-2011

Variables in Predicting Need for Laparotomy

<table>
<thead>
<tr>
<th>Specificity(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock</td>
</tr>
<tr>
<td>Peritonitis</td>
</tr>
<tr>
<td>Peritoneal penetration</td>
</tr>
<tr>
<td>Intraabdom bleeds</td>
</tr>
</tbody>
</table>

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A word about FAST

- Used since the early 1990s in most trauma centers
- Role in penetrating trauma has not been worked out...(stay tuned)
- FAST sensitivities reported to be 74-100% specificity has been reported to approach 100%
  Rozycki G et al., J Trauma 1993:34:516-526
- Can result in cost savings with the reduction in use of CT and other tests
- 1995 ACS/COT recommended ATLS adopt FAST at alternative to DPL or CT
  ACS COT ATLS Overview of Changes ACS 2002:33-28

FAST

- FAST scan is not perfect and the study can miss significant injuries
- Low sensitivities and low negative predictive value in a recent meta-analysis
- The authors concluded despite high specificity it has an unexpected low sensitivity for both free fluid and organ lesions
- A lot of observer variation editorial comment)
**Not So FAST**

- Study of the use of a protocol for USG in the initial evaluation of HD stable trauma patients at a Level I Center
- 359 patients with BAI
- 313 true negative studies, 16 TP, 22 FN, 8 FP. CT used to confirm injuries
- Sensitivity of 42%, specificity of 98%, PPV of 67%, Neg Pred Val of 93% accuracy of 92%
- Discordance between CT and FAST of 5.85% P<0.0001
- 6 patients with FN FAST had laparotomies for injuries
- 16 admitted for NOM
- 313 TN FASTs: 19 had intra-abdominal injuries without hemoperitoneum, 11 retroperitoneal
- FAST may under diagnose injuries after BAI in HD patients

Miller MT et al., J Trauma 2003;54:52-60

**What about the flank and back?**

<table>
<thead>
<tr>
<th>Risk</th>
<th>CT findings</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>No penetration</td>
<td>Discharge from ED</td>
</tr>
<tr>
<td></td>
<td>Penetration into subcutaneous tissue</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Penetration into muscle</td>
<td>Serial clinical assessments</td>
</tr>
<tr>
<td></td>
<td>Retroperitoneal hematoma, not near critical structure</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Contrast extravasation from colon</td>
<td>Laparotomy</td>
</tr>
<tr>
<td></td>
<td>Major extravasation from kidney</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hematoma adjacent to major retroperitoneal vessel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free air in retroperitoneum, not attributed to wounding object</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence of injury above and below diaphragm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free fluid in peritoneal cavity</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Himmelman et al [9].


**Unstable Patients with Abdomen Wound**

- Patients are in profound shock go directly to the OR
- Transient responders: try to stabilize but end up in the OR
- CT decompensation-run to the OR
- Post CT/ICU bleeding
- Angio can be helpful for big liver injuries
- Start MTP early
- Alert the nurse/anesthesia of the disaster

**Before You Open**

- Get the patient lined up ASAP
- Get prepped and draped in the OR surgeon in the room all time!!
- Make sure you have emergency blood in the room before you open up the patient
- Get the vascular instruments and open chest tray in case you need it
Opening the Patient

- Midline incision always
- Pack the open in sequence depending on where the bleeding in coming come
- GSW to RUQ pack there first
- Get suction ready - I like two working at all times
- Look to where the money is last when you remove the packs

Operative Strategies

- Establish hemostasis ASAP
- Think out loud to people in the room
- Think three steps ahead
- Ask for instruments or equipment before you need it
- Use vascular clamps liberally
- Do not do the bowel first during the operation as temping as it is!!

Liver Injuries

OIS Liver Injury Grades

- I  subcapsular hematoma < 10%, < 1 cm laceration
- II subcapsular hematoma 10-50%, intraparenchymal hematoma < 10 cm, 1-3 cm laceration
- III subcapsular hematoma > 50% or ruptured, intraparenchymal hematoma > 10 cm or expanding, laceration > 3 cm
- IV parenchymal laceration 25-75% of lobe or 1-3 segments of one lobe
- V parenchymal laceration > 75% of lobe or > 3 segments, juxtahepatic venous injury
- VI avulsion, devascularization
Operative Considerations
Liver

- Do not look too much
- Decide early if you have to do damage control and packing
- Pringle and do hepatic isolation
- Packing can help you get out of a tough spot
- Liberal use of argon beam, ligate named vessels, topical treatments
- Tractotomy or finger fracture in worst cases
- Can lose 50-60 units without trying
Management of Liver Injury

Hemodynamically Stable

+ CT Scan
- extravasation
  - non-operative treatment

extravasation
  + angiographic embolization
  - hepatorrhaphy
  + observation

- damage control (packing)

Splenic Injuries

Splenic Injury

Organ Injury Scale (Am Assoc Surg Trauma)

- I subcapsular hematoma < 10%, < 1 cm laceration
- II subcapsular hematoma 10-50%,
  intraparenchymal hematoma < 5 cm, 1-3 cm laceration
- III subcapsular hematoma > 50%, > 5 cm
  intraparenchymal hematoma, laceration > 3 cm
- IV laceration hilum with > 25% devascularization
- V shattered spleen, complete devascularization

• If injured and patient is hypotensive do a splenectomy
• No time for fixing the spleen
Splenic injury with a stable patient

- Splenorrhaphy is becoming a lost art due to nonoperative therapy
- Topical agents first, argon, then suture repair

Splenic Embolization for Trauma

- Topical agents first, argon, then suture repair

The retroperitoneal hematoma: blunt

- Zone 1: always
- Zone 3: almost never
- Zone 2: selective

The retroperitoneal hematoma: penetrating

- Zone 1: always
- Zone 3: always
- Zone 2: almost always

Renal Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Contusion</td>
<td>Microscopic or gross hematuria</td>
</tr>
<tr>
<td>Hematoma</td>
<td>Subcapsular, nonexpanding no parenchymal lac</td>
</tr>
<tr>
<td>II Hematoma</td>
<td>Nonexpanding, perirenal hematoma confined to renal retroperitoneum</td>
</tr>
<tr>
<td>Laceration</td>
<td>&lt;1cm parenchymal renal cortex with no extravasation</td>
</tr>
<tr>
<td>III Laceration</td>
<td>&gt;1cm parenchymal depth without collecting system rupture or urinary extravasation</td>
</tr>
<tr>
<td>IV Laceration</td>
<td>Parenchymal laceration extending through the renal cortex, medulla and collecting system</td>
</tr>
<tr>
<td>Vascular</td>
<td>Main renal artery or vein injury with contained hemorrhage</td>
</tr>
<tr>
<td>V Laceration</td>
<td>Completely shattered Kidney</td>
</tr>
<tr>
<td>Vascular</td>
<td>Avulsion of the renal hilum that devascularizes kidney</td>
</tr>
</tbody>
</table>

Moore et al, J Trauma 29:1664, 1989
Repair options

- Oversew of small bleedsers
- Suture of collecting system
- Suture of renal capsule
- Omental flap
- Peritoneal flap
- Just take it out

Repair of deep laceration

Retroperitoneal exposure: left

- Mobilize colon
- Mobilize spleen & pancreas tail
- Kidney easily mobilized w/ rapid proximal pedicle control
- Allows access of adjacent aortic injury

GSW to the iliac vein and artery with a-v fistula and pseudo aneurysm

- Vascular shunts are helpful
- Followed by bypass grafts
Retroperitoneal exposure: right

- Mobilize colon
- Generous Kocher
- Kidney easily mobilized w/ rapid proximal pedicle control
- Allows access of adjacent caval injury

Epidemiology of Pancreatic Injuries

- Not very common: Only 5-7% of trauma laparotomies for pancreatic trauma
- Associated injuries
  - Average ISS: 18.9
  - Blunt injury:
    - 90% have at least one associated injury
  - Penetrating injury:
    - 75% chance of injury to aorta, PV, or vena cava
- Anatomy of injury
  - Isolated parenchymal injury: 41.5%
  - Main duct involvement: 37%

AAST Pancreatic Organ Injury Scale

<table>
<thead>
<tr>
<th>GRADE</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>hematoma</td>
<td>Minor contusion</td>
</tr>
<tr>
<td></td>
<td>laceration</td>
<td>Superficial</td>
</tr>
<tr>
<td>II</td>
<td>hematoma</td>
<td>Major contusion</td>
</tr>
<tr>
<td></td>
<td>laceration</td>
<td>Deep</td>
</tr>
<tr>
<td>III</td>
<td>laceration</td>
<td>Distal transection and duct injury</td>
</tr>
<tr>
<td>IV</td>
<td>laceration</td>
<td>Proximal transection</td>
</tr>
<tr>
<td>V</td>
<td>laceration</td>
<td>Massive disruption of pancreatic head</td>
</tr>
</tbody>
</table>
If bleeding severe apply packs
Retrospective review of trauma registry 1998-2005
Demographic data and injury severity data were collected in urban level 1 trauma center
Univariate and multivariate analysis were performed on the patients
Blunt and penetrating similar until after age 55 when mortality was higher for penetrating

Insurance status is a potent predictor of outcomes in both blunt and penetrating trauma

Review of the NTDB patients who were injured from both mechanisms
Examined insurance class and mechanism of injury
Overall mortality was 3.7%
Penetrating 7.9% and 3.0% for blunt and sign higher in uninsured
Univariate and multivariate analysis penetrating trauma had higher death rate in uninsured

Conclusions
Complex patients to manage
Can manage some non-operatively in selected cases
Radiology studies can help with Rx
The abdominal organs pose a different challenges-Liver, spleen, kidney, root of the mesentery and the pancreas
Damage control techniques should be use liberally for these cases.