Techniques for Splenic Salvage

Feiran Lou
Kings County Hospital Center
Department of Surgery
Case

- 44 yo woman with unknown PMH s/p pedestrian struck BIBEMS, mangled left leg
- GCS 4/5/6
- VS Afebrile, BP 60-70’s/40’s, HR 100’s, RR 30’s, 100%
- Intubated in trauma bay
- Resuscitation with 3 L crystalloids, 4 u PRBC
- CXR, Pelvis XR
Work Up Cont.

• Labs
  – CBC 9.01/10.6/33.0/278
  – VBG 7.27/49/29/19.8/-3.9/43%
  – BMP, LFT, coags WNL

• FAST +
Intraoperative Course

- Hypotensive SBP 70-90’s
- LLE tourniquet applied
- Exploratory laparotomy: ~100 cc gross blood, 2-3 cm laceration ant. superior pole of spleen with moderate oozing. BioGlue applied. Spleen packed.
- Left open AKA
Intraoperative Course

- Abdomen
  - Packs removed
  - Spleen fully mobilized
  - Large posterior stellate laceration
  - Splenectomy

- Left chest tube

- 2 units pRBC

- 2 FFP
• POD 1 Continued resuscitation in SICU
• POD 2 Hemodynamically stable
• Tolerated diet
• Left AKA stump revised POD 8
• Vaccinations POD 13
• Discharged on POD 15
Historical Perspective

- 1738 John Ferguson: partial splenectomy
- 1910 Mayo “the internal secretion of the spleen is not important, as splenectomy does not produce serious results.” \(\Rightarrow\) ↑↑ splenectomies
- 1952 Post splenectomy syndrome in 4/5 children \(\Rightarrow\) severe/fatal meningitis + sepsis
- 1969 Overwhelming post splenectomy infection (OPSI) \(\Rightarrow\) Splenic preservation
Historical Perspective cont.

- Spleen salvage popularized in 1960-70’s by pediatric surgeons

**Surgical Repair of the Injured Spleen**

By Michael H. Ratner, Eugene Garrow, Victor Valda, V. L. Shashikumar, and Laurence A. Somers

*Journal of Pediatric Surgery, Vol. 12, No. 6 (December), 1977*
Splenic Function

1. Antibody Production
   Encapsulated Gm +

2. Factors in immune response: opsonins → complement activation

3. Filtration: blood cells, particulate matters

4. Sequestration: RBCs and platelets
Mechanism of injury -

- Blunt
  - Hemodyn. Unstable
    - Yes
      - FAST exam or DPL
        - Positive
        - Negative
          - Search for other cause of hypotension. Eventual CT scan
  - No
    - Abdominal CT
      - No Splenic injury
        - Treat other injuries
      - Splenic injury
        - Contrast blush?
          - Yes
            - Angiography and embolization
          - No
            - Splenectomy vs. Splenorrhaphy
    - Successful
  - No
Rate of Operative Intervention for Splenic Injuries in Trauma Centers in Maine

Management of adult splenic injury: A 20-year perspective
Hartnett, Kimberly L; Winchell, Robert J; Clark, David E
The American Surgeon; Jul 2003; 69, 7; ProQuest Central pg. 608
Splenic Injury

Small subcapsular hematoma (<10% surface area)
Small laceration (<1 cm deep)

Medium subcapsular hematoma (10% to 50% surface area)
Intraparenchymal hematoma (<5 cm in diameter)
Medium laceration (1 to 3 cm deep)

Large subcapsular hematoma (>50% surface area)
Intraparenchymal hematoma (>5 cm in diameter)
Expanding hematoma
Large laceration (>3 cm deep or involving trabecular vessels)
Splenic Injury

Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)

Shattered or devascularized spleen

Source: Mattox KL, Moore EE, Feliciano DV: Trauma, 7th Edition: www.accesssurgery.com
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Assessment of Spleen
Mobilization is key!!!
Grade I

- Hemostatic agents
  - Microfibrillar collagen
  - Gelatin sponge
  - Fibrin glue
  - Packing
Grade II and III

1. Argon beam
2. Suture: monofilaments (i.e. 2.0 chromic) pledget materials
   • Horizontal mattress vs. continuous vs figure of 8’s

Electrocautery of spleen rarely helpful!!
Grade IV

- Partial splenectomy
Partial Splenectomy
Grade IV

- Omental pedicle and peritoneal patch
Grade IV

- Absorbable mesh
Grade IV

- Autotransplant of splenic tissue
Post Operative Complications

- Bleeding
- Gastric distention
- Gastric necrosis – ligation of short gastrics, uncommon
- Pancreatic injury
Level I trauma center
1980-1989
240 adults underwent splenorrhaphy (43% of all splenic injuries)
86% performed on grades I-III
83% of repairs were simple suture w/ or w/o topical agents
Postoperative Complications

• 3 (1.3%) postoperative bleeding → splenectomy
• Total 6 deaths (2.6%), one from subphrenic abscess and septic shock
• Other complications: subphrenic abscess (3), drain abscess (1), dehiscence (1), early SBO (2), wound infections (2)
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Splenic Injuries</th>
<th>Splenorrhaphy</th>
<th>Reoperations for Bleeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giuliano(^{26})</td>
<td>1981</td>
<td>92</td>
<td>33 (35.9%)</td>
<td>0</td>
</tr>
<tr>
<td>Shackford(^{27})</td>
<td>1981</td>
<td>85</td>
<td>43 (50.6%)</td>
<td>0</td>
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<tr>
<td>Oakes(^{28})</td>
<td>1981</td>
<td>24</td>
<td>20 (83.3%)</td>
<td>1 (5.0%)</td>
</tr>
<tr>
<td>Pachter(^{29})</td>
<td>1981</td>
<td>27</td>
<td>24 (88.9%)</td>
<td>0</td>
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<tr>
<td>Traub(^{30})</td>
<td>1982</td>
<td>272</td>
<td>41 (15.1%)</td>
<td>1 (2.4%)</td>
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<tr>
<td>Barrett(^{32})</td>
<td>1983</td>
<td>36</td>
<td>18 (50.0%)</td>
<td>0</td>
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<td>Kreis(^{35})</td>
<td>1987</td>
<td>85</td>
<td>42 (49.4%)</td>
<td>1 (2.4%)</td>
</tr>
<tr>
<td>Beal(^{36})</td>
<td>1988</td>
<td>—</td>
<td>119*</td>
<td>4 (3.4%(^{†}))</td>
</tr>
<tr>
<td>Pickhardt(^{37})</td>
<td>1989</td>
<td>314</td>
<td>155 (49.4%)</td>
<td>4 (2.6%)</td>
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<tr>
<td>Molin(^{38})</td>
<td>1989</td>
<td>412</td>
<td>160 (38.8%)</td>
<td>4 (2.5%)</td>
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<tr>
<td>Feliciano(^{‡})</td>
<td>1989</td>
<td>553</td>
<td>240 (43.4%)</td>
<td>3 (1.3%)</td>
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<tr>
<td>Pachter(^{‡})</td>
<td>1989</td>
<td>152</td>
<td>102 (67.1%)</td>
<td>2 (2.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2052</strong></td>
<td><em><em>878</em> (42.8%)</em>*</td>
<td><strong>20/997(^{†}) (2.0%)</strong></td>
</tr>
</tbody>
</table>

*does not include Beal data
\(^{†}\)does include Beal data
Splenic Salvage After Intraoperative Splenic Injury During Colectomy

Stefan D. Holubar, MD; Jeffrey K. Wang, MD; Bruce G. Wolff, MD; David M. Nagorney, MD; Eric J. Dozois, MD; Robert R. Cima, MD; Megan M. O’Byrne, MA; Rui Qin, PhD; David W. Larson, MD

- Retrospective review of splenic injuries
- 59 injuries out of 13,897 colectomies (0.4%)
- 6 (10%) occurred without splenic flexure mobilization

Arch Surg. 2009;144(11):1040-1045
Splenic Salvage After Intraoperative Splenic Injury During Colectomy

**MANAGEMENT OF SPLENIC INJURIES**

- Splenectomy: 76%
- Attempted Repair
- Splenorrhaphy: 7%
- Primary Repair: 17%
Splenic Injury and Survival

Figure 1. Overall survival after colectomy with or without splenic injury.
Splenic Salvage After Intraoperative Splenic Injury During Colectomy

• Higher short and long-term mortality after splenic injuries

• However
  – Splenectomy vs preservation:
    • No difference in short-term adverse events
    • No difference in long term survival

• Conclusions: splenic salvage is frequently unsuccessful, outcomes not worse with splenectomy (vs. splenic salvage)
Summary

- Several methods are available for repair of splenic injuries
- Full mobilization is key to successful repair
- Splenorrhaphy can be performed safely in properly selected patients
Next Steps

- Patient condition
- Concomitant injuries
- Degree of splenic injury
Why not splenectomy?

• OPSI
  – 0.3-2% in adults
  – Mortality 50-80%

• Delayed immunologic deficits
  – ↓ antibody (IgM), opsonins, compliment activation
Laparotomy

Splenic injury identified

- Hemodynamically stable
- Isolated splenic injury
- Minimal concomitant injury

Low grade splenic injury (capsular tear)
- Topical hemostasis
- Argon beam/cautery
- Surgicel, Avitene, Fibrin
- Capsular suture (pledgeted)
- Compression

High grade injury
- Polar injury
  - Pledged suture repair
  - +/- topical hemostasis

Complex capsular injury
- Stellate
- Wrap with absorbable mesh
- Consider splenectomy
• “Equal tension on both sides of the crevice is best obtained with two-handed ties.”

• “Displays of virtuosity by immature residents using fancy one-handed ties should be discouraged”

• From Mastery of Surgery, 5th edition and Dr. Alfonso
Indications for Trauma

Splenectomy

• Unstable
• Serious concomitant injuries
• Grades IV (some) and V
• Failed non-operative management