Impalement:

- Penetration of a body cavity or region by an elongated object which remains in situ
- Features of both penetrating and blunt trauma
  - Lower velocity
  - Significant blunt force

Epidemiology of Impalement

- Falls
  - 1999: 17 employee deaths/day
    - #1 MVC
    - #2 Falls with impalement
- MVCs: posts, poles, gearshifts
- Assaults: weapons, perineal wounds

Unstable patients usually die at the scene
History

- Long a method of combat and torture
- "Vlad the Impaler" 5th Century
  - Most notorious
  - 15th prince of Romania
  - Inspiration of "Dracula"
  - Used torture extensively

Impalement

Literature Review:

- Perineal Impalement
  - Pediatrics
  - Job injuries
  - Auto eroticism
- Torso impalement
  - Falls, MVCs, assaults
- Head and Neck
  - "running with scissors"

Epidemiology
- Virtually non-existent
- Mostly case reports

<table>
<thead>
<tr>
<th>Impalement</th>
<th>Table 1: Abdominal Impalement Injuries: Review of the Literature (1980-2000)</th>
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<tr>
<td>Study</td>
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<td>Sykes et al., 1990</td>
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<td>Gendeiner &amp; Bates, 1990</td>
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<td>Ch et al., 1990</td>
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J Trauma 2005 July;51(1):164-167
Types of Impalement

- **Type I**
  - Moving body, immobile object
    - Falls, MVCs, fences
- **Type II**
  - Moving object, immobile body
    - MVCs, Assaults, Spears

**OSHA Standards**

Impalement protection:

- OSHA notes that although they do not provide approvals on any products, they do note that manufactured steel reinforced caps and wooden troughs are commercially available which will meet the test criteria of a 250 pound weight dropped from a distance of 10 feet without break through by the rebar. OSHA has also indicated that the manufacturers of these plastic mushroom caps agree that they are not designed to prevent impalement but merely provide scratch protection.
The soldiers broke the legs of the two thieves, but when they came to Jesus and saw that he was already dead, they did not break his legs. Rather, one of the soldiers pierced his side, probably with an infantry spear, and produced a sudden flow of blood and water.

Management of Impaling Injuries

- Depends on
  - condition of the patient
    - Stable or Unstable
  - capabilities of EMS
    - Extrication capability?
      - Jaws of Life
      - Bolt Cutters
      - Cutting Torch
      - Saw
    - And...
      - Transport time to definitive care?

Impalement Injury Management

- ABCs first!
- In General:
  - Field
  - ER
  - OR

—don’t remove object until in the OR
Field Management of Impalement
DO NOT REMOVE THE OBJECT!

- ABCs
  - Airway
  - Breathing
  - Circulation- IV access
- Consider multi-cavity penetration!
- Early communication with Medical Control
- Don’t remove object
- Trim back to facilitate transport
  -- But leave a handle?
- Stabilize object
  - Transfer to definitive care
- Don’t remove object

ER management of Impalement

IMPalement

- Rule #1

DON’T REMOVE THE OBJECT
ER management of Impalement

• Review and assure ABCs
• Tailor evaluation to:
  – Patient’s condition
  – Location of impalement
• In general: minimize unnecessary tests
  – Type and Cross
  – Baseline Labs
  – Tetanus prophylaxis
  – Assemble necessary consultants
  – Diagnostic imaging if patient is stable

IN The ER:

• RULE #1

DON’T REMOVE THE OBJECT

OR management of impalement

• Stabilize the object and position the patient
• Make a plan:
  – Considerations for Incision(s):
    • Location and trajectory
    • Proximal and distal vascular control

Hope for the best, prepare for the worst!
OR management
(continued)
• Incisions
  – Neck Zone II: explore, consider trache
  – Chest
    • Thoracotomy(ies)
    • Median sternotomy
  – Abdomen
    • midline vs connect entry and exit
  – Extremity
    • "fistulotomy" incisions, multiple

OR management
• Prepare for, and assume hemorrhage
• Prophylactic Antibiotics
• Perineal trauma:
  – Debride, decontaminate, ?Divert
• Thorough exploration of cavity and adjacent structures
• Leave skin open

Impalement:
Personal series
1. Construction worker, fell on rebar
2. 12 y.o passenger face vs pole
3. Motorcyclist- left road into bushes
4. ATV rider- left trail into bushes
5. Mt Biker vs tree limb though flank
6. Construction worker- fell on stake
7. MVC- car through iron fence
8. MVC- car through wood fence
9. Branch through abdomen (logger)
10. Board through abdomen (plane crash)
Patient 1

32 y.o. construction worker
- Fell on rebar
- Penetrating wound of perineum
- Lifted off rebar
- Hypotensive, abdominal distention
- OR: “carved-out” Rt SI joint, avulsion of internal iliac vein and artery

And Van Eaton’s

Patient 3

1. Motorcyclist- left road into bushes
   - Laid in bushes for 4 hours
   - Hypotensive on arrival
   - Positive DPL
     - Lap, splenectomy
   - “Trivial shoulder injury”
   - Died of clostridial sepsis day 6
     - Retained wooden foreign body
Patient 4

- 38 y.o. ATV rider-
  - Left trail into bushes
  - Impaled on branch in Rt thigh
  - Explored in OR,
    - Missed femoral vessels
    - Negative lap
  - Recovered after 1 month to heal open wound

Patient 6

- 32 y.o. construction worker
  - Slipped and fell down slope
  - Impaled perineum on survey stake
  - Stable VSs
  - Blood on rectal exam
    - Exploratory lap, colostomy
    - Sphincter repair
  - Persistent obturator n palsy
  - Impotence

Patient 6

- Single car, high speed MVC
  - Car through iron fence
  - Fence through patient
  - EMS cutting torch to free patient
  - Taken to local hospital- stable VS
  - Transferred via ALNW to HMC
Patient 6

- Single car, high speed MVC
  - Car left road and went through wooden fence
  - Wooden fence went through car & patient
  - Board sawed off by EMS in field
  - Stable VS
- Taken to local hospital
- In OR, unable to remove board
- Transferred to HMC via ALNW

Patient 6.b?

Patient 7

- Single car, high speed MVC
  - Car left road and went through wooden fence
  - Wooden fence went through car & patient
  - Board sawed off by EMS in field
  - Stable VS
  - Taken to local hospital
  - In OR, unable to remove board
  - Transferred to HMC via ALNW
Too much of a good thing:

In ER:

- VS normal
- Awake, intubated
- Absent Rt femoral pulse, threatened foot
- CT scan done to better assess injury
In the OR:

- General Surgery, Vascular Surgery
- Type and Cross match
- ? s:
  - Patient positioning
  - Ortho help
  - Power Tools

OPERATIVE PROCEDURE: 1. Exploratory laparotomy.
2. Ligation left common iliac vein.
3. Repair colon injury and suture mesentery.
4. Debridement and irrigation of flank wound.
5. Repair right inguinal hernia.

ATTENDING: Eileen E. Bulger, MD
SURGEONS PRESENT: Eileen E. Bulger, MD
Mark H. Meissner, MD (Vascular Surgery)
Hunter B. Wessels, MD (Urology)
Kimberly Costas, MD

Post OP

- RLQ fascial defect
Large, RLQ defect

Biosynthetic Hernia Repair
Post Op Course

- Viable foot
- Femoral Nerve Palsy
- Foot drop
- Rt lower quadrant hernia

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Post Op

- TFL delay and repair
- Ischemia
- Debridement
- Doing well
  - Many ops later
  - Risk reduction speaker for teens

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Patient #9

- Felling dead tree
- “Widow Maker”
- Struck by trunk/branch
- Pinned Prone
- Down 2 hrs
• Branch exiting anterior abdomen

• Branch impaling mesentery X 2
3 months later:

Images courtesy of USDA Forest Service, Mount St. Helens National Volcanic Monument
Patient #10

• Light plane crash
• Impaled by boat
• Flank out LUQ
• Loss of tissue

Pt. 10
Damage Control Laparotomy

• Multiple return trips to OR
• Debridement of non-viable tissue
• Missing Rectus muscle in LUQ

Partial closure
4 Months later

Patient 12

Steak knife(s) vs RUQ
- 2 knives stuck in him when medics arrived
- #1 fell out during EMS evaluation
- #2 Barely nicked the liver.

*The hidden benefits of the obesity epidemic*
Patient #13

• Car vs fence
• Split rail fence
  wooden rail split by steering wheel

SUMMARY
Impalement Injuries
  • Management depends on the patient's condition
    — ABCs
    — Leave object in place
    — Expect hemorrhage
    — Thorough exploration
    — Team approach …….

IMPALEMENT
  • Rule #1

DON'T REMOVE THE OBJECT