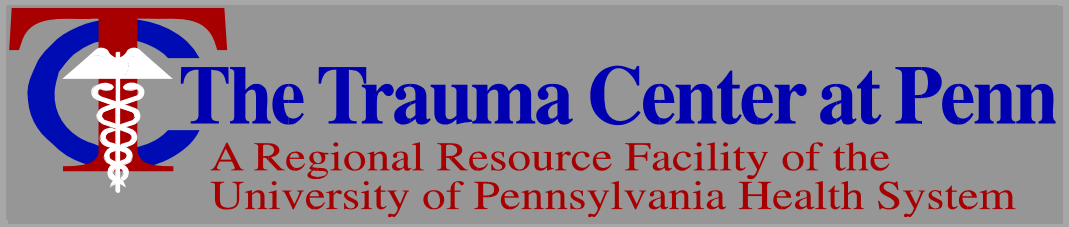
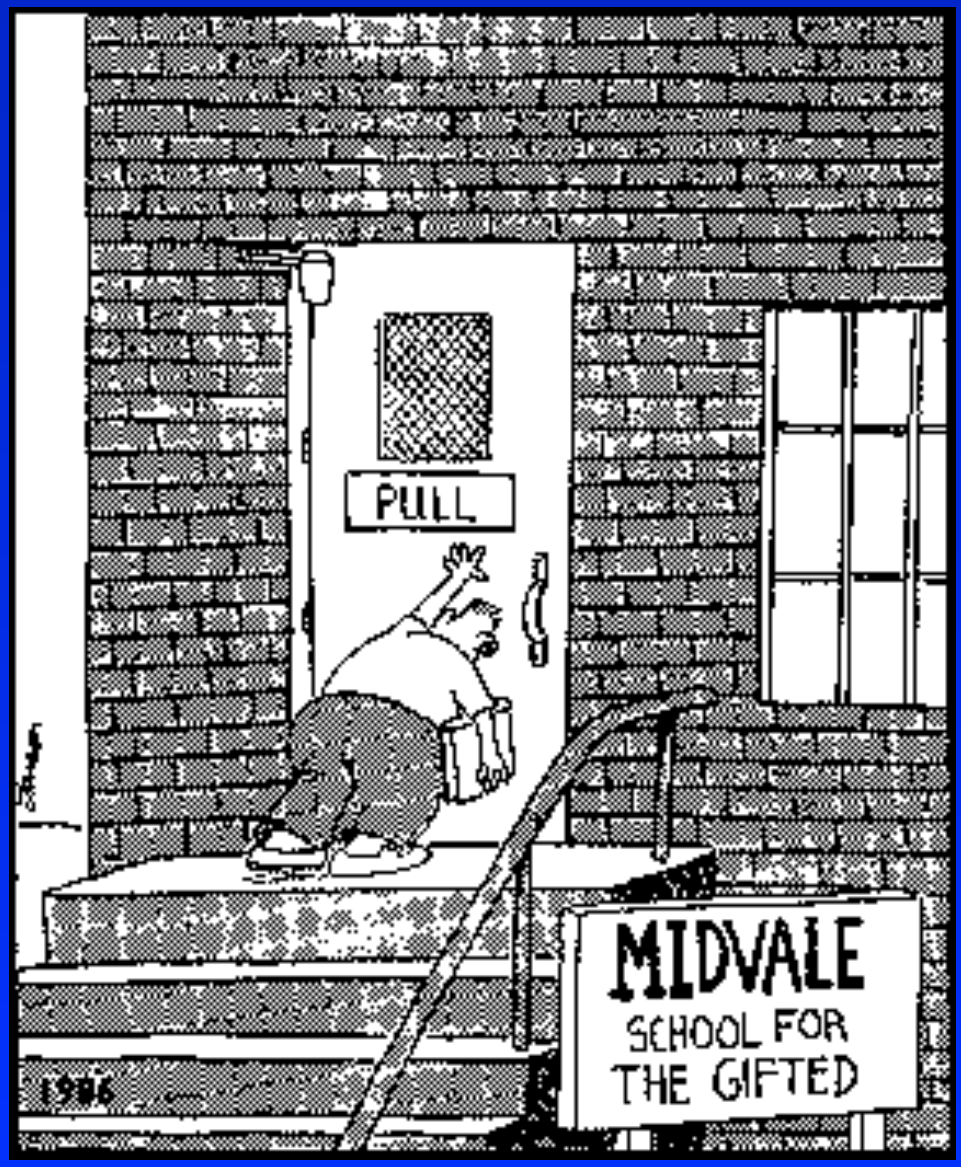
Gunshot Wounds to the Abdomen: From Bullet to Incision

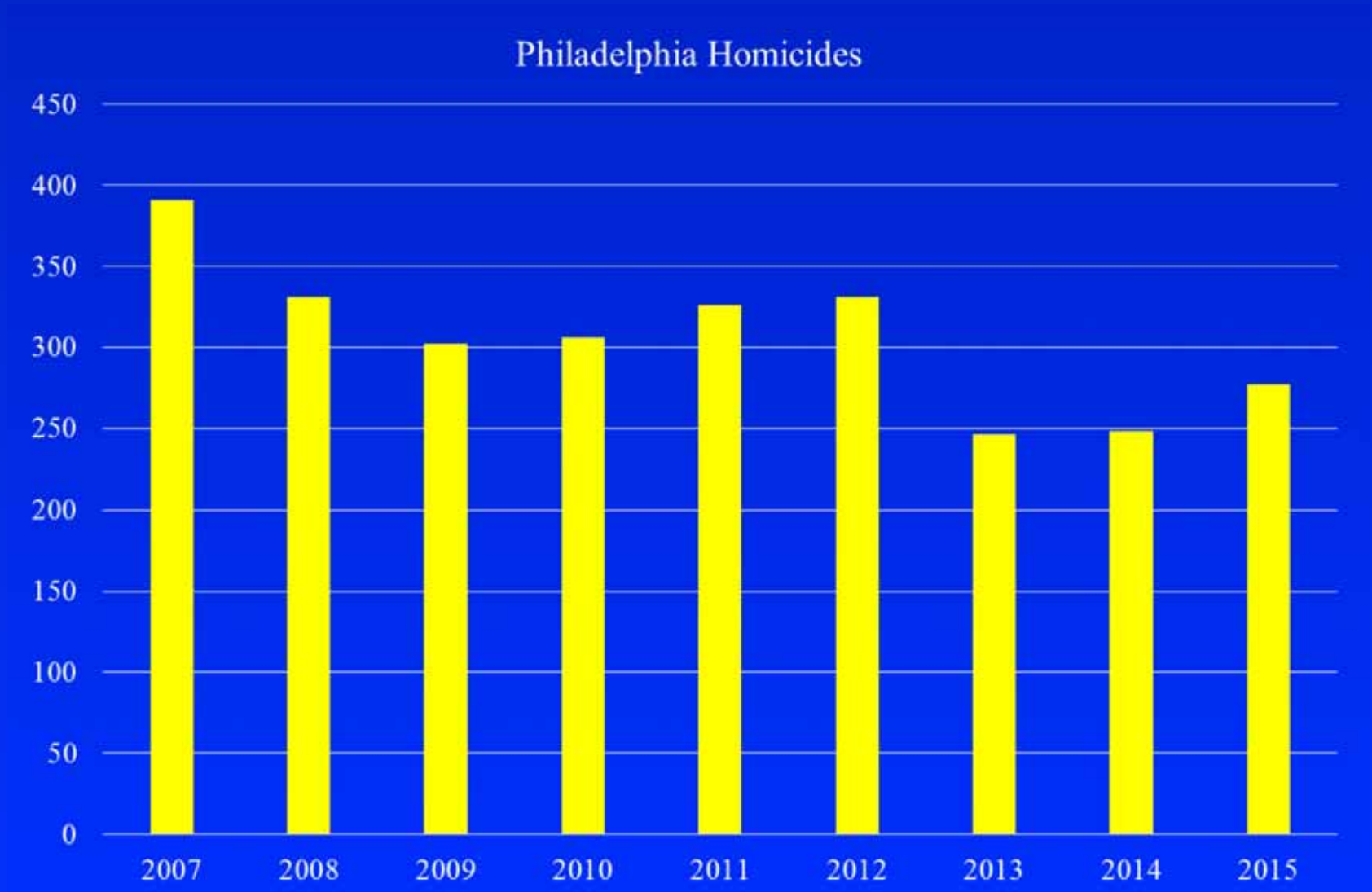
Patrick M Reilly MD FACS



Master?



…I Do Get The Chance to Practice…



What Are We Not Discussing?

- Stab Wounds
- Prehospital Care
- Management of Specific Injuries
- Damage Control
- What is the Best New Zealand Pinot Noir

What Are We Discussing?

- Examining the Patient
- Imaging the Patient
- Rapidly Synthesizing Data
- Going to the OR

What Are We Discussing?

- Examining the Patient
- Imaging the Patient
- Rapidly Synthesizing Data
- Going to the OR
- …Probably…

Injury Identification

“ (Accurate) Trajectory Determination Equals Injury Identification”

Mike Rotondo MD

CEO Faculty Group

University of Rochester

Preparation

- Short Prehospital Times
- Little / No Notification
  - It Helps to Have Some
- Universal Precautions
  - Protection of Team
- Assign Roles

Preparation

- Equipment
  - RSI Drugs and Equipment / Team
  - Quick Look Paddles
  - Chest Tubes
  - ED Thoracotomy Tray
- Uncrossmatched Blood Products

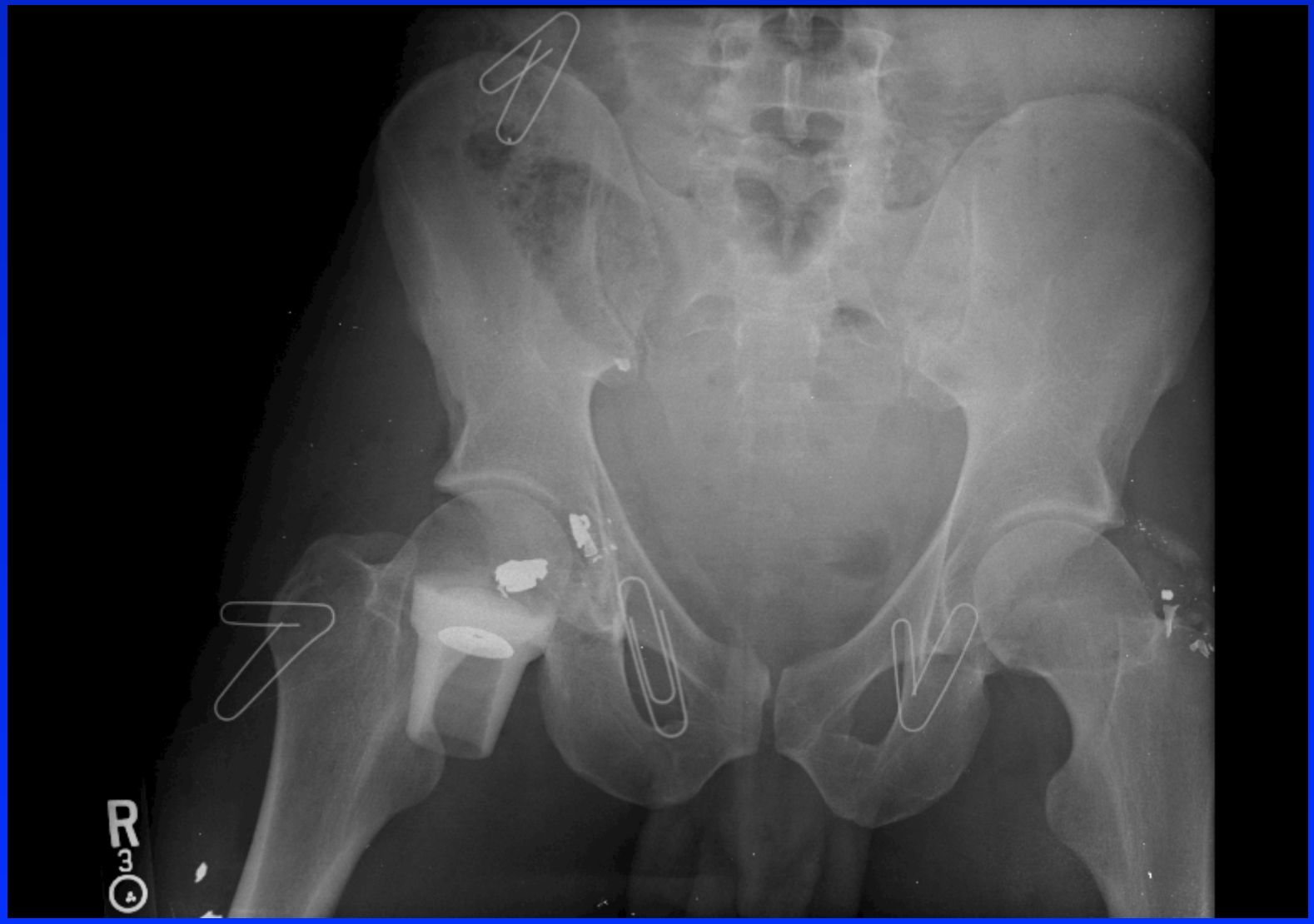
Arrival

- Listen to Report – If Any
  - **M**echanism
  - **I**njuries
  - **S**igns
  - **T**reatment
- Listen to Patient
  - “I’m Gonna Die”
  - “I Can’t Breathe”
    - Normal Chest Exam / CXR
      - Severe Metabolic Acidosis

Primary Survey

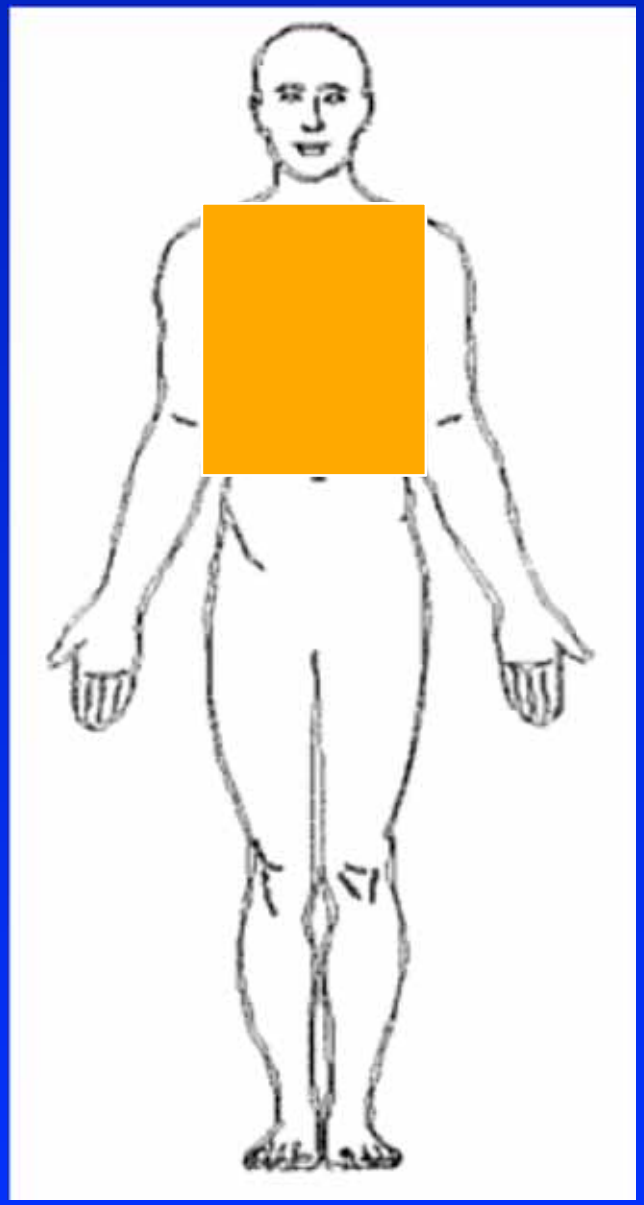
- Airway
- Breathing
  - Triage Quickly Depending on Physiology
- Circulation
  - Shock – Likely OR
- Disability
  - Moving Legs – Trajectory Point
- Exposure
  - Rectal Exam Properly Done
  - Mark Wounds

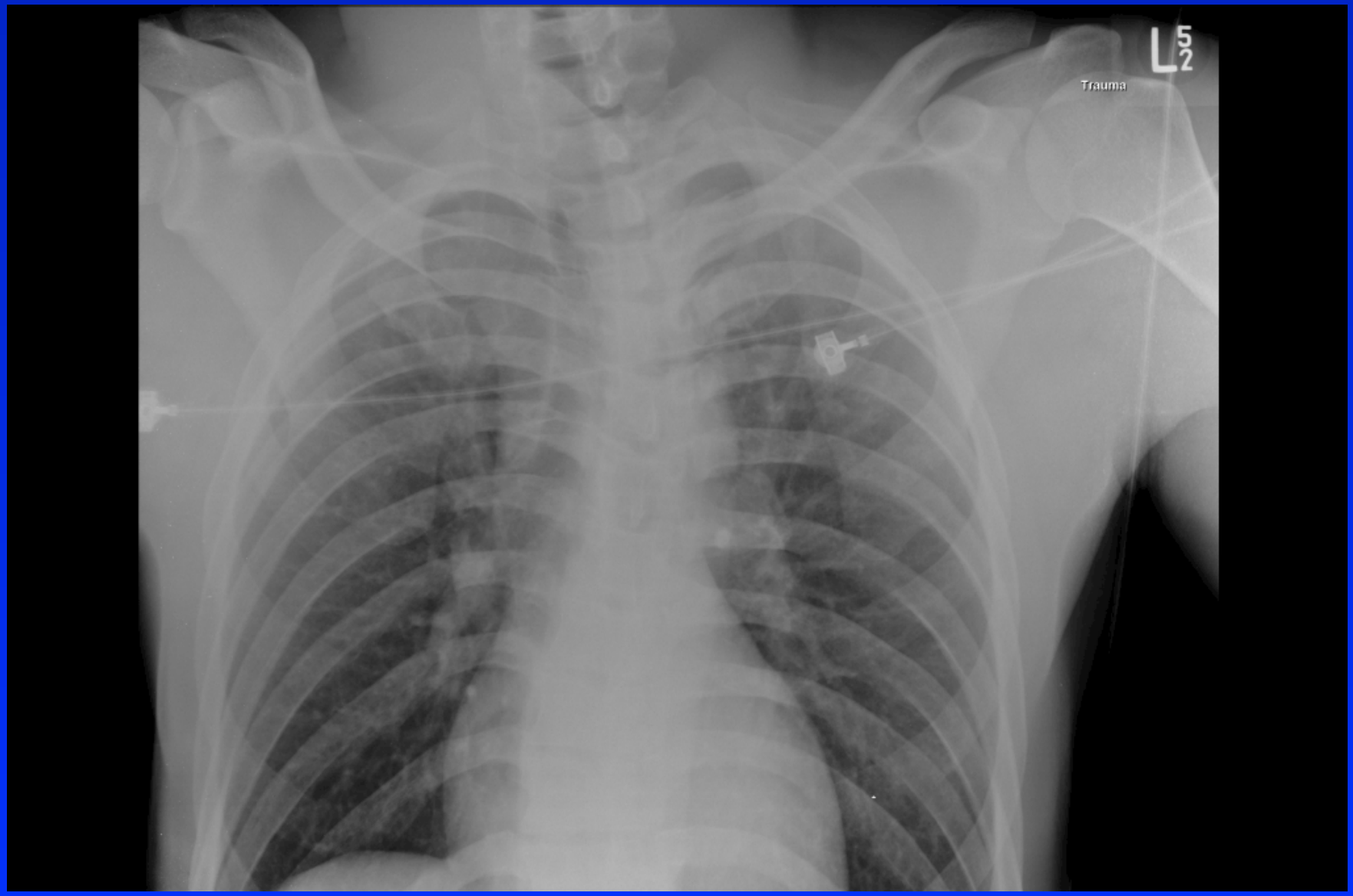
Paper Clips



Secondary Survey and Imaging

- Secondary Survey
  - Extremity Wounds
    - Look Under BP Cuff
  - Disparate Extremity Pulses
  - Obvious Fractures
- Three Plain Films of Torso
  - Lateral Film?
- FAST

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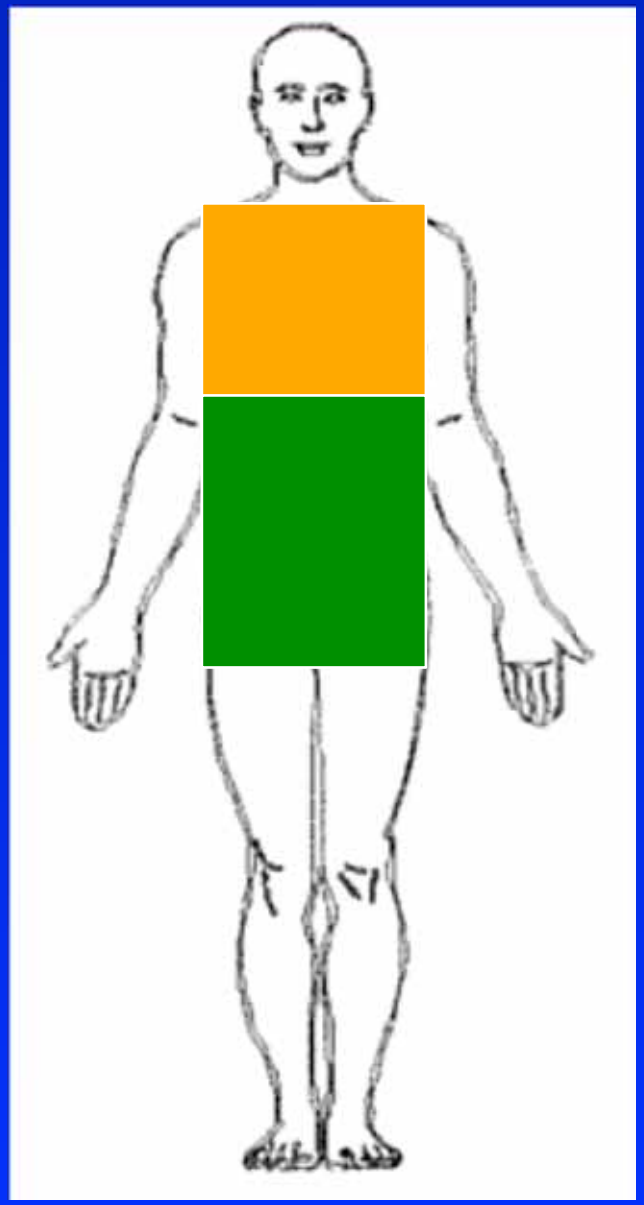
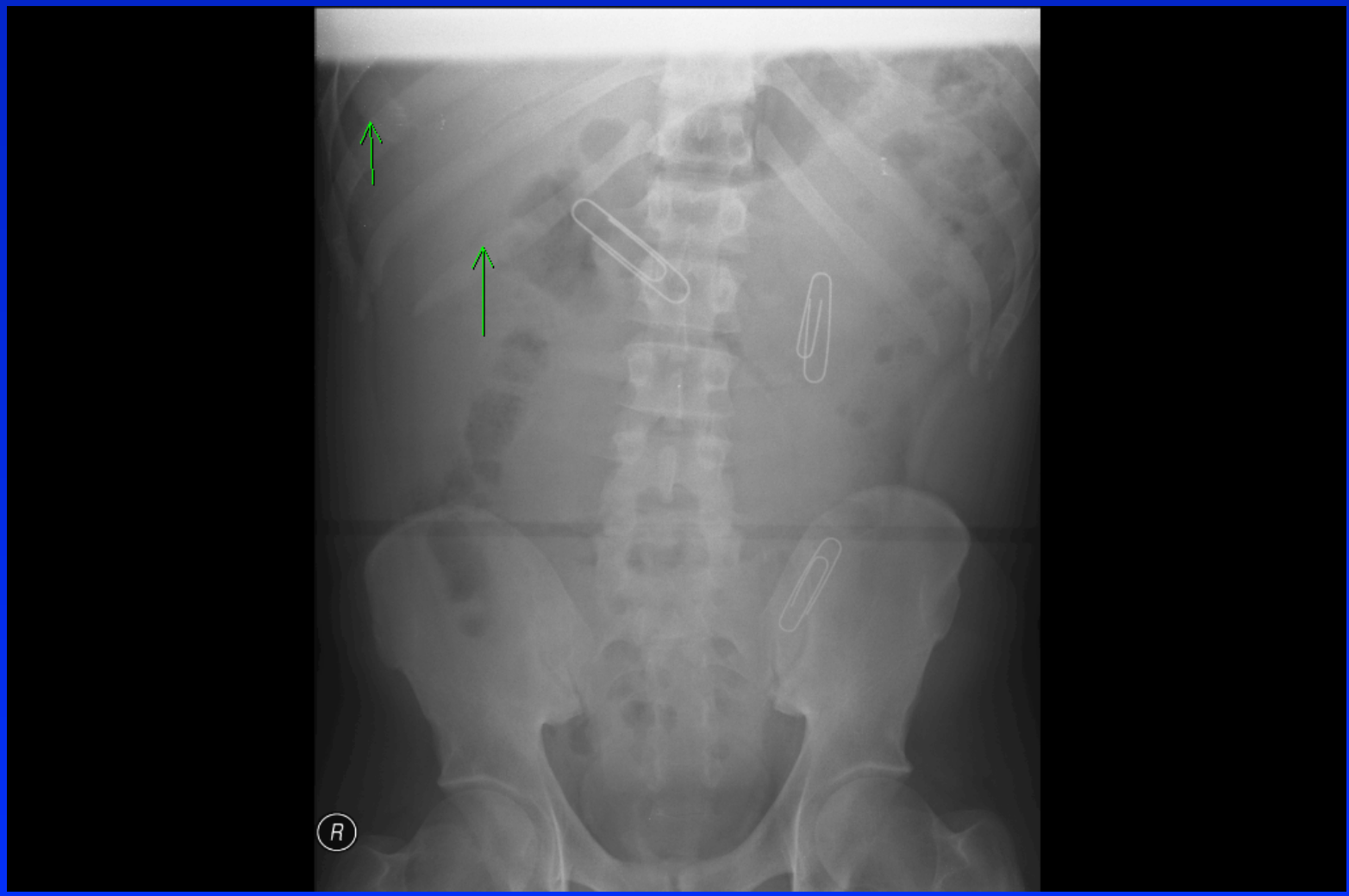
Trauma

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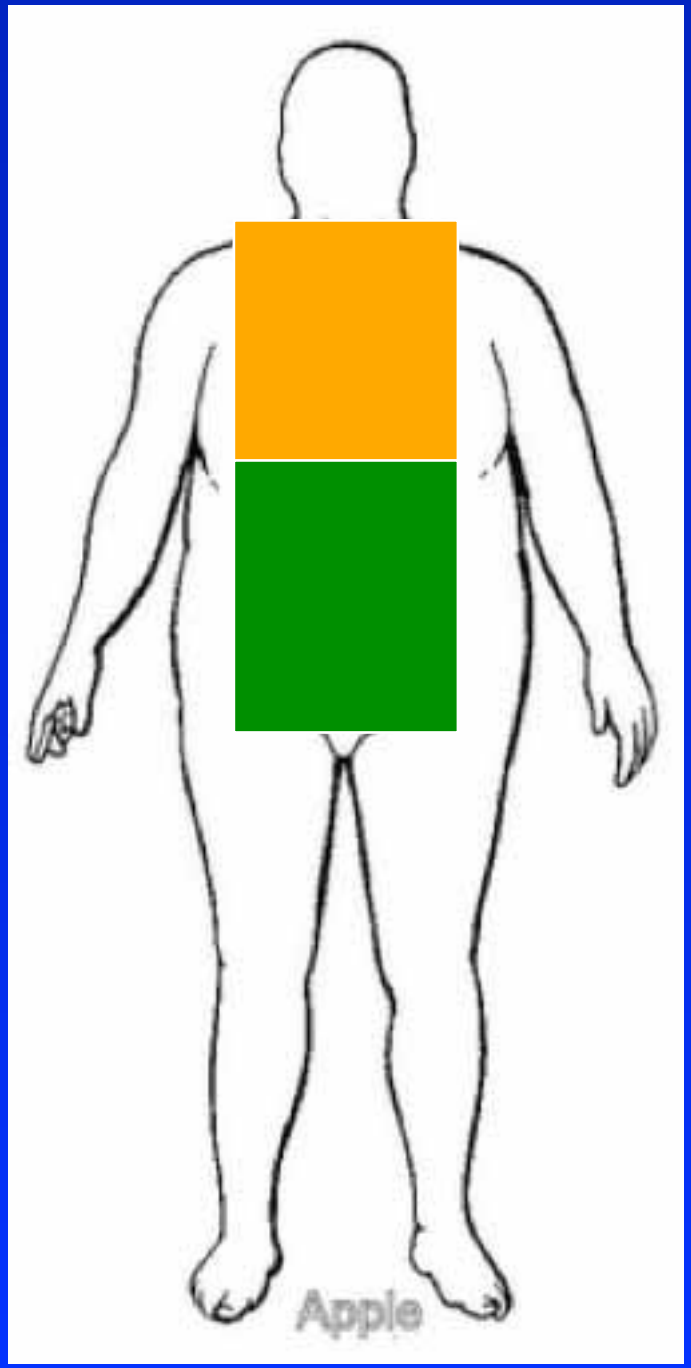
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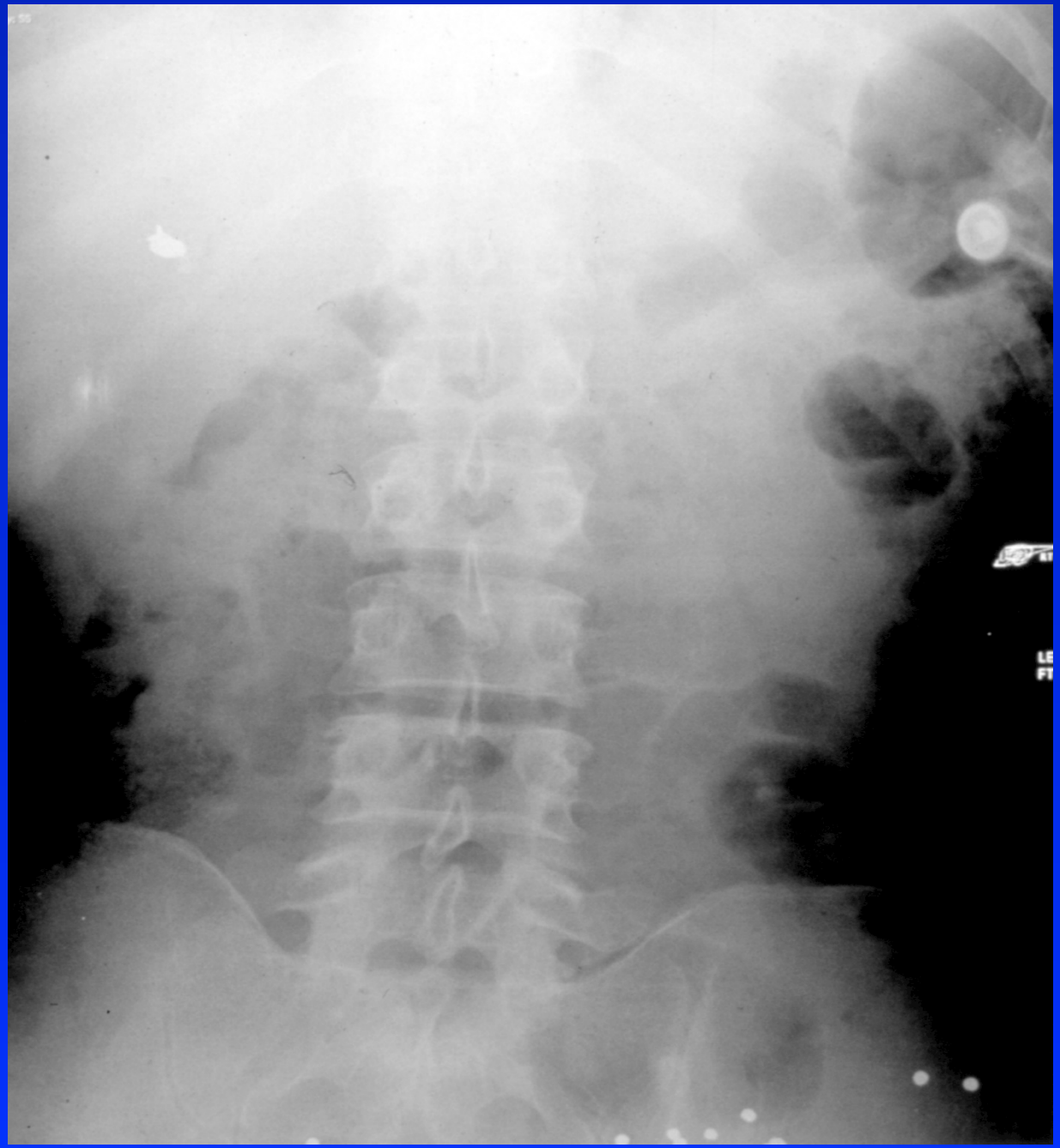

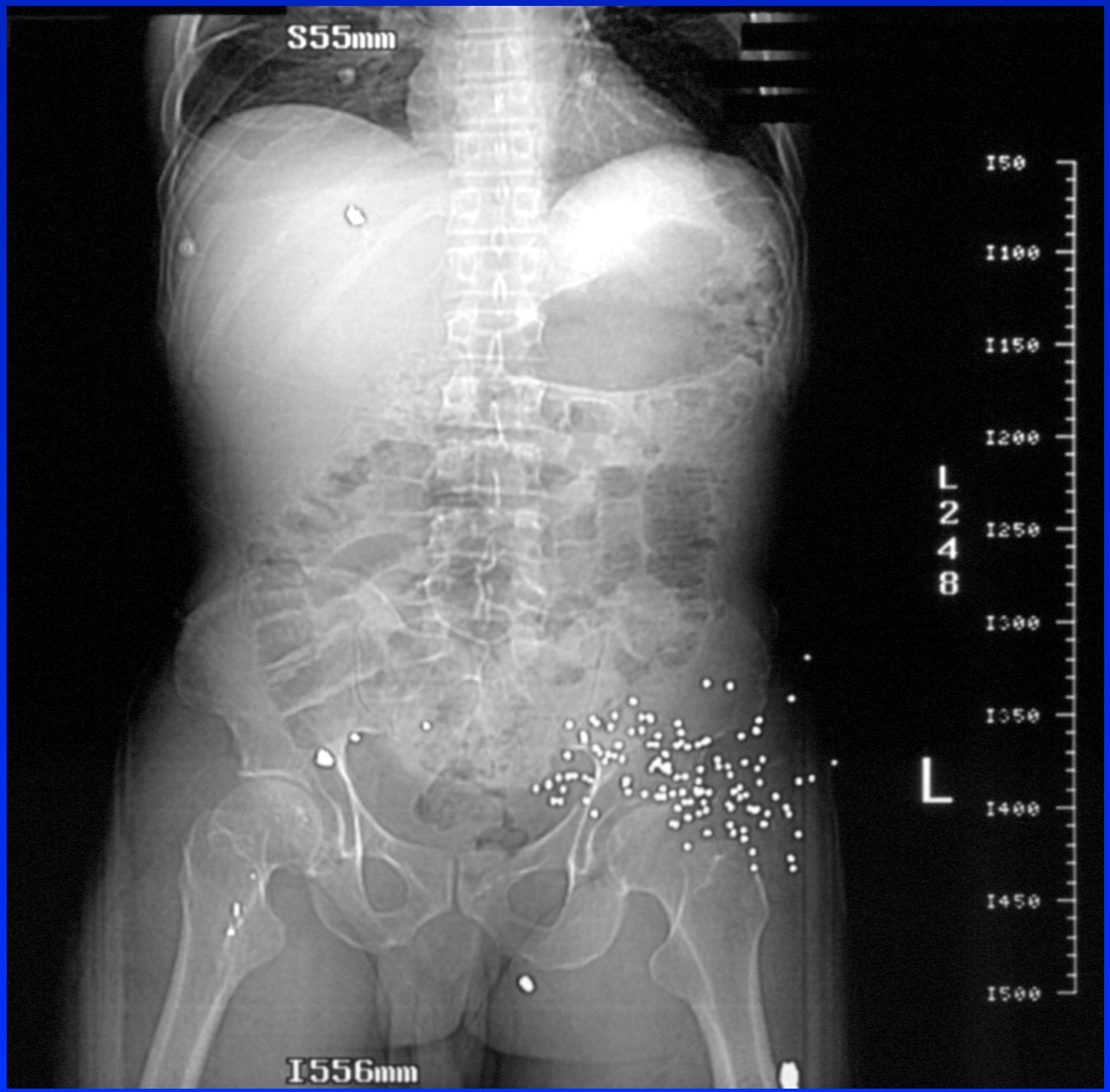
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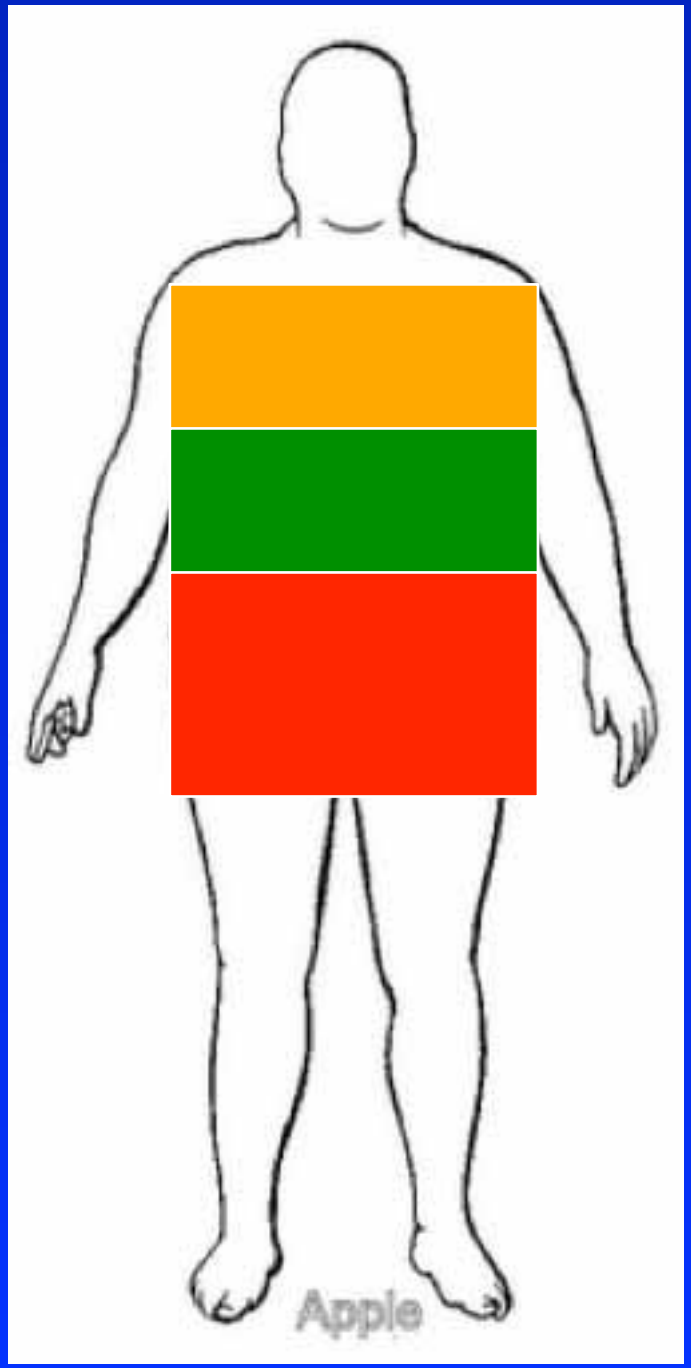
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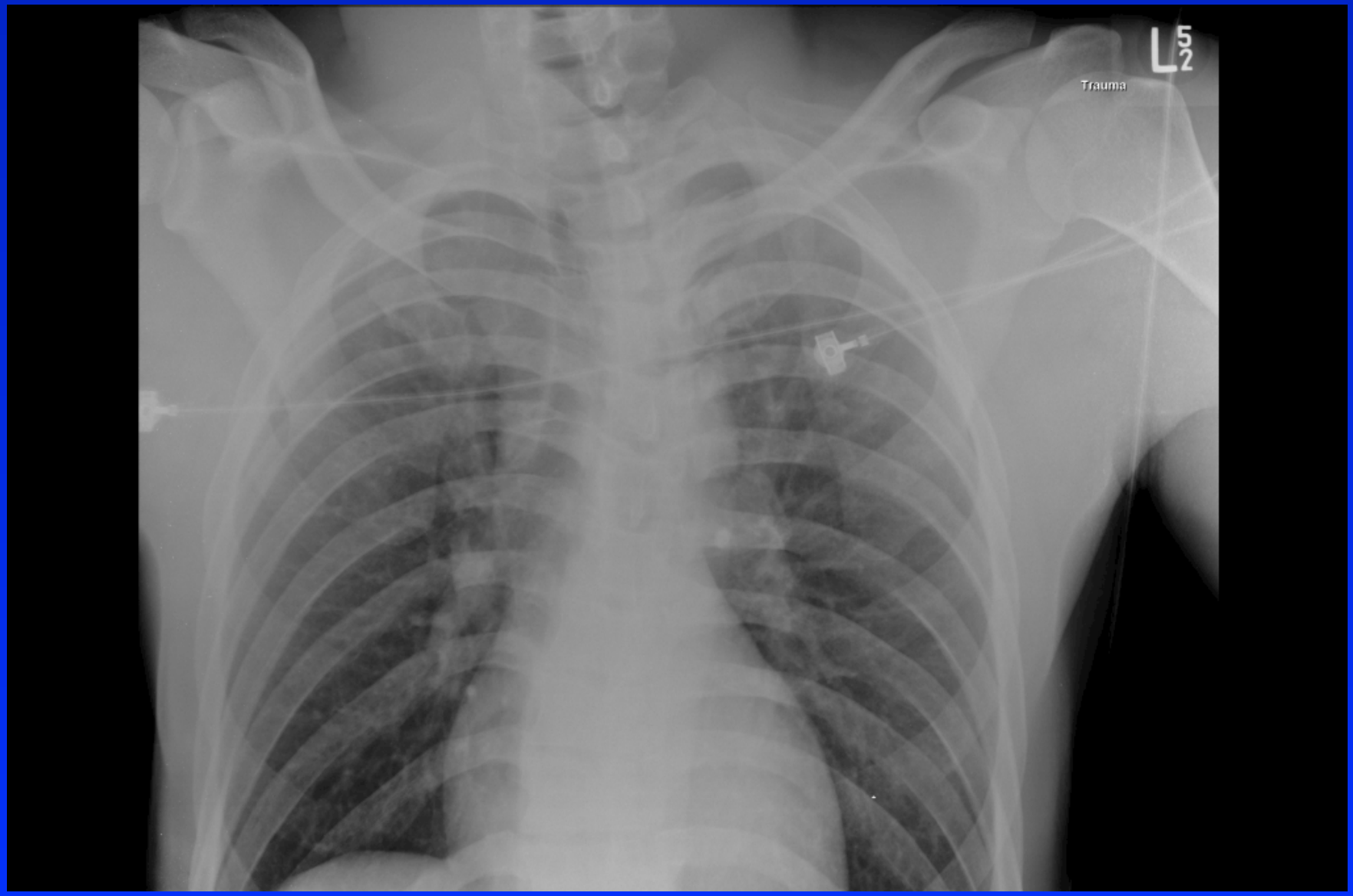
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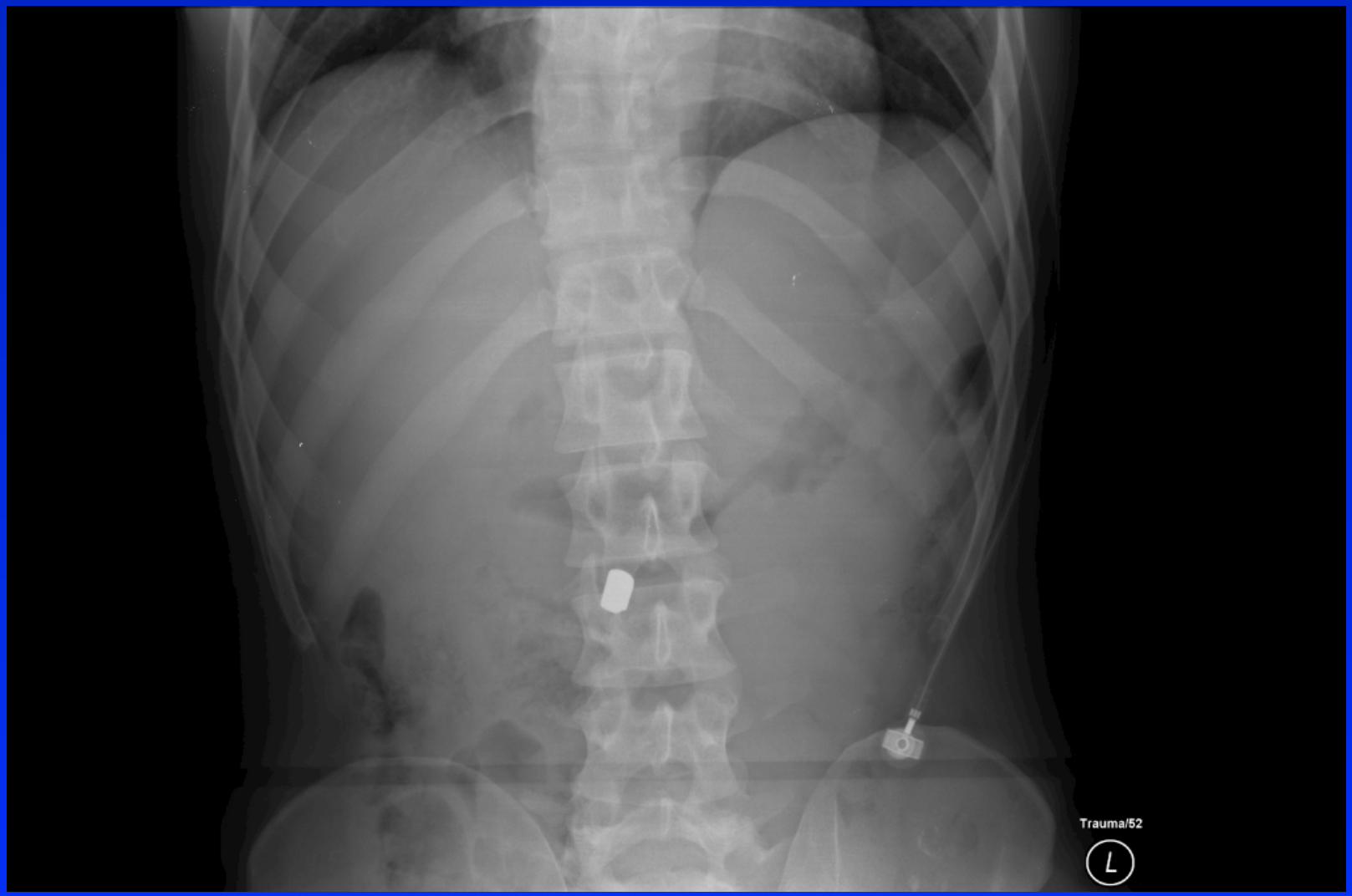
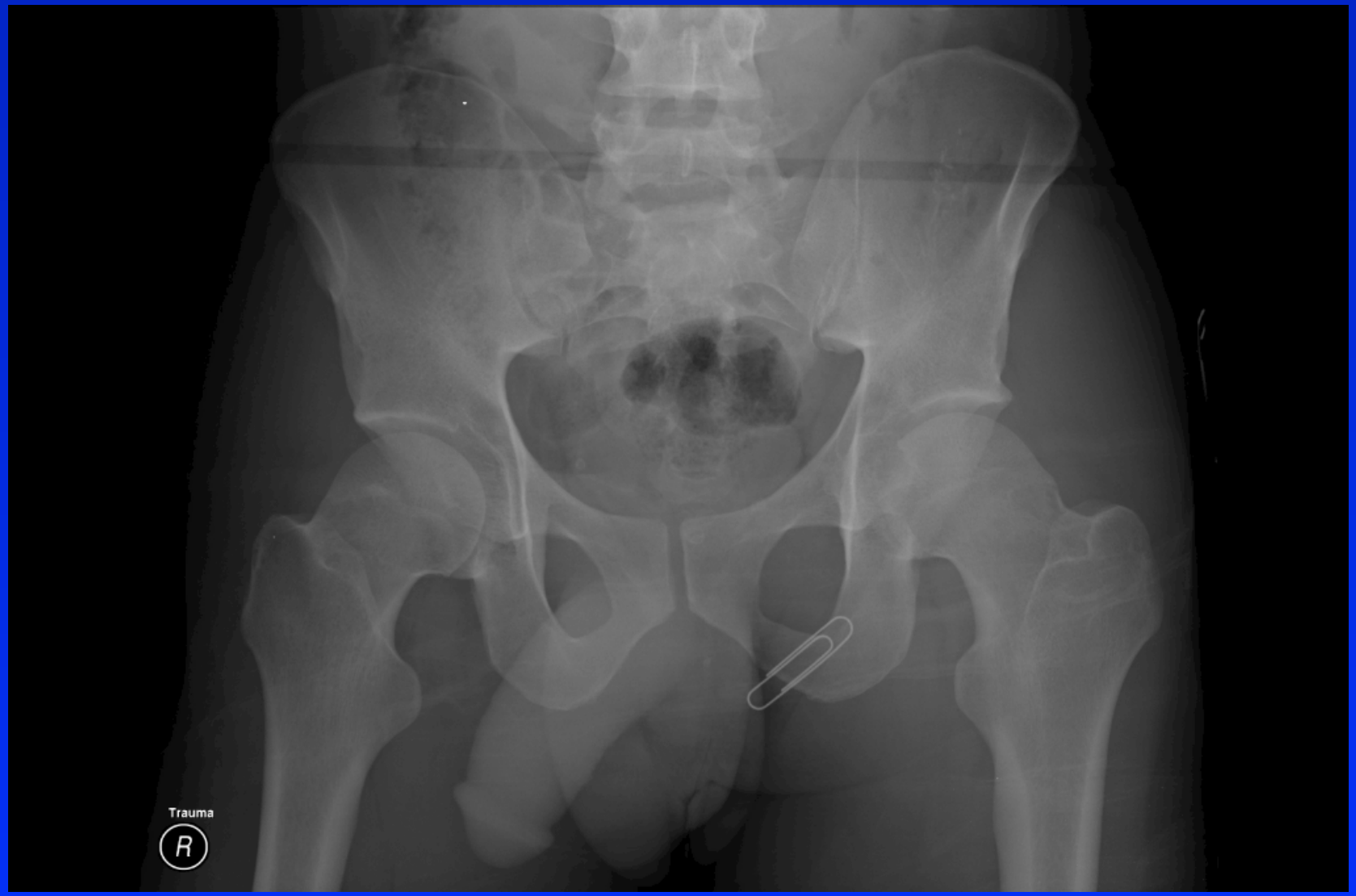
Trauma


Trauma/52
L


Trauma
R

More Trauma Dictums

- “(Accurate) Trajectory Determination Equals Injury Identification.”
- “The Number of GSWs and Foreign Bodies Should Equal an Even Number.” If Not…
  - Missing a Wound
  - Missing a Bullet
  - Patient Has Been Shot Before
    - Ask the Patient!

"You're gonna be OK, mister, but I can't say the same for your little buddy over there. ... The way I hear it, he's the one that mouthed off to them gunfighters in the first place."

FAST Exam and Abdominal GSW

- Do It on Everyone
  - Increased Experience
  - Increased Likelihood Positive Exam
- Positive FAST Predictive
- Negative FAST Not Predictive
  - Keep Churning
  - Going to the OR!
- Do I Tell My Oral Board Examiners?

FAST Exam and Abdominal GSW

What is the utility of the Focused Assessment with Sonography in Trauma (FAST) exam in penetrating torso trauma?

Antonia C. Quinn *, Richard Sinert

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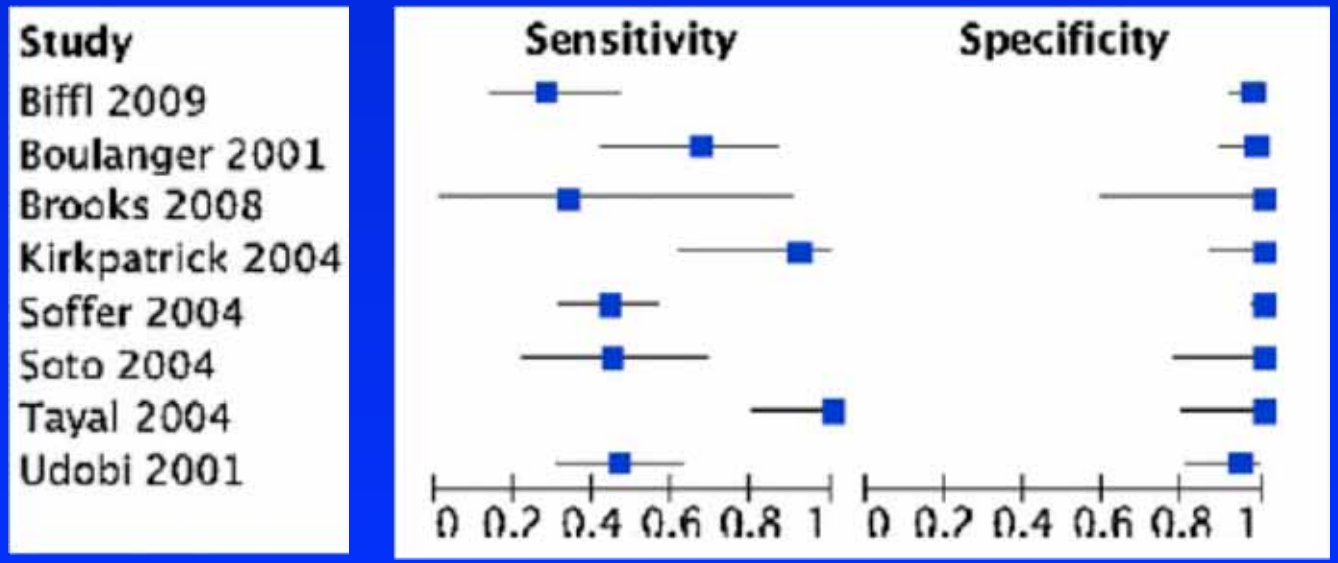

Injury 2011

Mandatory Laparotomy

HISTORY

CONFLICT	MORTALITY
Civil War	72%
WW I	53%
Korea	12%

Mandatory Laparotomy
Justification

* Injury Identification Requires Laparotomy
* GSW = Prohibitive Rate of Visceral Injury
* Delay to OR = ↑ Morbidity and Mortality
* Laparotomy = No Morbidity
* Laparotomy = Minimal Economic and Social Costs

Mandatory Lap : Plus Side

* Incidence of Intra-Abdominal Injuries
    - Am Surg 1993 85%
    - S Afr Med J 1988 98%
    - Am J Surg 1980 96%
* Unreliable Physical Exam
    - Am J Surg 1980 17%
    - Arch Surg 1980 20%
    - J Trauma 1977 41%

Mandatory Lap : Plus Side

* No Missed Injuries (Hopefully)
* No Delay in Diagnosis
    - No Serial Exams
    - Primary Colon Repair
* Maximal Resident Exposure
* Oral Board Answer

Selective Laparotomy

History

* Stab Wounds
    - Serial Physical Exams vs. Mandatory Lap
    - Peritoneal Irritation
    - Decreased Nontherapeutic Lap Rate
        - 34% → 7%

Am J Surgery 1960

Selective Laparotomy

History

* Stab Wounds - Further ↓ in NT Lap Rate

DPL

Am Surg 1977

Am J Surg 1984

Local Wound Exploration

J Trauma 1977

J Trauma 1980

BUT…..

* Stab Wounds are not Gunshot Wounds

	SW	GSW
Peritoneal Penetratration	66%	85%
Of Which……		
Surgical Intervention	50%	95%

Injury Identification

* Laparoscopy
    - Determine Trajectory?
    - Peritoneal Penetration?
        - Tangential GSW
    - Injury Identification?
    - Not Surgery? NO

Injury Identification

* Laparoscopy - Literature

  Stable / No Indications for Laparotomy

  Left ThoracoAbdominal GSW

  Peritoneal Penetration

  + Injury Identification

  Retroperitoneum

Arch Surg 1992

J Trauma 1995

J Trauma 1998

Injury Identification

* CT Scan
  - Determine Trajectory? YES
  - Peritoneal Penetration? YES
    - Tangential GSW
  - Injury Identification?
    - Solid Organs YES

Injury Identification

* CT Scan - Literature

  Stable / No Indications for Laparotomy

  Back / Flank

  Retroperitoneum

  Abdomen / Chest

  J Trauma 1986

  J Trauma 1991

  J Trauma 1998

  J Trauma 1998

Rate of Visceral Injury

* Thought to be High
* Vietnam - 19.2% Negative Lap Rate
* Civilian Wounds - Mandatory Lap

Negative Lap Rate	12 - 18%
Nontherapeutic Lap Rate	20 - 50%

Ann Surg 1974
J Trauma 1978
J Trauma 1995

Arch Surg 1976
Ann Surg 1988

Morbidity of Negative Laparotomy

* Multiple Associated Complications
    - Pulmonary
    - Infectious
    - Thromboembolic
    - Adhesions / Obstruction

Morbidity of Negative Laparotomy

* Morbidity Rate

  8 - 61%

* Mortality Rate

  0 - 1.6%

J Trauma 1972
Am Surg 1993
J Trauma 1996

Am J Surg 1988
J Trauma 1995

Morbidity of Unnecessary Laparotomy

* Prospective Data Base - Emory

  41.3% Complication Rate

  Mean LOS 8.1 Days

  Complications Tend to Add 50 - 100% to LOS

J Trauma 1995
J Trauma 1996

Morbidity of Unnecessary Laparotomy

* Prospective Study - USC

	LOS	Comp Rate
Ther Lap	12.5 d	39.3%
Neg/NT Lap	6.4 d	27.6%
Observation	3.3 d	

Arch Surg 1997

Costs of Negative Laparotomy

* Prospective Study - USC

	LOS	Comp Rate	Charges
Ther Lap	12.5 d	39.3%	
Neg/NT Lap	6.4 d	27.6%	$18,123
Observation	3.3 d		$8,595

Arch Surg 1997

Costs of Negative Laparotomy

* Retrospective Review
  - 230 NT or Negative Laparotomies
  - Estimated Savings
    - $2 Million
* Increased Disability - Poorly Studied

Am Surg 1994

Costs of Negative Laparotomy

* USC Study
* 8 Year Period
  - 3,560 Hospital Days Saved
  - $9,555,752 Hospital Charges Saved

Annals Surg 2001

What Are We To Do?

- Need to Plan on Going to the OR
  - Slowly Back Away as You Obtain Data

- Unstable / Peritonitis
  - Operating Room
- Unexaminable
  - Operating Room
- Limited Resources
  - Operating Room

What Are We To Do?

* Laparoscopy - Tangential Wounds
  - Mid Abdomen
  - Left ThoracoAbdomen
* CT Scan
  - Back / Flank
  - Right ThoracoAbdomen
  - Pelvis

What Are We To Do?

* Injury Identification
    - Solid Viscus
        - Liver /Kidney
        - No Arterial Blush on CT
    - Option for Nonoperative Management
* R Diaphragmatic Holes
    - Natural Hx?

Going to the OR – Practical Issues

- Consent
  - Possible Colostomy
- Antibiotics
  - Stop Them Promptly Post OP
- Tetanus
  - Yes…Unless Clear Up To Date
- Femoral A-Line
- Book
  - How Emergent?

PPMC OR Levels
Add - On cases

- Now – Self Explanatory*
- Hot – OR Less then Two Hours
- Cold – OR Less then Six Hours
- Urgent – OR Today
- Elective – Self Explanatory

Going to the OR – Practical Issues

- Intubation : Trauma Bay vs OR
  - Comfort Level
  - OAFAT

	EM	Anesth
Total	460	198
DL x 1	86.4%	89.7%
DL > 2	2.6%	3.6%
Surgical Airway	0.4%*	0%

* PI - Care Appropriate

Annals of Emerg Med 2004

Anesthesia Communication

- Formal Process
  - A : Intubated / Details
  - B : Chest Tubes?
  - C : Physiology and IV Access
    Blood Requests
  - D : Neuro Status in Trauma Bay
  - E : Location of Suspected Injuries

Blood Products

- Bring Trauma Bay Blood
- Type and Cross
  - Cell Saver
- Trauma Exsanguination Protocol
  - Cell Saver Included
- TXA

An Emergency Department Thawed Plasma Protocol for Severely Injured Patients

Zayde A. Radwan, BS; Yu Bai, MD, PhD; Nena Matijevic, PhD, PharmD; Deborah J. del Junco, PhD; James J. McCarthy, MD; Charles E. Wade, PhD; John B. Holcomb, MD; Bryan A. Cotton, MD, MPH

Table 3. Primary and Secondary Outcome Data[a]

Variable	Median (IQR) TP-ED (n = 164)	Median (IQR) TP-BB (n = 130)	*P* Value
Time to first unit of RBCs, min	18 (11-73)	20 (10-72)	.85
Time to first unit of plasma, min	43 (21-106)	89 (48-192)	<.001
24-h RBC transfusions, U	5 (2-10)	6 (3-11)	.13
24-h Plasma transfusion, U	6 (3-11)	7.5 (4-14)	.08
24-h Platelet transfusion, U	12 (6-18)	12 (6-18)	.77
24-h Cryoprecipitate transfusion, U	0	0	.03
Massive transfusion rate, %	27.0	39.0	.04
24-h Mortality, %	9.7	6.9	.39
30-d Mortality, %	20.7	22.3	.74
Hemorrhage-related mortality, %	14.7	27.5	.21

JAMA Surg 2013

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Table 4. Multiple Logistic Regression Model Predicting 30-Day Mortality

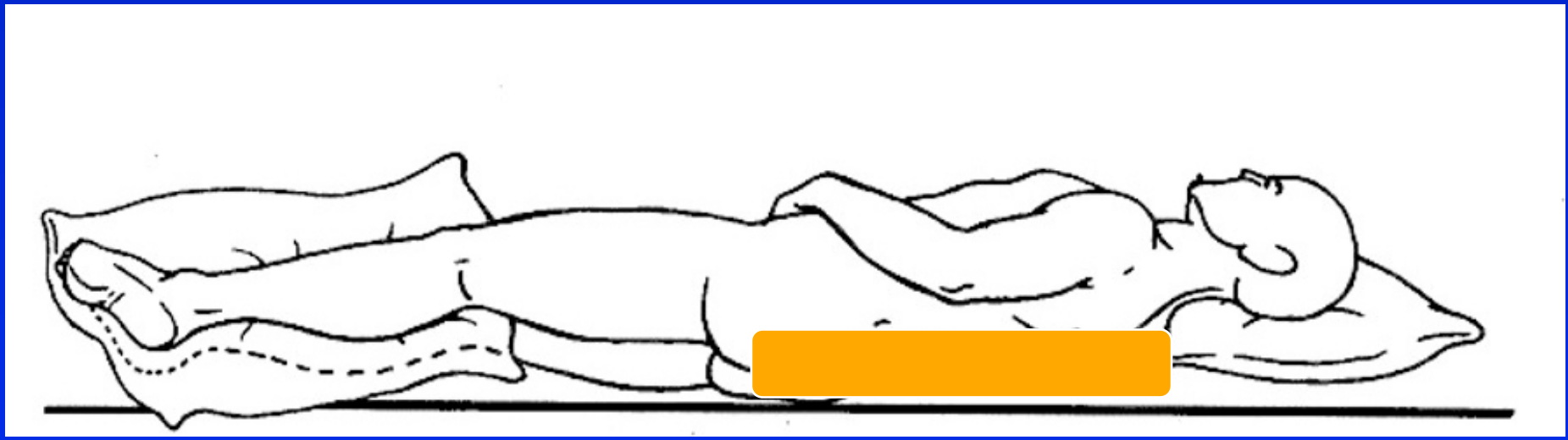
Variable	Odds Ratio (95% CI)	*P* Value
Thawed plasma in ED	0.43 (0.194-0.956)	.04
Injury severity (ISS)	1.12 (1.070-1.174)	<.001
Physiologic status (w-RTS)	0.84 (0.694-1.012)	.07
Admission base deficit	0.99 (0.921-1.070)	.84
Blunt mechanism of injury	2.32 (0.608-8.825)	.22

JAMA Surg 2013

Positioning

- Chest Tubes / Foley at Head of Bed
  - Make Sure Someone is Monitoring
- Majority of Patients
  - Supine
- Thoracoabdominal GSWs
  - Modified Taxi Hailing Position
  - Long Roll – Spine Precautions
  - Elevate Arm
  - Airplane the Table as Needed

Modified Taxi Hailing Position



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Positioning

- Pelvic GSW
  - Supine NOT Lithotomy
  - Concern for Pelvic Vascular Injury
    - Don't Want to Operate Uphill
    - Distal External Iliac Artery Injury
  - Stop / Reposition and Do Rigid Sigmoidoscopy Later
  - Presacral Drains PRN at End of Case

Incision

- Favor Abdominal Exploration First
  - Abdomen as a Black Box
  - Chest Tubes for Pleural Issues
  - Transdiaphragmatic Pericardial Window
  - Drape in / Follow Extremity Wounds?
- Generous Midline Incision
  - Chevron Incision for Prior Midline and Extreme Shock
- Good Luck!

Summary

- Plan on Going to the Operating Room
- Rapidly and Systematically Evaluate the Patient
- Let Physiology and Incoming Data Slowly Lead You to Further Studies and Away from Your Surgical Plan
- Plan on Going to the Operating Room

Thank You