Blunt Chest Trauma:
To CT or Not To CT
Providing our highest-value care

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Rocky Mountain Trauma & Emergency Medicine Summer Conference
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I believe we provide our highest-value care when we employ patient-center, evidence-based care.
Case 1
Case 1
What’s the Difference?
The Probability of Disease

Low Probability ———— High Probability
### Physician Gestalt for Chest Trauma

<table>
<thead>
<tr>
<th>Very Low PTP</th>
<th>High PTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sens 97</td>
<td>Sens 26%</td>
</tr>
<tr>
<td>Spec 18</td>
<td>Spec 99%</td>
</tr>
<tr>
<td>Neg LR 0.16</td>
<td>Neg LR 0.76</td>
</tr>
<tr>
<td></td>
<td>Pos LR 27</td>
</tr>
</tbody>
</table>

Concern for Chest Trauma

Very Low Probability

STOP

High Probability

High-value Evidence-based Care

CT SCAN
Physician Gestalt for Chest Injury

Very Low PTP
Sens 97
Spec 18
Neg LR 0.16

High PTP
Sens 26%
Spec 99%
Neg LR 0.76
Pos LR 27

What about those in between?
NOW OPEN

Kelina Hospital opens at
NO 7, OLOGUN AGBAJE STREET,
OFF ADEOLA ODEKU STREET,
VICTORIA ISLAND, LAGOS
on Monday April 11, 2022.

As part of our Corporate Social
Responsibility, we will be doing Free
CT-scan for all patients who need it.

CALL OR TEXT

08033644644  07016837070
08129908324  08033309669

WE CAN’T SCAN EVERYONE!
Remember The Goal...

We provide our highest-value care when we employ patient-center, evidence-based care.
<table>
<thead>
<tr>
<th>Scanning Everyone</th>
<th>Comes at a Cost!</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT Chest Average Charge</td>
<td>$3500</td>
</tr>
<tr>
<td>CT Chest Radiation Exposure</td>
<td>7 mSv (~350 CXRs)</td>
</tr>
<tr>
<td>Time and Other Resources</td>
<td>Significant</td>
</tr>
<tr>
<td>Other Institutional Charges</td>
<td>$20 - $40K</td>
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</tbody>
</table>
Chest radiography and chest CT/CTA are complementary first-line imaging modalities in the workup of patients with high-mechanism blunt trauma.

When initial trauma survey and mechanism of injury suggest a low probability of significant thoracic trauma (normal mental status, normal clinical examination, and normal chest radiograph), further assessment with chest CT/CTA may not be necessary. Inclusion or exclusion of CT in this setting should be site and/or case specific.
Avoid the routine use of “whole-body” diagnostic computed tomography (CT) scanning in patients with minor or single system trauma.

Aggressive use of “whole-body” CT scanning improves early diagnosis of injury and may even positively impact survival in polytrauma patients. However, the significance of radiation exposure as well as costs associated with these studies must be considered, especially in patients with low energy mechanisms of injury and absent physical examination findings consistent with major trauma.
Concern for Chest Trauma

- Very Low Probability
- Intermediate Probability
- High Probability

STOP

CT SCAN
Concern for Chest Trauma

- Very Low Probability
- Intermediate Probability
- High Probability

CXR Rule

- STOP
- CT SCAN
Nexus CXR Rule
Rodriguez et al JOT 2011 & JAMA Surg 2013

12 Variables ➔ Multivariate CART ➔ Final Rule (7)

- Age > 60 years
- Rapid deceleration
- Hypoxia
- Chest pain
- Shortness of breath
- Intoxication
- Distracting injury
- Chest Wall TTP
- Pain on lat chest compression
- Abnormal auscultation
- Abnormal mental status
- Visible chest wall skin injury

Goal Sensitivity 99%

- Age > 60 years
- Rapid deceleration
- Chest pain
- Intoxication
- Distracting injury
- Chest Wall TTP
- Abnormal mental status
Nexus CXR Rule
Rodriguez et al JOT 2011 & JAMA Surg 2013

12 Variables → Multivariate CART → Final Rule (7)

Derivation & Validation
Sensitivity 99%
Specificity 14%
Neg LR 0.07

10% Pre Test Probability = 0.8% Post Test Probability

Age > 60 years
Rapid deceleration
Chest pain
Intoxication
Distracting injury
Chest Wall TTP

Abnormal mental status

Visible chest wall skin injury
Pain on lat chest compression
Abnormal auscultation
Mechanism of blunt trauma that exerts rapid deceleration force on the patient:

Fall from a height >20 feet, or

Motor vehicle accident at speeds > 40 mph with sudden deceleration
The Details: Distracting Injuries

Any condition thought by the clinician to be producing sufficient pain to significantly distract the patient from a second injury.

- Long bone fractures
- Visceral injuries requiring surgical consultation
- Large lacerations, de-gloving injuries, or crush injuries
- Large burns
- Spine fractures
- Spinal cord injuries
- Any other injury producing acute functional impairment
1. Age > 60 years
2. Rapid Deceleration
3. Intoxication
4. Abnormal Mental Status
5. Distracting Painful Injury
6. Chest Pain
7. TTP Chest Wall
Concern for Chest Trauma

- Very Low Probability
  - STOP

- Intermediate Probability
  - CXR Rule

- High Probability
  - CT SCAN

- CXR
What Are We Looking For In The Chest?

- Multiple rib fractures
- Sternal fractures
- Spinal fractures
- Pneumothorax
- Hemothorax
- Pneumomediastinum
- Pulmonary contusion
- Ruptured diaphragm
- Aortic or great vessel injury
Trachea Deviation

Superior Mediastinum Widening

Opacification of the AP Window

Apical Cap

Indistinct Aortic Knob
Thickened Rt Paratracheal Strip

Displaced Lt Paraspinal Line

Mediastinum Wide
Hemothorax
Trachea Deviated
Depressed Lt Mainstem Bronchus
Narrowing of the Carinal Angle
Hemothorax
Rt PTx
Concern for Chest Trauma

Very Low Probability

CXR Rule

Intermediate Probability

CXR

High Probability

CT Rule

CT SCAN

STOP
Nexus CT Chest Rule

Age > 60 years
Rapid deceleration mechanism
Hypoxia
Chest pain
Shortness of breath
Intoxication
Distracting injury
Chest Wall TTP
Pain on lat chest compression
Abnormal auscultation
Abnormal mental status
Visible chest wall skin injury

Goal Sensitivity
99%

Distracting Injury
Chest Wall Tenderness
Sternal Tenderness
Spinal Tenderness
Scapular Tenderness
Rapid Deceleration*
Abnormal CXR
Nexus CT Chest Rule

14 Variables $\rightarrow$ Multivariate CART $\rightarrow$ Final Rule (7)

**Major Injury**
- Sensitivity 99.2%
- Specificity 31.7%
- Neg LR 0.03

**Any Injury**
- Sensitivity 95.4%
- Specificity 25.5%
- Neg LR 0.18

Distracting Injury
Chest Wall Tenderness
Sternal Tenderness
Spinal Tenderness
Scapular Tenderness
Rapid Deceleration*
Abnormal CXR
## Nexus CT Chest Rule(s)

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- Long bone fractures
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- Spinal cord injuries
- Any other injury producing acute functional impairment
The Details: Rapid Deceleration

Mechanism of blunt trauma that exerts rapid deceleration force on the patient:

- Fall from a height >20 feet, or
- Motor vehicle accident at speeds > 40 mph with sudden deceleration
The Details: Abnormal CXR

Any thoracic injury
  ? Isolated clavicular fracture
  ? Isolated rib fracture
  Widened mediastinum
CASE 3

65 yo RD of an moderate-to-high speed (45 mph) MVC. The car slide off the road on a bend, sideswiping the guardrail before coming to rest in a field. Airbags did not deploy. He denies hitting his head or LOC. His only complaint is right ankle pain and left shoulder pain from the seatbelt.

VS: 145/84 105 18 99% on RA

   ABC: good, moderate pain
   Chest: TTP lt anterior shoulder
   Ankle: significant swelling and TTP lat malleolus
Concern for Chest Trauma

- Very Low Probability
  - CXR Rule
  - STOP

- Intermediate Probability
  - CXR
  - CT Rule

- High Probability
  - CT SCAN
Concern for Chest Trauma

Very Low Probability

CXR Rule

Intermediate Probability

STOP

CXR

High Probability

CT Rule

CT SCAN
NEXUS CXR Rule

1. Age > 60 years
2. Rapid Deceleration
3. Intoxication
4. Abnormal Mental Status
5. Distracting Painful Injury
6. Chest Pain
7. TTP Chest Wall
NEXUS CXR Rule

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Concern for Chest Trauma

- Very Low Probability
  - CXR Rule
  - CXR

- Intermediate Probability
  - CXR Rule
  - CT Rule

- High Probability
  - CT Rule
  - CT SCAN

STOP
CXR2

- Fuzzy Aortic Knob
- ? Displaced LT Paraspinal Line v. Apical Cap
- Normal Mediastinum
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Concern for Chest Trauma (CXR1)

- Very Low Probability
  - STOP
- Intermediate Probability
  - CXR Rule
  - CT Rule
  - CT SCAN
- High Probability
  - CT SCAN
Concern for Chest Trauma (CXR2)

Very Low Probability

CXR Rule

Intermediate Probability

CT Rule

High Probability

STOP

CXR

CT SCAN
Concern for Chest Trauma

- Very Low Probability
  - CXR Rule
  - STOP

- Intermediate Probability
  - CXR
  - CT Rule

- High Probability
  - CT SCAN
I believe we provide our highest-value care when we employ patient-center, evidence-based care.
Blunt Chest Trauma:

Thank You!

Providing our highest-value care
Blunt Chest Trauma: Questions? Providing our highest-value care

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