POINT OF CARE ULTRASONOUND IN CRITICALLY ILL PATIENT WITH ACUTE DYSPNEA

*He can’t breathe but you can scan*

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OUTLINE

1. Life threatening Conditions
2. Work up
3. Evidence of POCUS in critical care areas: ED & ICU
4. Scanning protocols
5. Cases
6. References
ACUTE DYSPNEA

- DiagnosisPro, an online medical expert system, listed 497 distinct causes in October 2010.
ACUTE DYSPNEA

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DIAGNOSTIC APPROACH: CHALLENGES

CT Angio
- Detects intra-luminal defects
- Has become the imaging test of choice in adults BUT
- Limitations: sub-segmental arteries, movement or breathing that might occur in pedi studies, requires iodine contrast and radiation.
- Sensitivity 50-100%
- Specificity 81-100%

Saddle type pulmonary embolus

D-Dimer

BNP
Diagnostic approach: Challenges

- **RESSOURCES**
- **TIME**
- **IRRADIATION**
- **BNP**
- **D-Dimer**

*Sx+Phy Ex.*
EVIDENCE OF FOCUS IN CRITICALLY SICK DYSPNEIC PATIENT
Usefulness of lung ultrasound in the bedside distinction between pulmonary edema and exacerbation of COPD

Giovanni Volpicelli · Luciano Cardinale · Giorgio Garofalo · Andrea Veltiri

We think it will spread very soon as a new visual stethoscope in the daily practice of radiologists, emergency physicians, intensivists, cardiologists, and pulmonologists.

Fig. 3 Oblique lung scan showing multiple comet tails or B lines with a distance between them of less than 7 mm. This is the B+ pattern. Arrow pleural line, asterisks comet tails
PE Signs and symptoms are non specific

Conclusions: Multiorgan ultrasonography is more sensitive than single-organ ultrasonography, increases the accuracy of clinical pretest probability estimation in patients with suspected PE, and may safely reduce the MCTPA burden.
In a cohort of patients with severe, undifferentiated dyspnea, immediate TS — in essence, an extension of the physical exam — resulted in a statistically significant improvement in treating physicians’ overall diagnostic accuracy. While its primary utility appeared to be rapid diagnosis or exclusion of ADHF, the TS also seemed to
Traumatic Pneumothorax Detection with Thoracic US: Correlation with Chest Radiography and CT—Initial Experience

TABLE 1
Pneumothorax Depiction at CT, US, and Chest Radiography

<table>
<thead>
<tr>
<th>No. of Patients*</th>
<th>CT</th>
<th>US</th>
<th>Chest Radiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
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<tr>
<td>1</td>
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<tr>
<td>7</td>
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<td>Absent</td>
</tr>
<tr>
<td>4</td>
<td>Present</td>
<td>Present</td>
<td>Present</td>
</tr>
</tbody>
</table>

* Numbers of patients in whom a pneumothorax was present or absent at the given imaging examination.
SCANNING ALGORITHMS
1. **BLUE PROTOCOL**

![Diagram of the BLUE protocol]

- **Lung sliding**
  - Present
    - B profile → Pulmonary Edema
    - A profile → Venous analysis
  - Any
    - A/B or C profile → Pneumonia
  - Abolished
    - B profile → Pneumonia (plus lung point)
    - A lines → Pneumothorax

- **The BLUE protocol**

- **A profile** means predominantly A lines
- **B profile** means predominantly multiple anterior diffuse B lines
- **A / B profile** means predominant A lines on one side and predominant B lines on the other side.
- **C profile** means anterior alveolar consolidation(s)
- **PLAPS** means *posterolateral alveolar and/or pleural syndrome* detected on a lateral sub-posterior sonological examination.

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Daniel A. Lichtenstein Annals of Intensive Care 2014, 4:1
2. **The Radius Protocole**

The Rapid Assessment of Dyspnea with Ultrasound: RADIUS

William Manson, MD*, Nadim Mike Hafez, MD

**KEYWORDS**
- Emergency
- Ultrasound
- Dyspnea
- Critical care

The RADIUS examination has the ability to change clinical practice by rapidly narrowing the differential diagnosis and allowing the clinician to administer definitive therapy. This real-time bedside sonographic examination combines research from cardiology, radiology, critical care, and emergency medicine. Although its ability to diagnose some
1. **Lung ultrasound**

   - Bilateral A-lines
     - Bronchial asthma
     - Chronic obstructive pulmonary disease (COPD)
     - Non-cardiogenic acute dyspnea
   - Focal multiple B-lines
     - Pneumonia and pneumonitis
     - Atelectasis
     - Pulmonary infarction
     - Pulmonary contusion
     - Pleural disease
     - Neoplasia
     - Non-cardiogenic acute dyspnea
   - Diffuse multiple bilateral B-lines
     - Pulmonary edema of various causes
     - Interstitial pneumonia/pneumonitis
     - Pulmonary fibrosis
     - Acute respiratory distress syndrome (ARDS)

2. **Cardiac ultrasound**

   - LVEF $\geq 40\%$ (preserved EF)
     - MR: moderate to severe?
   - LVEF $<40\%$ (reduced EF)
     - MR or TR: moderate to severe?

3. **IVC ultrasound**

   - Collapsibility $< 50\%$?
     - Non-cardiogenic acute dyspnea
     - Cardiogenic acute dyspnea
3. **TRIPLE SCAN**

- **Echo for squeeze**
- **Lung sliding**
- **B lines**
- **and the IVC**

*The Triple Scan*
4. MULTI ORGAN SCANS
PUTTING TOGETHER
Case 1

You got a low EF + B lines present throughout

Fat IVC + F#!%in'

= Decompensated CHF
Case 2

OK Squeeze??

Collapsing IVC

Only A-lines

Maybe COPD
(Unlikely Decompensated CHF)
Case 3

Hyperdynamic + Focal B lines only = PNEUMONIA

IVC Flattening
To conclude
✓ "Speed of sound"
✓ Portable. Issue of CXR or CT for Critically sick patient in Critically ill
✓ Non radiating, Non invasive
✓ Recordable information vs Auscultation
✓ Cost effective
✓ Repeatable
✓ Much better than CXR (poor quality, supine)

✓ Operator dependent-Training
Radiography is a familiar tool that lacks sensitivity: 60-70%, all fields considered.

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