Drowning Rule Out With Novices (DROWN) in Ultrasound

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Background

CDC data from 2018:

- 9,659 incidents of nonfatal drownings in US.
- 2,481 drowning fatalities reported.
- One of leading causes of death in children less than 4 years old.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Cause of death ranking (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 4</td>
<td>2</td>
</tr>
<tr>
<td>5 – 9</td>
<td>3</td>
</tr>
<tr>
<td>10 – 14</td>
<td>5</td>
</tr>
<tr>
<td>15 – 24</td>
<td>6</td>
</tr>
</tbody>
</table>
Objective

The purpose of this study was to determine the utility of lung ultrasound in identifying interstitial edema in patients presenting after nonfatal drownings, when compared to chest radiography.
Hypothesis

Point of care lung ultrasound can identify interstitial edema in patients presenting after nonfatal drownings.
https://radiopaedia.org/cases/normal-frontal-chest-x-ray
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Methods

- Study included all patients presenting after a submersion event who received a CXR.
- Study conducted in Myrtle Beach, SC at a single academic emergency department with annual census of approximately 125,000.
- US performed by EM residents not involved with patient’s care using BLUE protocol.
- US reviewed by 4 blinded expert sonographers and results compared to CXR.
- Patients contacted 2 weeks later.
BLUE Protocol

• Bedside Lung Ultrasound in Emergency is helpful in determining etiologies of acute respiratory failure.

• EM residents were trained in the BLUE protocol and gave an initial “novice” interpretation of the bedside US they performed and blinded to the chest radiographs.
Methods

59 enrolled
(Median age = 6)

21 Adults
(Median age = 49)

- 16 male
- 5 female

38 Children
(Median age = 3.5)

- 23 male
- 15 female
## Methods

<table>
<thead>
<tr>
<th></th>
<th>Adult (n=21)</th>
<th>Pediatrics (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds Underwater (median)</td>
<td>120</td>
<td>30</td>
</tr>
<tr>
<td>Bystander CPR</td>
<td>33%</td>
<td>26%</td>
</tr>
<tr>
<td>ED Disposition = Admitted</td>
<td>76%</td>
<td>53%</td>
</tr>
<tr>
<td>Intubated</td>
<td>31%</td>
<td>5%</td>
</tr>
<tr>
<td>Survived to discharge (or transfer)</td>
<td>94%</td>
<td>95%</td>
</tr>
</tbody>
</table>
## Results

### Sensitivity and specificity of Lung Ultrasound vs. Chest X-ray

<table>
<thead>
<tr>
<th></th>
<th>All patients (n=59)</th>
<th>CXR (+)</th>
<th>CXR (-)</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound (+)</td>
<td></td>
<td>20</td>
<td>12</td>
<td>83.3% (62.6-95.3)</td>
<td>65.7% (47.8-80.9)</td>
</tr>
<tr>
<td>Ultrasound (-)</td>
<td></td>
<td>4</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Results

### Sensitivity and specificity of Lung Ultrasound vs. Chest X-ray

<table>
<thead>
<tr>
<th>Discharged patients (n=23)</th>
<th>CXR (+)</th>
<th>CXR (-)</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound (+)</td>
<td>2</td>
<td>2</td>
<td>66.7% (9.4-99.2)</td>
<td>90.0% (68.3-97.2)</td>
</tr>
<tr>
<td>Ultrasound (-)</td>
<td>1</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discussion

• 24 patients had pulmonary edema on CXR, 20 of those had positive B lines according to novice interpretation.

• Compared to CXR, US resulted in 83.3% sensitivity and 65% specificity in detecting pathologic B lines in nonfatal drownings.

• 12 out of 35 cases where patient had negative CXR with positive lung US, 10 of which required admission for further treatment.

• Suggests US may detect significant pulmonary edema earlier than CXR.

• Ultrasound performed in patients discharged from ED with Sensitivity of 66.7% and Specificity of 90%.

• Interpretation of sensitivity and specificity may be biased as CXR was used as “Gold Standard” which is imperfect in identifying pulmonary edema.
Conclusion

• **Diagnosis:** Lung ultrasound is useful for determining presence of pulmonary edema in patients presenting after submersion events.

• **Utility:** So easy, even a novice can do it.
Thank You!
References


