Revisiting CT Esophagography in the Emergency Setting: Workflow, Diagnostic Accuracy, and Radiology Interpretations

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Background

Chest Computed Tomography (CT) and CT Esophagography (CTE) are more widely used to diagnose esophageal perforation (EP) and assess the extent of mediastinal contamination, both important in guiding patient management. CT/CTE can often replace the role of fluoroscopic esophagography in an emergency setting, however fluoroscopy maintains the highest rating for American College of Radiology (ACR) appropriateness criteria for esophageal injury. There is substantial variation in the interpretation of these studies due to the rarity of the diagnosis and therefore lack of experience of many general radiologists.

Normal

Mucosal Tear

Objective

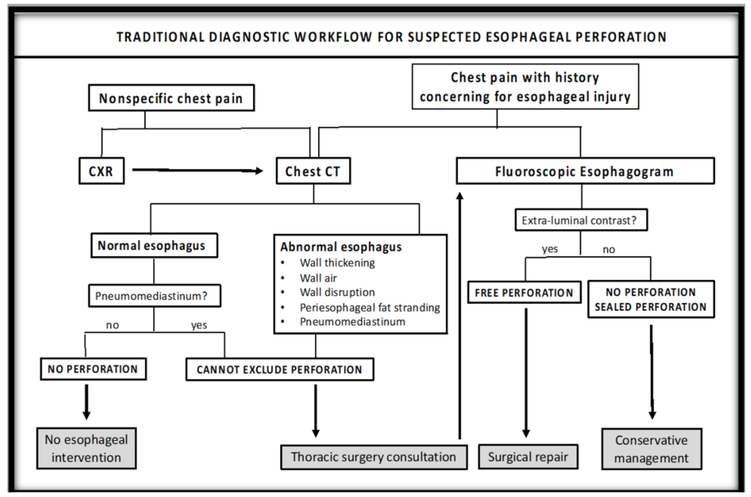
- The primary purpose of this study is to assess diagnostic accuracy and imaging findings of CT/CTE in esophageal injuries. This is in attempt to better understand the spectrum of esophageal injuries and to help guide the imaging workflow/direct clinical management.
- Our secondary purpose is to compare diagnostic accuracy of the initial general radiologist's interpretation of CT/CTE versus specialized radiologist interpretation.

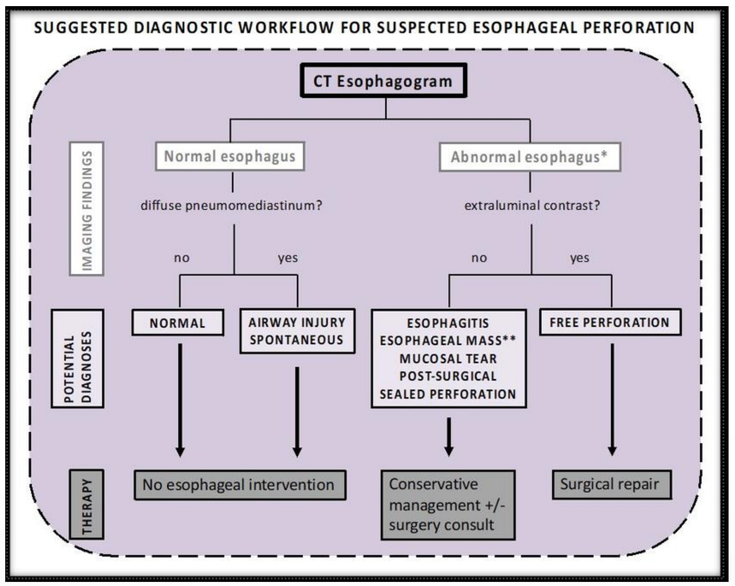
Summary of our CTE protocol

1. +/- Non Contrast: Mandibular angle to lower diaphragm
2. Oral contrast: Upright position if able or through NG tube
3. Postcontrast: Mandibular angle to lower diaphragm
   - *+/- IV contrast to assess other possible etiologies*
   - *Can repeat if motion or poor esophageal distention*
4. +/- prone position to better evaluate for anterior perforation
5. Sagittal, coronal, sharp lung kernel reformats created

Methods and Materials

This is a retrospective study of patients presenting with suspected esophageal perforation from 2010 – 2020. CTCTE studies were reviewed by 2 experienced radiologists who, blinded to final diagnosis, independently identified key imaging findings and categorized esophageal injuries: (1) normal esophagus; (2) abnormal esophagus without evidence of perforation; (3) sealed/contained perforation; or (4) free perforation. Imaging findings were collected and correlated with presence of perforation. Initial general radiologist and expert consensus interpretation were compared to gold standard fluoroscopic, endoscopic, surgical, or clinical diagnosis.





*Abnormal Esophagus findings:
focal pneumomediastinum, wall thickening, wall air, wall disruption, or periesophageal fat stranding.

** Esophageal mass without perforation generally requires additional nonemergent workup including endoscopy, fluoroscopy, or surgical resection.

Results

139 CT cases performed for suspected esophageal perforations were identified from 136 patients. 69 chest CTs and 87 CT esophagograms were evaluated with 46 confirmed perforations including sealed and free types. Most common imaging features seen in esophageal perforation: esophageal wall thickening 98%, pneumomediastinum 91%, mediastinal inflammation/fluid 83%. Both general and expert radiologists had high NPV for perforation compared to fluoroscopy when performed (94% and 100% respectively). CTE technique improved sensitivity and specificity for perforation in the general radiology group (79% and 63%) compared to CT without oral contrast. NPV was higher in expert consensus (95%) compared to general radiologists (86%) with fair agreement in overall interpretation of CTs (kappa 0.38) and moderate agreement of CTE (kappa 0.42). Specifically, only fair agreement for the finding of extra-luminal contrast (kappa 0.39), which was commonly confounded by streak artifact. Based on our results we created a workflow for a new model of imaging utilization in the workup of esophageal injury (adjacent diagram).

Conclusion

The high specificity of CTE supports its role as an initial screening test to rule out EP, obviating the need for fluoroscopic evaluation. CTE is also superior as it illustrates a variety of imaging patterns. Recognition of these patterns was better by expert radiologists and general radiologists may need extra training, however overall, the use of CT improves patient care by helping to categorize patients into management pathways and streamline imaging.

Clinical Implications

- Universal adoption of our suggested workflow prioritizing CTE to screen for esophageal injury has the potential to minimize the testing performed on presenting patients.
- This in turn could decrease hospital admissions, decrease radiation exposure, and improve patient flow through the healthcare system.
- The ACR should consider reassessing the appropriateness criteria for esophageal injury, ultimately providing cost savings and improved patient care.

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