

Journal Club Of Boston Medical Center using Dual-detector Helical Ct Angiography To Detect Deep Venous Thrombosis In Patients With Suspicion Of Pulmonary Embolism: Diagnostic Value And Additional Findings

P McGinnis

Citation

P McGinnis. *Journal Club Of Boston Medical Center using Dual-detector Helical Ct Angiography To Detect Deep Venous Thrombosis In Patients With Suspicion Of Pulmonary Embolism: Diagnostic Value And Additional Findings*. The Internet Journal of Radiology. 2000 Volume 2 Number 1.

Abstract

A review of an article that discusses What is the value of dual-slice helical CT angiography in detecting deep venous thrombosis in patients suspected of acute pulmonary embolism? Also, what are common extrathoracic findings.

1. WHAT IS THE QUESTION BEING ASKED?

What is the value of dual-slice helical CT angiography in detecting deep venous thrombosis in patients suspected of acute pulmonary embolism? Also, what are common extrathoracic findings.

2. WHY IS THIS QUESTION IMPORTANT?

With multi-detector helical CT becoming a mainstream modality, it is important to realize its potential to improve patient care and increase departmental efficiency. In this case, the potential for using CT as a “one stop” modality for both accurately detecting pulmonary embolism and assessing for the most likely cause of PE may represent an instance where both improved patient care and departmental efficiency can be demonstrated.

3. WHAT IS THE BACKGROUND WORK:

What groundwork lead to this question?

- PE is a major cause of morbidity/mortality, and the disease has high association with DVT as a causative condition. Until the relatively recent development of multi-detector CT, radiology has been left with requiring a multimodality approach to work-up of PE. The development of multi-detector CT has provided a non-invasive modality fast enough and potentially accurate enough to resolve the need for a multimodality approach.

- Has anybody else tried to answer this question?
- Yes. Recently multiple studies have been published which have addressed the potential of multi-detector CT in the work-up of PE in conjunction with lower extremity venography.
- In the year 2000 alone:
 - Yankelevitz, et al, attempted to determine optimal time delay for venous phase lower extremity enhancement.
 - Loud, et al, performed a similar prospective study on 71 patients suspected of PE, and compared CT venography to ultrasound
 - Cham et al, as part of a multi-institutional study, enrolled 541 pts suspected of PE.
 - Garg, et al, scanned 70 patients
 - All comparative studies considered CT venography as accurate as ultrasound (1-4).

4. WHAT IS THE NULL HYPOTHESIS?

In the setting of obtaining CTPA for the work-up of PE, combining CTPA with a CT venography will provide diagnostic information comparable to US.

5. WHO IS THE TEST POPULATION?

All patients referred for CT unit for work-up of suspected PE from December 1998 to June 1999.

6. WHAT ARE THE METHODS USED?

- The study is a cross sectional prospective comparison of CT venography to lower extremity ultrasound which enrolled all patients over a 7 month period sent to their department for the work-up of PE, employing blinded interpretation of CT and US studies.
- 79 consecutive patients were referred to the department, with 14 being excluded from the study (5 due to unavailability of radiologists to perform US, 5 suffered bronchospasm after chest CT, and four for technical reasons). This left 65 patients enrolled in the study.
- All enrolled patients received a CTPA according to their protocol, followed by contiguous axial CT of the lower extremities (2-3 min after contrast injection for the chest ct, without additional contrast), scanning from the mid-calf to the pelvis. Standardized routines were used to optimize deep venous enhancement (elevation of legs, tourniquets above ankles and thighs). Patients were then scanned from the pelvis to the intrahepatic IVC at 40mm intervals. CTs were interpreted by two separate radiologists unaware of ultrasound results. "Subsequent consensus was achieved for final interpretation in all cases."
- All patients had lower extremity ultrasound within 24hrs of the CT. All ultrasound studies were performed by two radiologists unaware of CT findings. Two radiologists interpreted all US's without information regarding CT findings. "Discrepancies were resolved by consensus."
- Lower limb ascending phlebography was used in 12 patients with discordant results between CT and US. 2 other patients who had discordant results refused phlebography, 1 patient could not be catheterized. For these three patients, "final diagnosis was reached by consensus of the three observers."
- Sensitivity, specificity and positive and negative

predictive values were calculated for both modalities in detecting DVT.

7. WHAT ARE THE RESULTS?

35% (22) of the patients had PE and 25% (16) had a DVT. 59% (13) of patients with PE had a DVT, and 19% (3) patients only had a DVT.

Figure 1

	Sensitivity	Specificity	PPV	NPV
CT	93%	97%	93%	97%
US	87%	97%	93%	96%

Interobserver agreement: Kappa = 0.88. Extrathoracic pathology (p. 1038).

8. WHAT ARE THE PROS/CONS IF RESULTS?

The results as presented support the use of CT for work-up of DVT combined with CTPA, demonstrating equal (if not superior) efficacy to US. Reported additional (extrathoracic) findings of questionable value.

9. WHAT ARE THE LIMITATIONS?

- Small numbers likely decrease strength of calculated statistics (ie, was there truly a statistically significant difference between CT and US for sensitivity? Notice no "p-values" were even calculated)
- No cost-effectiveness analysis was performed. If ultrasound can provide an equally accurate study, and for less money and radiation, is the time saved by CT venography at CTPA more valuable?
- Interobserver agreement was never really addressed, nor were potential pitfalls/limitations for reading CT venography which may not be encountered with ultrasound (5).

10. WHAT IS THE NEXT QUESTION RAISED?

See #9.

References

1. Loud PA, Katz DS, Klippenstein DL, et al. Combined CT venography and pulmonary angiography in suspected thromboembolic disease: diagnostic accuracy for deep venous evaluation. AJR 2000 Jan; 174 (1) 61-5.
2. Yankelevitz DF, Gamsu G, Shah A, et al. Optimization of combined CT pulmonary angiography with lower extremity CT venography. AJR 2000 Jan; 174 (1): 67-9.
3. Cham MD, Yankelevitz DF, Shaham D, et al. Deep

Journal Club Of Boston Medical Center using Dual-detector Helical Ct Angiography To Detect Deep Venous Thrombosis In Patients With Suspicion Of Pulmonary Embolism: Diagnostic Value And Additional Findings

venous thrombosis: detection by using indirect CT venography. The Pulmonary Angiography-Indirect CT Venography Cooperative Group. Radiology 2000 Sept; 216 (3) 744-51.

4. Garg K, Kemp JL, Wojcik D, et al. Thromboembolic disease: comparison of combined CT pulmonary

angiography and venography with bilateral leg sonography in 70 patients. AJR 2000 Oct; 175 (4): 997-1001.

5. Garg K, Kemp JL, Russ PD, et al. Thromboembolic disease: variability of interobserver agreement in the interpretation of CT venography with CT pulmonary angiography. AJR 2001 Apr; 176 (3): 1043-47.

Author Information

Paul McGinnis, MD

Resident, Department of Radiology, Boston University