

Diagnosis of thromboembolic disease: combined ventilation perfusion lung scan and compression ultrasonography

Dadparvar S. MD, Woods K. BSN, Magno R.M. MD,
Sabatino J.C. MD, Patil S. MD, Dou Y., MD.

Division of Nuclear Medicine, Hahnemann University Hospital, Department of
Radiological Sciences, Philadelphia, PA 19102, U.S.A

Abstract

The clinical management of pulmonary embolism and deep venous thrombosis of the legs are similar and requires prolonged anticoagulation therapy. The standard diagnostic approach in patients suspected of pulmonary embolism is ventilation-perfusion (V/Q) lung scan and compression ultrasonography to detect deep venous thrombosis. This retrospective study analyzed the role of V/Q lung scan and compression ultrasonography in detection of thromboembolic disease.

One hundred-twenty consecutive patients (65 female, 55 male) age range 18-95 (mean age 60.7) suspected for pulmonary embolism underwent concomitant V/Q lung scan and compression ultrasonography of the lower extremities. The clinical and radiographic correlation was performed.

Of patients with non-diagnostic (low or intermediate probability) lung scans, 15.4% (14/91) received anticoagulation therapy for pulmonary embolism. These patients had either high pre-clinical suspicion for PE or underwent pulmonary arteriogram. However, there was an additional 7%(7/91) increase in the number of patients who received anticoagulation therapy based on the results of ultrasound with confidence interval (3%- 16%).

We conclude that V/Q lung scan is a more sensitive examination for thromboembolic disease, and has a high negative predictive value. Ultrasonography of lower extremities demonstrated higher specificity and positive predictive value. Among patients with non- diagnostic lung scan, the detection rate of thromboembolic disease is improved with addition of ultrasound.

	Sens	Spec	Acc	(+) PV	(-) PV
V/Q Lung Scan	0.85	0.62	0.69	0.52	0.89
Ultrasound	0.33	0.98	0.77	0.93	0.75
	P<0.001	P<0.001	P=NS	P=<0.001	P=<0.02

Introduction

Thromboembolic disease directly or indirectly causes 200,000 deaths per year. Most thrombi originate in the deep veins of thigh. Less common sources include vessels

below the knee, pelvic veins and upper extremities. The clinical diagnosis is highly inaccurate. The most common predisposing factor is immobilization. Symptoms include

dyspnea, pleuretic chest pains, hemoptysis and tachypnea. ECG findings are non-specific and may show ST&T changes and sinus tachycardia. Arterial blood gas reveals hypoxemia and hypocapnia.

The perfusion ventilation lung scan is highly specific in normal and high probability for pulmonary embolism. Low probability or intermediate probability for pulmonary embolism needs further investigation.

The compression ultrasonography is highly specific and sensitive non-invasive technique for detection of above knee thrombosis. False positive studies are with heart failure and prior deep venous thrombosis. The treatment of thromboembolic disease is anticoagulation.

Patients & Methods

This retrospective study evaluated one hundred-twenty consecutive patients (65 female and 55 male), age range 18-95 (mean age 60.7 years) suspected of pulmonary embolism. The perfusion lung scan was performed following intravenous injection of 4.0 mCi ^{99m}Tc -MAA. The ventilation lung scan was followed after inhalation of ^{81m}Kr . Subsequently, the compression ultrasonography was performed within 24 hours on all these patients.

Results

Of the patients with non-diagnostic (low or intermediate probability) for pulmonary embolism 15.4% (14/91) received anti-coagulation therapy. These patients had either preclinical suspicion for pulmonary embolism or underwent pulmonary arteriogram. The compression ultrasonography resulted in an additional 7% (7/91) increase in number of

patients who received anti-coagulation therapy with confidence interval (3%-16%).

Discussion and Conclusion

The non-invasive studies for diagnosis of thromboembolic disease are very valuable prior to anticoagulation therapy. If the V/Q lung scan is normal, no treatment is necessary. The patients with high probability for PE could be heparinized without additional studies. If the V/Q lung scan shows low or intermediate probability for PE, then the patient requires compression ultrasonography and if it is consistent with deep vein thrombosis, then the patient is heparinized. The V/Q lung scan is highly sensitive with high negative predictive value. The compression ultrasonography is highly specific with high positive predictive value. Among patients with nondiagnostic lung scan, the detection rate of thromboembolic disease is improved with addition of ultrasonography for deep venous thrombosis.

References

- 1- Alavi A, Palersky HI, Bankole A et al: Likelihood of pulmonary embolism correlates with the number of segmental mismatches on ventilation-perfusion lung scans: an observation from the PIOPED study. *J Nucl Med* 1992;33: 849
- 2- Alderson Po, Gottshalk A: Ventilation perfusion study for pulmonary embolism: a rebuttal to Dr. Eugene Robin, *Semin Nucl Med* 1979 (letter) 9: 145-146,
- 3- Alderson Po, Martin EC: Pulmonary embolism: diagnosis with multiple imaging modalities. *Radiology* 1987; 164: 297-312
- 4- Biello Dr: Radiological (Scintigraphic) evaluation of patients with suspected pulmonary thromboembolism. *JAMA* 1987; 257: 3257-3259.
- 5- Biello DR, Mattar AG, Mcknight RC et al: Ventilation - Purfusion studies in suspected pulmonary embolism. *AJR* 1979; 133: 1033-1037

6- Gattshalk A, Sostman HD, Coleman RE et al. Ventilation- perfusion scintigraphy in the PIOPED study . part II . Evaluation of the scintigraphic criteria and interpretations. J Nucl. Med 1993; 34:1119-1126

7- Holden RE, Klatte Ec, Park HM et al : Efficacy of noninvasive modalities for diagnosis of thrombophebitits. Radiology 1981; 141: 63-66

8- Huisman MV, Baller. HR, ten Cate Jw et al: Unexpected high prevalence of silent pulmonary embolism in patients with deep vein thrombosis. Chest 1989; 95: 498-502

9- Moser KM, Fedullo PF, Little John JK et al: Frequent asymptomatic Pulmonary embolism in patients with deep vein thrombosis. JAMA 1994;271; 223-225

10- Secker – Walker RH: on purple emperors, Pelmonary embolism , and venous thrombosis. Ann Inter Med 1983;98: 1006-1008