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Prevalence and clinical significance of solitary pulmonary sub-segmental microembolism

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Abstract

BACKGROUND: Solitary pulmonary microembolism is rarely discussed as a distinct diagnostic entity.
The purpose of this investigation was to determine the prevalence and clinical significance of embolism limited to subsegmental branches in a group of patients discharged from hospital on anticoagulants with a diagnosis of pulmonary embolism based on ventilation-perfusion imaging followed by selective angiography.
MATERIAL AND METHODS: Of 29 consecutive patients with classic signs of pulmonary embolism at angiography, we identified a subgroup of 5 patients with sub-segmental embolism, which was solitary in all cases.
RESULTS: Clinical presentation included chest pain (2/5), shortness of breath (2/5, or hypoxemia (1/5). Chest X-rays were normal (2/5), or showed pulmonary oedema (1/5) or atelectasis with (1/5), or without (1/5) pleural effusion. VQ imaging patterns included small subsegmental mismatch (1/5), one segment mismatch (1/5), single (1/5) or triple (2/5) match. The site and size of the microemboli found at angiography were incompatible with the location and severity of symptoms in 4/5 (80%) patients, and with location and extent of Chest X-ray findings and with VQ patterns in all patients. VQ abnormalities were either disproportionably larger or were non congruent with the vascular territory compromised by the subsegmental embolus.
CONCLUSIONS: Sub-segmental pulmonary micro-emboli were always solitary, and not uncommon, comprising 17% of all patients with pulmonary embolism. The location and size of the emboli were inconsistent with clinical, Chest X-ray and scintigraphic findings, suggesting that isolated microemboli are a serendipitous finding, of no clinical significance.
Keywords: pulmonary embolism, radionuclide imaging, pulmonary angiography, microembolism

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Introduction

Clinical investigations of subsegmental pulmonary microembolism have generally focused on those patients in respiratory distress with or without hemodynamic compromise, in association with multiple emboli of endogenous or exogenous origin, such as following massive transfusion, major vascular surgery, fat embolism after major trauma, embolism of oily particles after lymphangiography, tumour microembolism and others [1–12]. The opposite scenario, that pulmonary microemboli documented by angiography may represent an incidental and clinically irrelevant finding is rarely discussed.

The purpose of this investigation was to determine the prevalence and clinical significance of embolism limited to subsegmental branches in a group of 29 consecutive patients discharged from hospital on anticoagulants with a diagnosis of pulmonary embolism based on selective angiography.

Material and methods

From a total of 29 consecutive patients discharged from hospital on anticoagulants with a diagnosis of pulmonary embolism based on the presence of one or multiple endoluminal filling defects on selective angiography, we identified a subgroup of 5 patients with emboli confined to subsegmental branches. We reviewed the medical records, Chest X-ray, venous Doppler studies (when available), scintigraphic and angiographic records in an attempt to determine the clinical significance of isolated microembolism.

This subgroup consisted of 3 men and 2 women, age 58 ± ± 18 years old. Clinical presentation included chest pain (2/5), shortness of breath (2/5), or hypoxemia (1/5). Risk factors for pulmonary embolism included: a past history of DVT in 1 patient, cancer in 2 patients, recent (past 3 months) surgery in 1 patient, and a recent history of immobilization in 1 patient.

None of the patients had clinical deep vein thrombosis (DVT). A Doppler study was negative in 3, equivocal in 1 and not done in 1 patient.

Chest X-rays were either normal (2/5), or showed pulmonary oedema (1/5) or atelectasis, either with (1/5), or without (1/5) pleural effusion.

Ventilation-perfusion scintigraphy (VQ)

All 5 patients underwent ventilation-perfusion scintigraphy no more than 4 days before the pulmonary angiogram. All images were acquired with a single head Siemens Orbiter camera with low energy all purpose collimator and 64 × 64 acquisition matrix. The ventilation-perfusion studies were interpreted by 2 observers; discrepancies were resolved by consensus.

Complete ventilation studies, including wash in, equilibrium and washout images were obtained using Xe-133 (Draximage, Canada) in 2 separate views: left and right posterior oblique. Perfusion images (400,000 counts) were acquired in the 6 conventional views following the injection of 5mCi (185 MBq) of Tc-99m macro aggregates of albumin (Draximage, Canada).

Pulmonary angiography technique and interpretation

The catheter was directed via the femoral vein into the main pulmonary artery of each lung. Anteroposterior and oblique views were acquired after the contrast material injection according to the standard method, and image acquisition techniques. Supplementary oblique or magnified views were obtained when necessary such as in the case of overlapping structures or if there was doubt as to the presence of an embolus. All patients underwent bilateral angiography. The angiograms were reviewed by 2 observers and showed in all 5 cases a single subsegmental filling defect.

Results

Ventilation-perfusion (VQ) imaging: VQ imaging patterns included small subsegmental mismatch (1/5), one segment mismatch (1/5), single (1/5) or triple (2/5) match.

Brief description of individual patients

Patient 1 — A 65 year old man presented with acute shortness of breath, bibasal atelectasis and bilateral pleural effusions on Chest X-ray, large matched ventilation-perfusion abnormalities in both bases on the VQ scan and a minute single subsegmental embolus in territory of the left posterior basal branch at angiography. Both the abnormalities on Chest X-ray and those on the VQ scans were much larger than the vascular territory compromised by the embolism.

Patient 2 (Fig. 1) — A 26 year old woman presented with left sided chest pain, a normal Chest X-ray, a small sub-segmental left lateral basal matched defect on the VQ scan, an unequivocal small single free floating trailing embolus was found in a sub-segmental branch of the right superior basal branch, visible only on supplementary oblique views with magnification at angiography. The microembolus was located on the right side, although both the chest pain and subsegmental VQ defect were located on the left side and the perfusion of the right base was normal on the VQ scan.

Patient 3 — A 72 year old man, one week post-op of a bowel resection, developed acute shortness of breath, hypoxemia, and confusion. He was immediately sent for both a chest X-ray and a VQ scan. The VQ scan showed a large matched ventilation perfusion defect at the right base, and the angiogram a small single subsegmental embolus in the posterior segment of the right base. The chest X-ray, which had initially been lost, was found only after the VQ scan was completed and showed acute pulmonary oedema for which the patient was successfully treated.

Patient 4 — A 41 year old man presented for shortness of breath, a normal Chest X-ray, and a segmental mismatched defect at the right base on the VQ scan. The angiogram showed a single small subsegmental embolus in the territory of the right anterior upper lobe branch, with no perfusion defect in the right base.

Patient 5 — A 56 year old woman presented with left sided chest pain, bibasal atelectasis on Chest X-ray, a single matched right basal defect on VQ scan and a small subsegmental right posterior basal embolus on the angiogram. The territory of the embolus was much smaller than the radiologic and scintigraphic abnormalities. On follow-up, she had to be readmitted for a gastrointestinal bleed secondary to warfarin.

Correlation of clinical, radiographic, scintigraphic and angiographic data

The site and size of the microemboli found at angiography were incompatible with the location (contralateral to the side of the pain) and severity of symptoms in 4/5 (80%) patients, and with location and extent of Chest X-ray findings and with VQ patterns in all patients. VQ abnormalities were either disproportionably larger or were non congruent with the vascular territory compromised by the subsegmental embolus.

Discussion

Microembolism is rarely discussed as a distinct diagnostic category. The prevalence of solitary subsegmental microembolism among the population of patients with classic angiographic signs of pulmonary embolism (i.e. an endoluminal filling defect) was 17% (5/29) in our study; 22% (29/130) in an angiographic series [13] and was the most common pattern of pulmonary embolism (162/216 = 75%) in a large autopsy study [14]. Microembolism should therefore be regarded as a distinct subgroup of patients with pulmonary embolism patients rather than a rare finding.

Isolated microembolism is never as discussed as a distinct therapeutic category in the medical literature. Indeed, accepted practice is to consider all patients with pulmonary embolism alike, irrespective of clot load. In our series, the site and size of the vascular territory compromised by the microemboli found at angiography were discordant with the location (contralateral to the side of the chest pain) and severity of symptoms in 4/5 (80%) patients, and with location and extent of Chest X-ray findings and with VQ

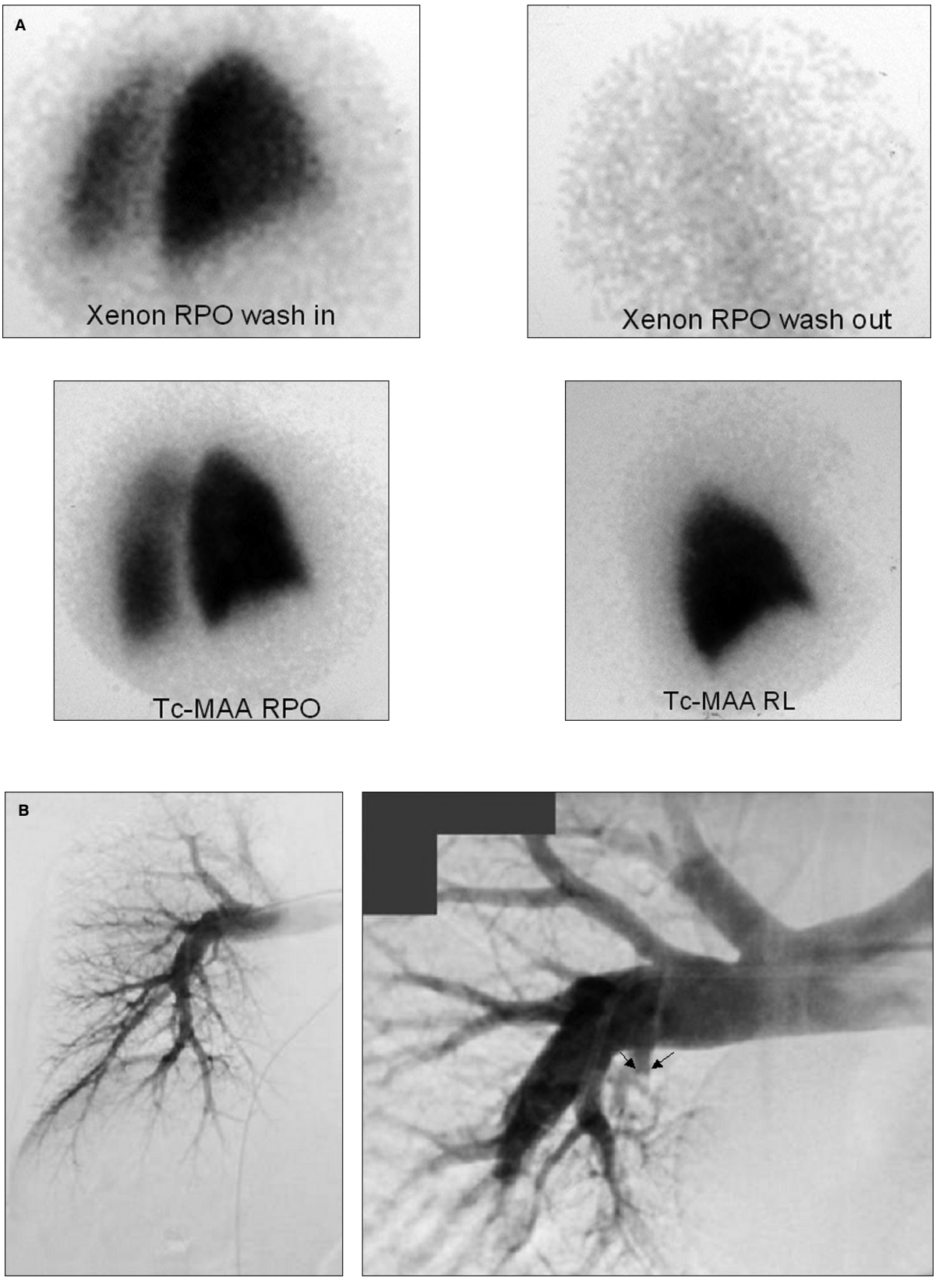

Figure 1A, B. A 26 year old woman with left sided chest pain. On the VQ scan, there is a small sub-segmental left lateral basal matched defect (not shown) and normal ventilation and perfusion of the right lung (A). The pulmonary angiogram was normal on the left and initially appeared normal on the right (B, left); however supplementary oblique views with magnification demonstrated an unequivocal single subsegmental free floating trailing embolus in the territory the right superior basal branch (1B, right). Note that the microembolus is contralateral to both the site of the pain and the VQ defect.

patterns in all patients, suggesting that the microembolus was an incidental finding of no clinical significance. Pathologists who reviewed the medical records and autopsies of 1455 consecutive patients found 162 cases of solitary subsegmental embolism and concluded that such emboli are incidental findings unrelated to the clinical status of the patient and which did not contribute to mortality [14]. In our study, one patient (1/5) was subsequently readmitted for a gastrointestinal bleed secondary to warfarin, which illustrates the well known fact that anticoagulation is not without risks.

Spiral CT is rapidly replacing both selective angiography and ventilation/perfusion imaging for the investigation of pulmonary embolism. Our study may help explain why patients with a negative Spiral CT study have an excellent prognosis although the test often fails to demonstrate subsegmental emboli [15–19].

Once an embolus is found during selective angiography, thus confirming the diagnosis of pulmonary embolism, it is common practice to halt the angiographic procedure. Our study suggests that if a subsegmental microembolus is the sole finding, the angiographer should complete the procedure in both lungs to determine if segmental or larger emboli are present, thus giving the clinician all the information necessary to decide if the clot load is clinically significant.

The clinical and imaging literature is almost exclusively concerned with making sure that no case of pulmonary embolism escapes detection. The concept of clinically insignificant pulmonary embolism is not discussed. Withholding anticoagulation in a patient with documented pulmonary embolism would be regarded as heresy and malpractice in the medical community.

Our study suggests that solitary pulmonary sub segmental embolism is not uncommon and may well be a serendipitous finding of doubtful clinical significance. Further studies are warranted to determine if anticoagulation can be withheld in patients with solitary microembolism in the absence of other major risk factors such as deep vein thrombosis.

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