

# A large intra-atrial thrombus detected during a lung perfusion scan with technetium-99m macroaggregated albumin injected through the subclavian venous line

## Abstract

A sixty five year old female patient carrying a double lumen subclavian catheter, with severe right-sided heart failure, was subjected to lung perfusion scan in order to rule out pulmonary embolism. Administration of technetium-99m macroaggregated albumin ( $^{99m}\text{Tc}$ -MAA), via a double lumen (Hickman) subclavian line, resulted in trapping almost half of the injected dose in the right atrium, at the tip of the subclavian catheter. There was no evidence of pulmonary embolism. This finding was interpreted as consistent with the presence of a large intra-atrial thrombus. This thrombus, despite the thrombolytic treatment that followed, was detached and caused cardiac arrest and eventually the death of the patient. Autopsy showed a massive pulmonary embolus. This report suggests, that injecting  $^{99m}\text{Tc}$ -MAA for a lung perfusion study via the central venous line, may result in the early detection of a thrombus, as in this case at the tip of the catheter and this may be life saving for the patient. We have been unable to find in the literature a similar case of a thrombus detected by the iv administration of  $^{99m}\text{Tc}$ -MAA.

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## Introduction

Many post-surgery patients carry for long periods of time, central venous catheters, greatly facilitating fluids or drugs administration and also allowing repetitive blood sampling. These catheters are prone to a number of complications, such as infection [1, 2] and deep vein thrombosis [3-11]. As far as thrombosis is concerned, two kinds of central venous catheter-related thrombi are known: occlusive thrombi, developing inside the catheter lumen and sleeve thrombi, developing on the outer surface of the catheter lumen [5,12]. Multiple factors are known to contribute to the incidence of thrombosis, such as Virchow's triad of venous stasis, vessel injury and hypercoagulability [2,9]. Irrespective whether the catheter material is polyethylene, silicone or polyurethane, it is generally accepted that within 5-7 days post catheter placement, a fibrin sheath is circumferentially formed along the entire catheter length [10-13]. Nonetheless, the presence of large intra-atrial thrombi, in patients with indwelling subclavian catheters, is a rare complication and only few such reports are encountered in medical literature [14-17].

Nuclear medicine flow studies provide a diagnostic alternative to the use of contrast venography, for the detection of subclavian thrombosis.  $^{99m}\text{Tc}$ -pertechnetate [18] or  $^{99m}\text{Tc}$ -tagged red blood cell ( $^{99m}\text{Tc}$ -RBC) venography have been described in studying the patency of the subclavian venous system, including that of the catheter [19,20]. Persistent focal activity at the catheter tip has been found to be consistent, but not specific, of fibrin sheath formation [12].

## Description of the case

A sixty five year old female with metastatic breast cancer was hospitalized in the plastic surgery department for a flap placement over the left hemithorax, after ipsilateral radical mastectomy. Due to the obesity of the patient and the inaccessibility of the peripheral veins, a double lumen subclavian catheter (Hickman) was inserted, to allow venous sampling and fluids/drugs ad-

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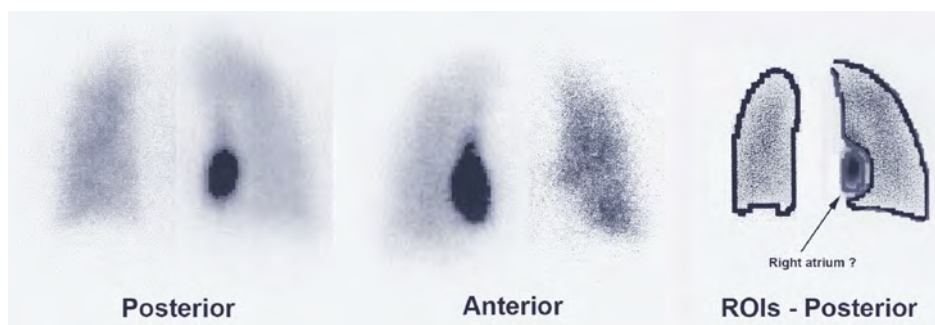
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**Figure 1.** Anterior and posterior views of patient's lung perfusion scan. A dose of 74 MBq of  $^{99m}\text{Tc}$ -MAA was administered through the subclavian catheter, as described in the text. ROIs from the posterior image revealed that 40% of the injected dose remained in the right heart chambers.

ministration. The patient was hypertensive, treated with an angiotensin-II receptor inhibitor (Losartan<sup>®</sup>) and also diabetic, treated with Glucophage<sup>®</sup>. Twenty-five days after the surgical procedure, the patient suddenly developed dyspnea with edema anasarca and the diagnosis of heart failure was established. She was treated with the intravenous administration of furosemide (80 mg bid). Despite treatment, the patient remained edematous. Her laboratory values revealed increased brain natriuretic peptide (486 pg/mL, reference values: <100 pg/mL) and D-dimers (3450 pg/mL, reference values: <400 pg/mL), while the MB-fraction of creatinine kinase and troponin-I were found within normal limits. These findings ruled out myocardial infarction, but showed an on-going thrombotic process (increased D-dimers) with right heart failure (increased brain natriuretic peptide). The ECG showed sinus tachycardia (120 beats/min). Her blood pressure was 140/90 mmHg. No heart ultrasound study was performed at that point, although no apparent cause for the observed right-sided heart failure was found. Seventeen days later and forty-two days after the surgical procedure, the patient developed an exacerbation of her respiratory distress and a lung perfusion study was ordered.

After checking the flow through the subclavian catheter by a syringe containing heparinized normal saline, a dose of 74 MBq of technetium -99m macroaggregated albumin ( $^{99m}\text{Tc}$ -MAA) (MAASOL<sup>®</sup> Amersham Health, UK), with albumin aggregates distribution from 10 to 100  $\mu\text{m}$ , was administered through the catheter and flushed with heparinized normal saline. No noticeable flow resistance was noticed during the radiopharmaceutical administration. By that time, the patient was receiving 2-3 liters of fluids daily through the subclavian line. Due to the patient's condition, only anterior and posterior views (of 500 kcounts each) were obtained with an Orbiter  $\gamma$ -camera (Siemens, Germany), equipped with a LFOV-LEHR collimator and interfaced to a computer for data processing. A recent chest X-ray showed the typical findings of heart failure, her ECG showed sinus tachycardia with 120 beats/min and her blood pressure was 145/90 mmHg. The arterial blood gases showed 32 Torr  $\text{pCO}_2$ , 53.4 Torr  $\text{pO}_2$ , although the patient was under a Venturi oxygen mask, with a blood pH of 7.41. The D-dimers levels were 650 pg/mL, while fibrinogen was 588 mg/dL (reference values: 200-400 mg/dL). In Figure 1, the anterior and posterior views of the patient's lung perfusion scan are shown. Both lungs showed a homogeneous distribution of  $^{99m}\text{Tc}$ -MAA, with no signs of pulmonary embolism. A teardrop shaped "hot" region was noticed cor-

responding to the region of the right heart chambers, presumably in the right atrium, appearing more intense in the anterior view. Regions of interest (ROIs) were drawn over the lung fields and the right heart chambers region. It was found that 40% of the injected dose was trapped in the right heart chambers region, with dimensions of approximately 4x3 cm. Since normal right atrium end diastolic volume is approximately 60  $\text{cm}^3$ , the observed hot region that appeared to occupy a significant portion of the right atrium, increasing significantly venous pressure and leading to the observed interstitial fluid accumulation. The thrombus, which had developed at the catheter's tip, although did not obstruct the flow through the subclavian catheter, trapped a significant portion of the injected microparticles in its fibrin mesh. The patient's condition did not allow for any further examination to verify the intracardiac thrombus by trans-esophageal [21] or trans-thoracic echocardiography [22-23]. Thrombolytic treatment was started immediately [24], but the next day the patient had a cardiac arrest and died. Autopsy confirmed the massive intra-atrial thrombosis.

## Discussion

The risk of pulmonary embolism in patients with dual lumen central venous catheter is quite high, with an associated mortality between 40% and 60% [2, 10-17]. Although the patency of the subclavian system, including that of central venous catheters, has been studied with either  $^{99m}\text{Tc}$ -pertechnetate solution or  $^{99m}\text{Tc}$ -RBC [18, 20], we were unable to find in the literature a case of a large intra-atrial thrombus at the tip of a central venous line detected by  $^{99m}\text{Tc}$ -MAA. It should be emphasized though, that prior to the  $^{99m}\text{Tc}$ -MAA administration, the patency of the central venous catheter, should be carefully checked by a syringe containing heparinized normal saline, to avoid dislodging of any intra-luminal thrombus that may have developed. In the case reported, it is believed that the observed thrombus had developed about 25 days after hospitalization and it had already caused the clinical picture of right-sided heart failure, accompanied by edema anasarca, which was not rectified by intense diuretic treatment. The thrombus apparently persisted for seventeen days, until the forty-second day after hospitalization, when the patient was referred to our department for a lung perfusion scan. It appears that the thrombus had developed around the catheter lumen and it did not obstruct the flow of intravenous fluids supplied during all these days [14].

*In conclusion*, when patients with a central venous line are subjected to  $^{99m}\text{Tc}$ -MAA lung perfusion scan and the radiopharmaceutical should be administered through the central venous line, checking the catheter's flow by a syringe containing heparinized normal saline is important. Besides the lung perfusion scan, thrombi that could be life-threatening may thus be identified.

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