



# Tc-99m Ethambutol Planar Image Retention Index As A Quantitative Diagnostic Parameter of Lung Tuberculosis



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## ABSTRACT

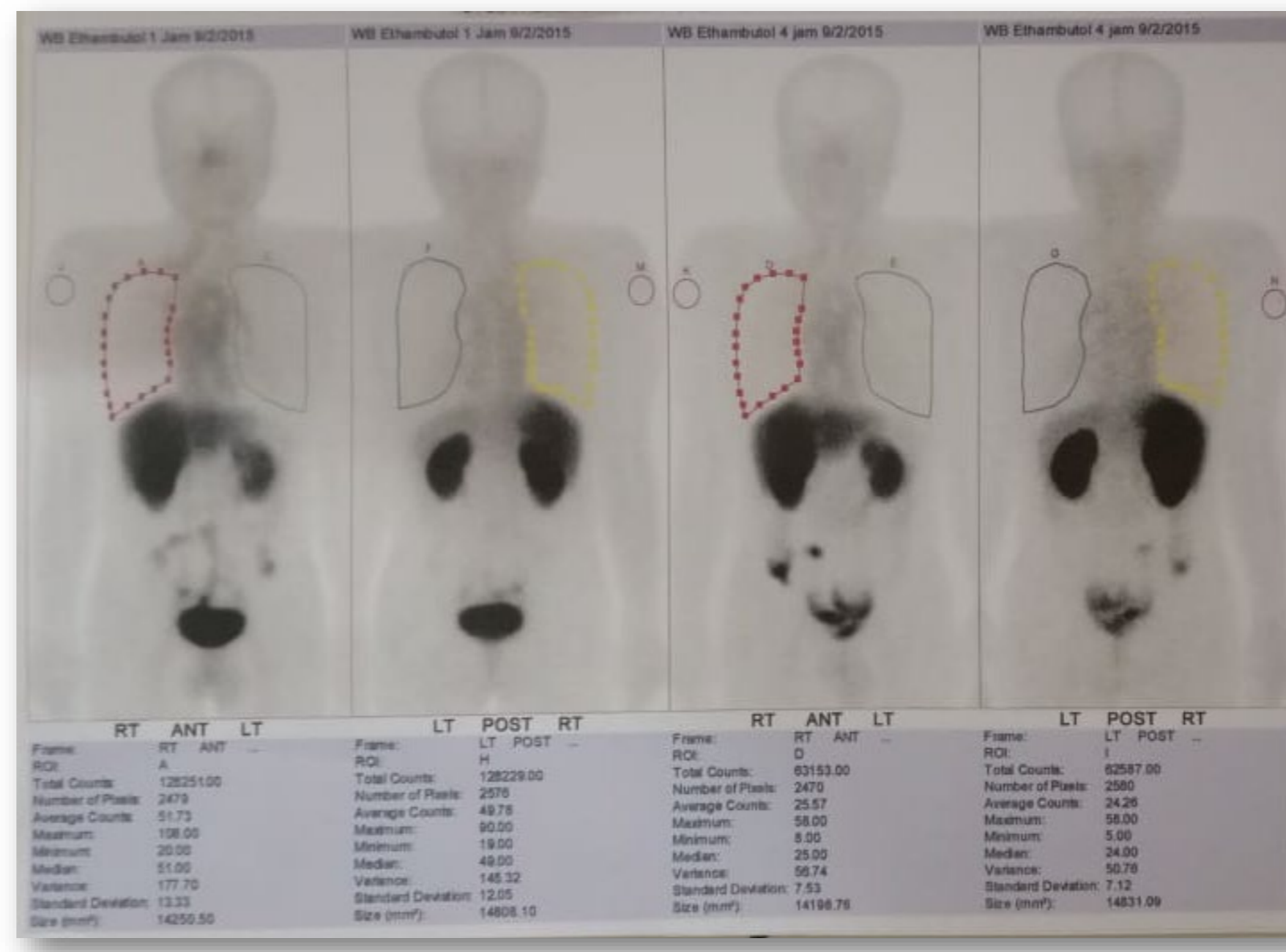
**Introduction.** Ethambutol labelled with Tc-99m (Tc-99m-Ethambutol) will be uptake specifically by Mycobacterium tuberculosis. It can be used to detect pulmonary tuberculosis. Ethambutol scintigraphy visually (qualitatively) allows subjectivity factors to influence the results, so a more objective (quantitative) assessment is needed. The purpose of this study was to obtain a parameter in the form of a retention index cut-off (IR) of Tc-99m-Ethambutol uptake from planar images for the diagnosis of pulmonary TB.

**Subjects and Methods.** This study involved 45 subjects. Calculation of the cut-off value of the retention index (IR) of planar images based on the calculation of the Receiver Operating Characteristics (ROC) curve, planar image retention index >0 (IR>0), visual analysis of planar images and SPECT/CT of Tc-99m-Ethambutol on TB lungs subjects with AFB sputum examination results as a comparison

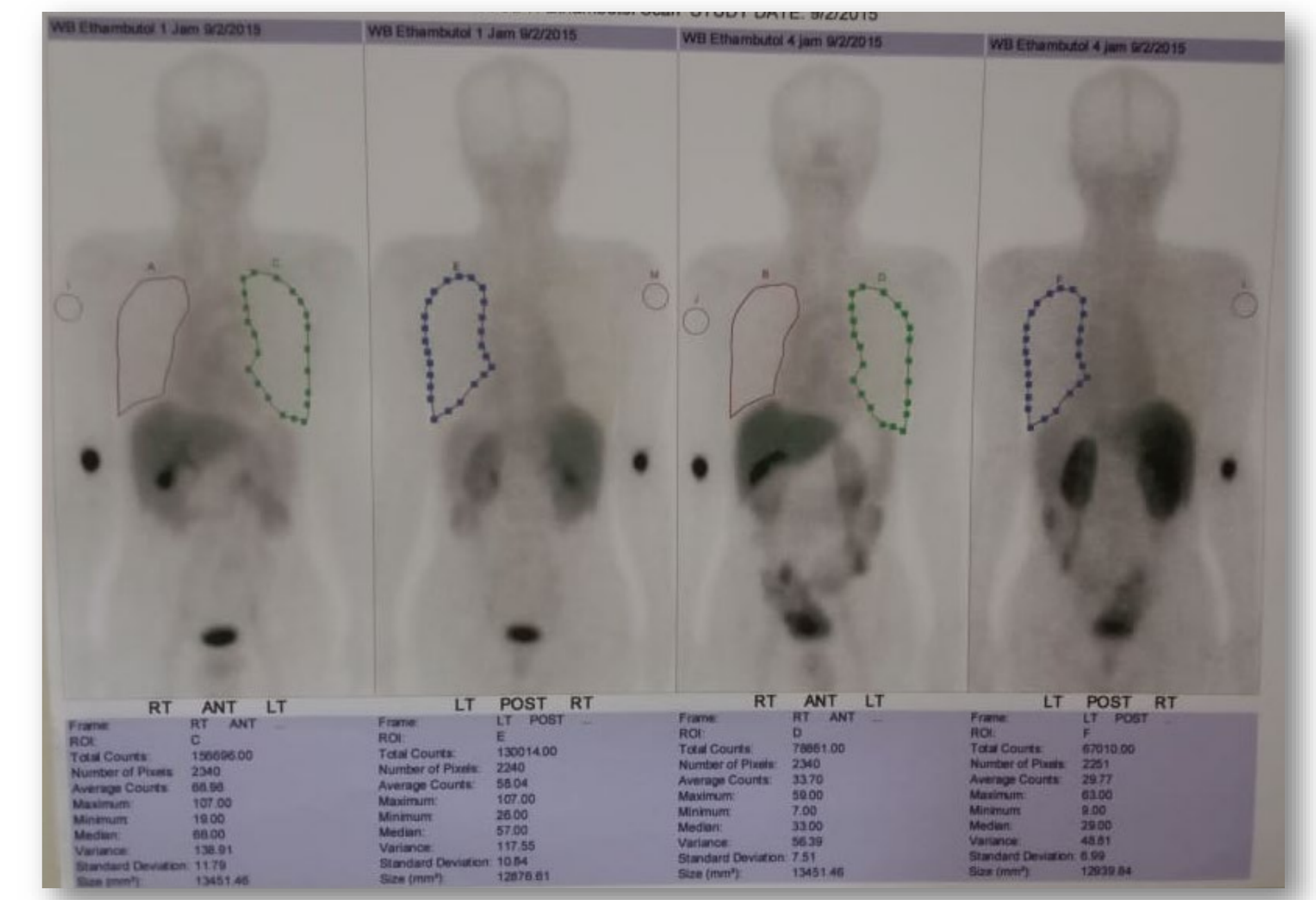
**Results.** The cut-off value of bilateral lung IR was >-6.683 (AUC=0.620) with a sensitivity of 76.7%, specificity of 60.0% and accuracy of 71.1% (p=0.015). At (IR>0), sensitivity was 66.7%, specificity was 84.6% and accuracy was 72.1%. Visual assessment on planar images obtained sensitivity of 40%, specificity 53.85% and accuracy 44.19%, while the visual assessment on SPECT/CT images sensitivity was 93.3%, specificity was 76.9% and accuracy was 88.4%. When (IR>0) combined with visual assessment SPECT/CT obtained 100% sensitivity, 84.6% specificity and 95.4% accuracy. False negative results based on IR cut-off of planar images can be caused by the location, size, characterization of the lesion and attenuation in the thoracic region.

**Conclusion.** The cut-off value of the planar image retention index cannot be used as a diagnostic quantitative parameter for pulmonary TB independently. Combination between IR>0 and visual assessment of SPECT/CT images provide higher accuracy for the diagnosis of pulmonary TB.

$$\text{Retention Index (RI)} = ((\text{Delay ratio} - \text{Early ratio}) \times 100) / \text{Early ratio}$$



Early ROI



Early ROI

No	Modality	Sensitivity	Specificity	Accuracy
1	Planar Image (Qualitative/Visual)	40%	53,85%	44,19%
2	Index Retention of Planar Image (IR >0)	66,7%	84,6%	72,1%
3	SPECT/CT (Qualitative/Visual)	93,3%	76,9%	88,4%
4	Combination ( Index Retention of Planar Image (IR>0) and SPECT/CT (Qualitative/Visual))	100%	84,6%	95,4%

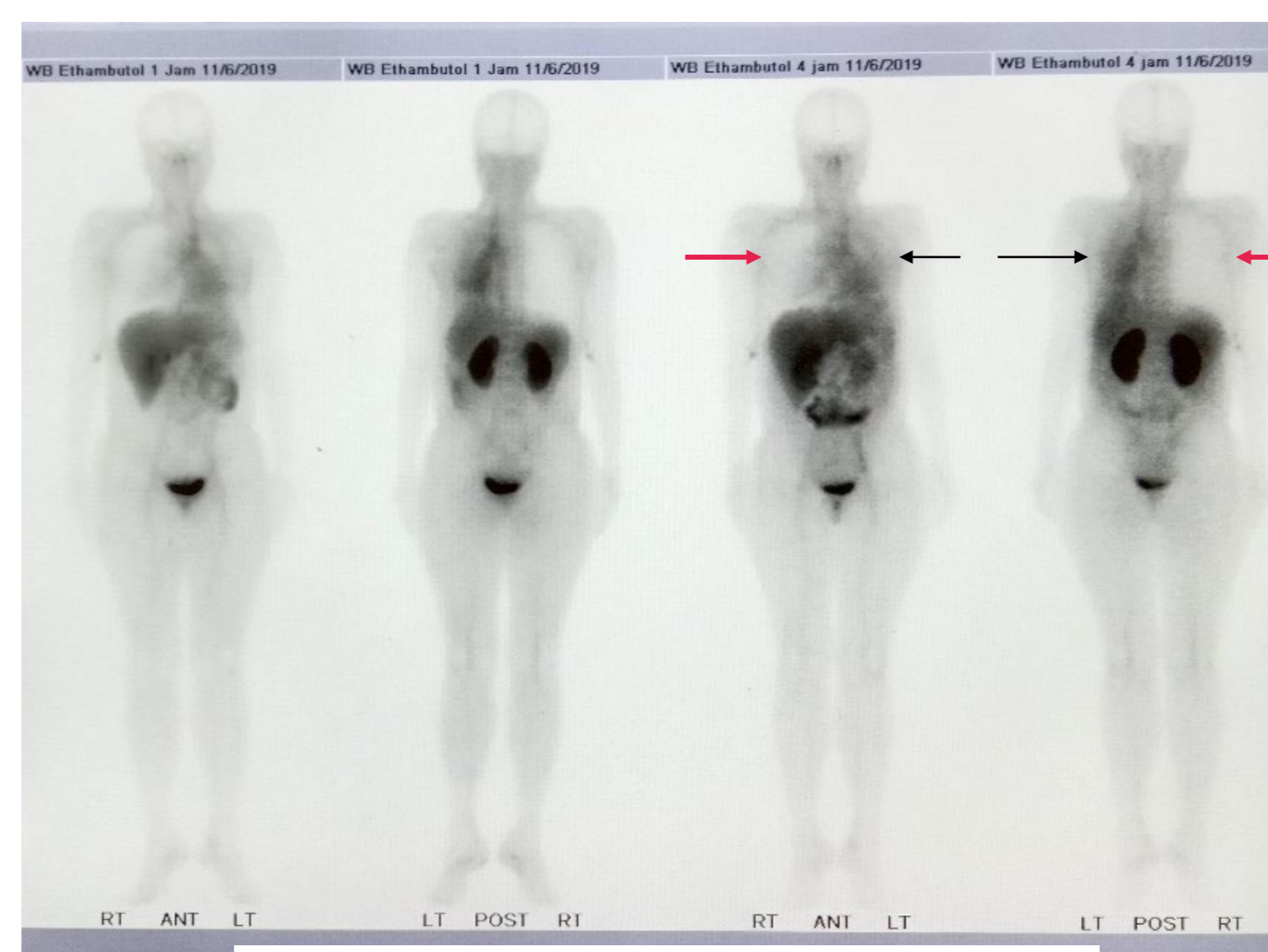


Figure 1.a Red arrow : RI of Right Lung (RI<0)  
Black arrow : RI of Left Lung (RI<0)

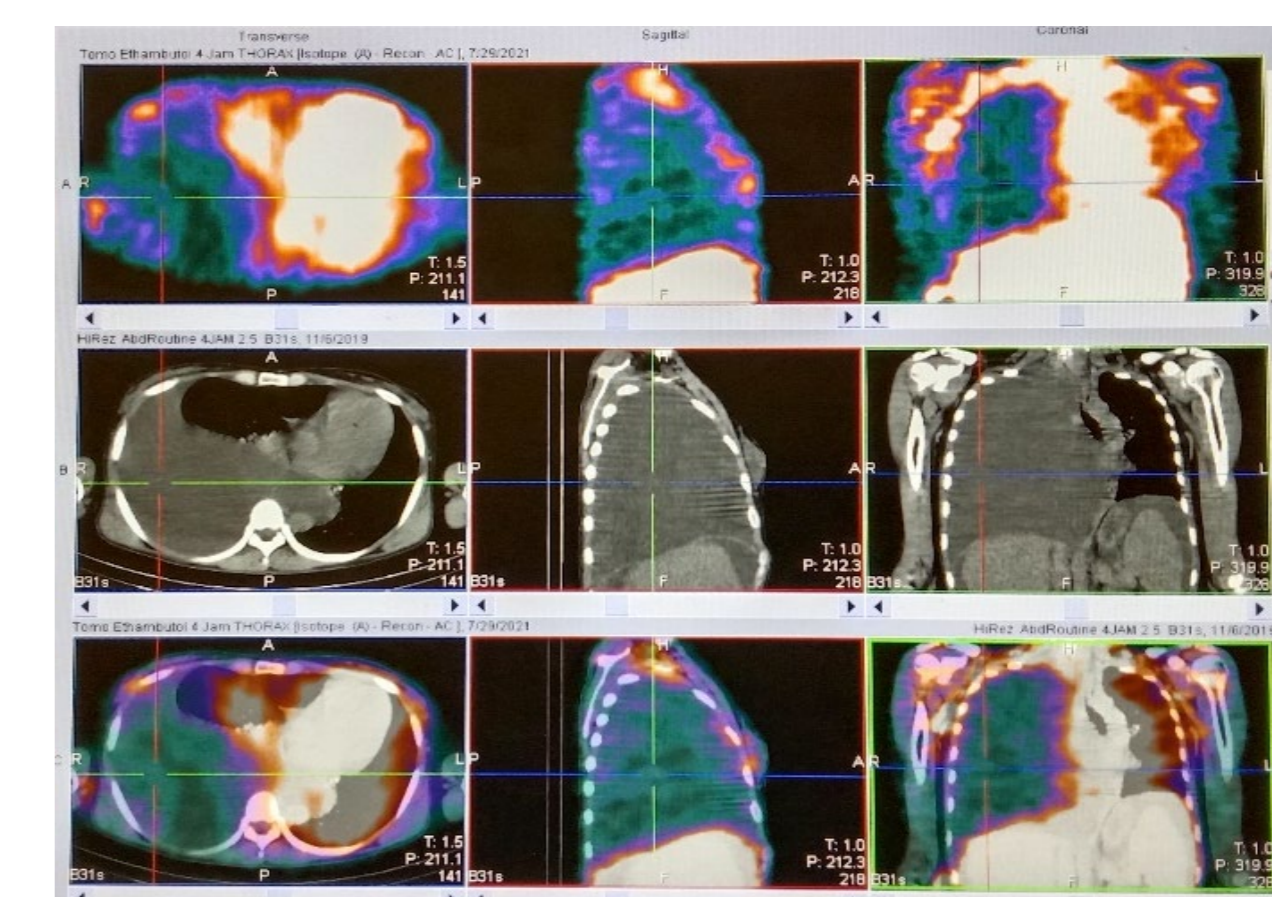


Figure 1.b RI of Right Lung (RI<0); pleural effusion

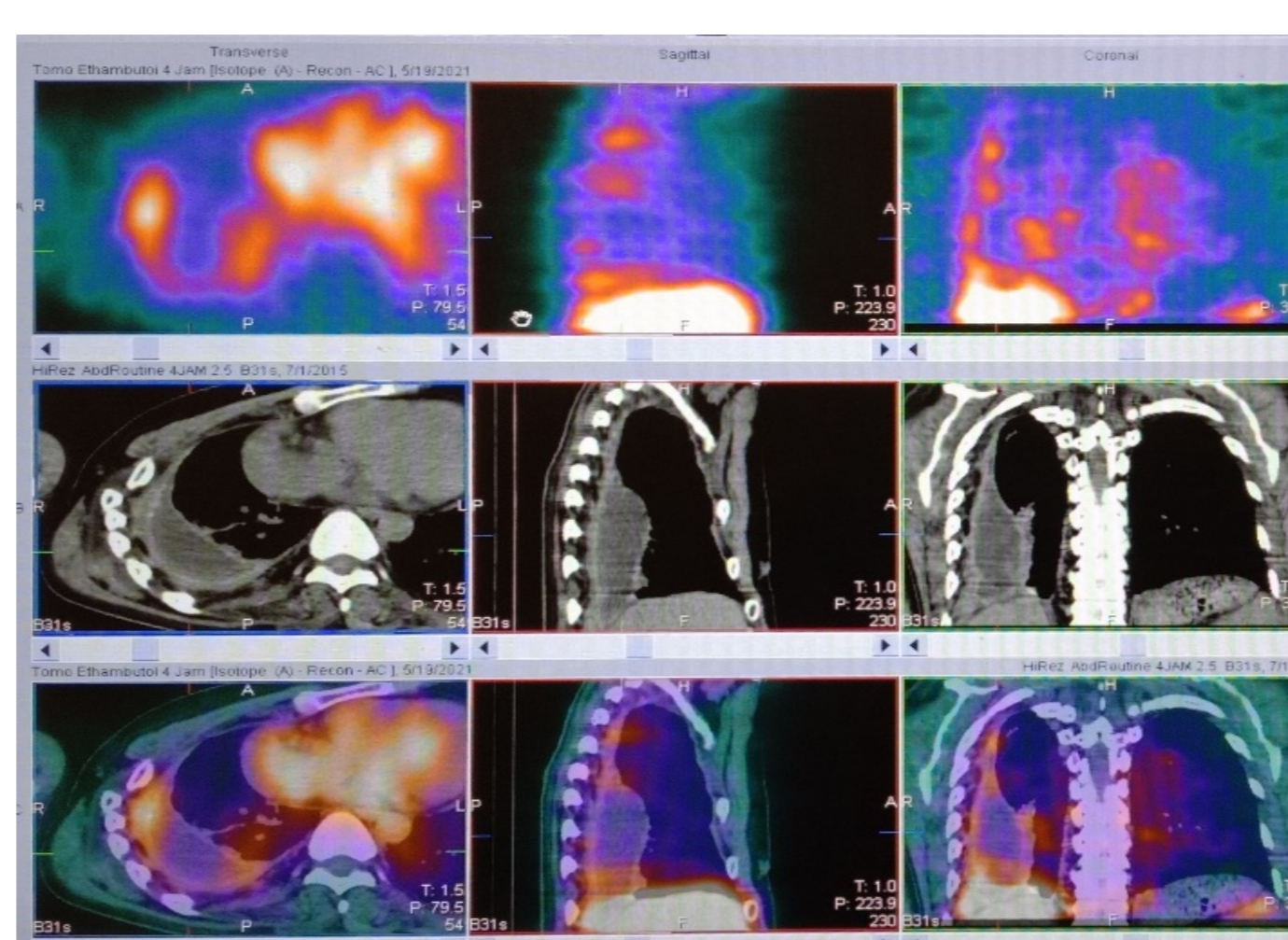


Figure 2. Pulmonary TB with pleural thickening and effusion.  
Tc-99m Ethambutol uptake of pelura.

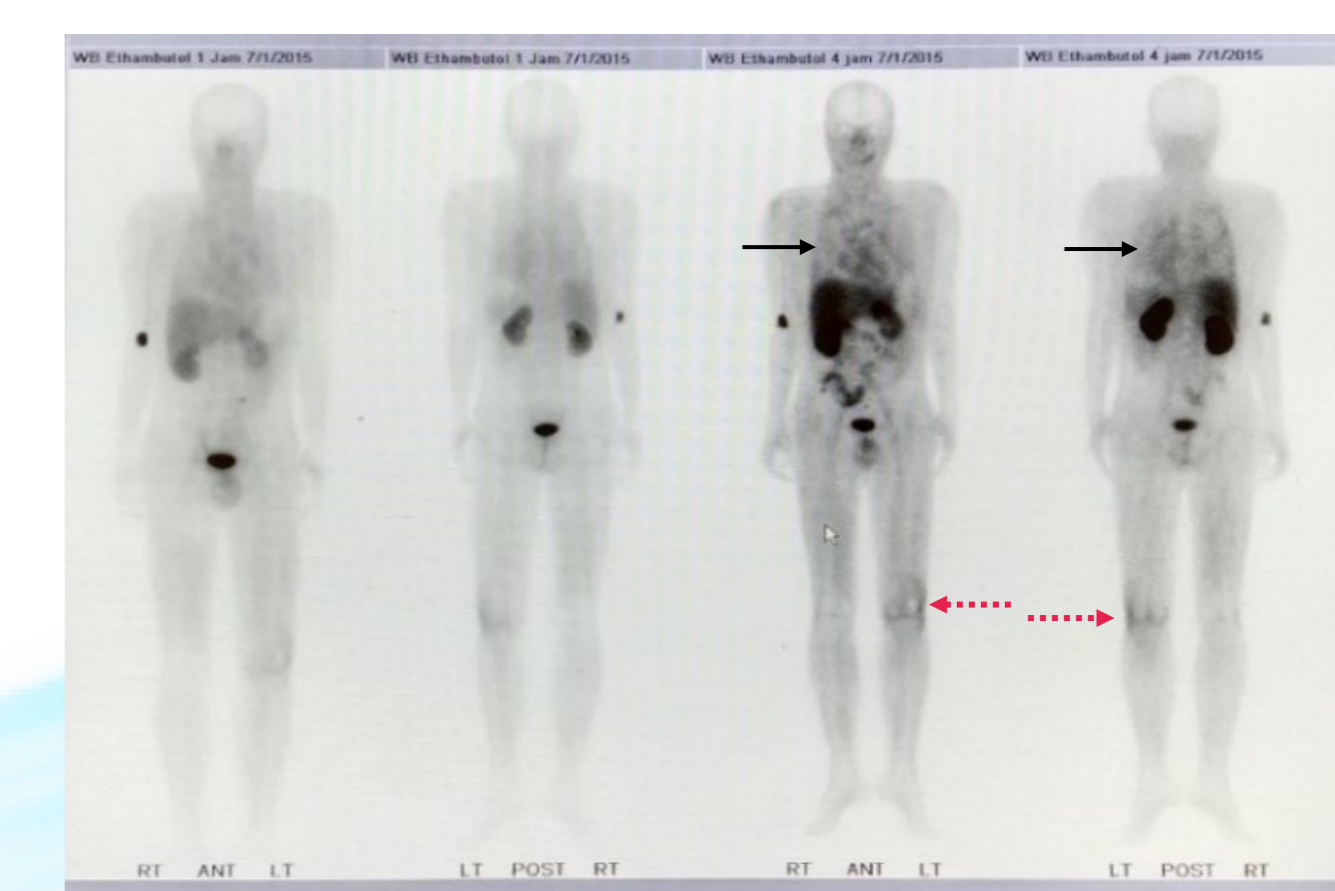


Figure 3. Right & Left Lung IR>0 (positive); positive Mtb in sputum.  
Abnormal radiopharmaceutical distribution in thorax and left knee (dotted arrow).