FULL PAPER

DIAGNOSTIC PERFORMANCE OF $^{99m}$Tc-ETHAMBUTOL SCINTIGRAPHY IN DETECTING PERITONEAL TUBERCULOSIS
(Preliminary study)

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DIAGNOSTIC PERFORMANCE OF $^{99m}$Tc-ETHAMBUTOL SCINTIGRAPHY IN DETECTING PERITONEAL TUBERCULOSIS (Preliminary study)

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ABSTRACT

Objective. Peritoneal tuberculosis is an extrapulmonal predilection of tuberculous infection which clinical features often resemble other gastrointestinal diseases. Conventional diagnostic techniques not uncommon fail to detect peritoneal tuberculous infection. A cross sectional study was designed to evaluate diagnostic performance of ethambutol scintigraphy in detecting abdominal tuberculosis.

Material and method. Abdominal SPECT-CT imaging was done one hour after intravenous injection of 370 – 555 MBq $^{99m}$Tc-Ethambutol in 9 adult patients with suspected of having peritoneal tuberculosis. Scintigraphy was considered positive when pathological $^{99m}$Tc-Ethambutol uptake was seen in the suspected area. Biopsy surgery was performed to obtain tissue for histopathological examination within one week after scintigraphy. Histopathological finding served as gold standard was considered positive according to CDC criteria.

Results. There were concordance results between scintigraphy and histopathology in 7 of 8 patients (87.5%). Four patients were positive on both ethambutol scintigraphy and histopathology finding, while the other three patients were negative on both examinations. All the three patients showed non specific peritonitis. There was discordant in one patient, where scintigraphy was
positive while histopathological finding was negative. This was presumably due to different biopsy target area shown on scintigraphy.

**Conclusion.** From our preliminary study $^{99m}$Tc-ethambutol scintigraphy is a promising diagnostic modality in detecting peritoneal tuberculous infection.

**Introduction**

Tuberculosis is world’s endemic infection, especially in developing countries. Annually, nine million persons develop active *M. tuberculosis* infection, and one third of the world's population, approximately 2 billion persons, are thought to be latently tuberculous infection. Approximately two million persons die each year from active tuberculosis despite the existence of effective treatments for both latent infection and active disease.¹

Tuberculous can involve any part of the body as a single or multiple sites. Multifocal tuberculosis is characterized by the presence of multifocal tuberculous areas in the same or different organs. Extra-pulmonary tuberculosis usually presents more of a diagnostic problem than pulmonary tuberculosis. Peritoneal tuberculosis is an extra-pulmonary predilection of tuberculous infection which clinical features often resemble other gastrointestinal diseases. Difficulty on diagnosis of multifocal tuberculosis may lead to a delay in diagnosing of tuberculous infection. Conventional diagnostic techniques are not uncommon fail to detect peritoneal tuberculous infection. In addition, extrapulmonary tuberculosis involves relatively inaccessible sites for bacteriologic confirmation. In this case, invasive procedures are frequently required to establish a diagnosis.

Radionuclide imaging using leucocyte and antibiotic labeled was widely use to detect and localize infection. Infection imaging using radiopharmaceutical
$^{99mTc}$-ciprofloxacin has sensitivity and specificity 86.36% and 72.73% respectively in detecting and localizing infection including abdominal infection.\textsuperscript{2,3} The problem is still remain, since it could not differentiate tuberculous from non-tuberculous infection. $^{99mTc}$-Ethambutol is one of non-invasive imaging modality can be used to detect and localize site of tuberculous infection.

Ethambutol is a specific antibiotic actively agains mycobacterium through inhibition of mycoic acid cell membrane. Ethambutol is used as first line treatment for tuberculous infection.\textsuperscript{3-5}

Ethambutol can be labeled by $^{99mTc}$. $^{99mTc}$-ethambutol will specifically bind to mycoic acid on mycobacterial cell membrane after intravenous injection. $^{99mTc}$-ethambutol accumulated in site of mycobacterial infection can be imaged using gamma camera.\textsuperscript{6,7}

The aim of this preliminary study was to evaluate diagnostic performance of $^{99mTc}$-ethambutol scintigraphy in detecting peritoneal tuberculosis.

**Material and method**

Observational cross sectional and diagnostic performance study was done in Department of Nuclear Medicine, Dr. Hasan Sadikin General Hospital/Faculty of Medicine Universitas Padjadjaran after receiving ethical clearance from Health Research Ethics Committee Faculty of Medicine Universitas Padjadjaran. Subject was adult patient with suspected of having peritoneal tuberculosis based on history, physical examination and standard supporting diagnostic modalities and agree to participate on this study by signing informed consent form. Subject with primary as well as secondary malignancy in abdomen, and patient has been taking anti tuberculous drug more than 2 weeks were excluded.
Abdominal SPECT-CT imaging was done one hour after intravenous injection of 370 – 555 MBq $^{99m}$Tc-Ethambutol in 9 adult patients with suspected of having peritoneal tuberculosis. Scintigraphy was considered positive when pathological $^{99m}$Tc-Ethambutol uptake was seen in the suspected area. Biopsy surgery was performed to obtain tissue for histopathological examination within one week after scintigraphy. Histopathological finding served as gold standard according to CDC criteria.

**Results**

Eight males and one female age range 21-52 years old (x=31) were included in this study. There were concordance results between $^{99m}$Tc-ethambutol scintigraphy and histopathology in 8 of 9 patients (88.9%). Five subject were positive on both $^{99m}$Tc-ethambutol scintigraphy and histopathology finding, while the other three patients were negative on both examinations. There was disconcordant in one patient. (table 1).

<table>
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<th>Participant</th>
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</table>
Discussion

This study showed mean age of subject was 31 years old, which include in reproductive age. This study was similar to other study showed that the most abdominal tuberculosis patients were in the reproductive age (20-40 years).\textsuperscript{8-10}

Ethambutol is a first line treatment for tuberculosis through inhibition of developing mycois acid membrane cell of mycobacterium tuberculosis. \textsuperscript{99m}Tc-labeled ethambutol will be uptaken by mycobacterium tuberculosis and could be imaged using gamma camera.

This study showed a concordance results between \textsuperscript{99m}Tc-ethambutol scintigraphy and histopathology in 8 of 9 patients (88.9%). Eight males and one female age range 21-52 years old (x= 31) were included in this study. There were concordance results between \textsuperscript{99m}Tc-ethambutol scintigraphy and histopathology in 8 of 9 patients (88.9%). Five subject were positive on both \textsuperscript{99m}Tc-ethambutol scintigraphy and histopathology finding, while the other three patients were negative on both examinations. Discordance results was find in one subject with positive \textsuperscript{99m}Tc-ethambutol scintigraphy but negative histopathology finding. Five out of 8 concordance results were positive on both \textsuperscript{99m}Tc-ethambutol scintigraphy and histopathology finding, while the other 3 subjects were negative on both examinations. All three subject showed non tuberculous peritonitis. This discordance was presumably due to sample taken from biopsy target area different from area shown positive pathology on \textsuperscript{99m}Tc-ethambutol scintigraphy. Other possibility of negative result of \textsuperscript{99m}Tc-ethambutol scintigraphy is competitive uptake with non-radioactive ethambutol taken prior to scan, but further study is recommended.
False positive result could be found in $^{99m}$Tc-ethambutol scintigraphy. False positive could be due to hypervascular lead to increase tracer uptake. Serial images on 2 and 4 hours after injection of $^{99m}$Tc-ethambutol are recommended to minimize false positive result. Increase tracer uptake on late images considered to be true positive, on the other hand false positive result if decrease tracer uptake on late images.

**Conclusion**

From this preliminary study $^{99m}$Tc-ethambutol scintigraphy is a promising diagnostic modality in detecting and localizing peritoneal tuberculous infection.

**Referens**


