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**THORAX MULTI-SLICE COMPUTER TOMOGRAPHY (MSCT)  
EXAMINATION TECHNIQUE IN THE CASE OF MEDIASTINUM  
TUMOR AT RADIOLOGY INSTALATION OF SEMARANG DISTRICT  
GENERAL HOSPITAL**

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**ABSTRACT**

**Background:** Thorax Multi-slice computer tomography (MSCT) scan examination requires contrast medium to image the difference in density with the surrounding tissue. The contrast images is largely determined by the volume of contrast, injection rate and injection methods. Thorax CT scan is performed by slice thickness of 5-10 mm. Meanwhile, it should use the routine slice thickness of 10 mm. Slice thickness of 8-10 mm of coronal and sagittal images require reconstruction by thin slices of 1-1.5 mm and subsequently by applying 3D.

**Aims:** This is to analyse the volume of contrast and slice thickness used in the examination of tumor mediastinum by thorax MSCT examination.

**Methods:** This research used descriptive qualitative design with case study approach, described and explained systematically, related to the procedure of Thorax MSCT examination technique in the case of mediastinum tumor with 3 samples of 3 patient and assessment performed by three radiologist as respondents.

**Results:** This study indicates the success of the use of proper contrast of 80 cc and slice thickness of 2-3 mm to observe lesions of mediastinal tumor.

**Conclusion:** Thorax MSCT examination in the case of mediastinum tumor should use contrast 80 cc and slice thickness of 2-3 mm to observe lesions of mediastinal tumor and coronal and sagittal axial slices, because the sagittal slice can show the lymphadenopathy enlargement so that the mediastinum tumor is clearly visible. The print out or filming results should be included the MPR or 3D to show the presence or absence of bone destruction and metastases.

**Keywords:** Thorax MSCT, Mediastinum Tumor, Contrast medium, Slice Thickness

**INTRODUCTION**

Thorax CT scan examination technique is a radiological examination technique to obtain anatomical information of cross-sectional or cross-axial slices of the thorax. Mediastinum CT scan cannot be separated from the examination of the thorax cavity, so abnormalities that will be examined in mediastinum are abnormalities found in the thorax cavity itself. Additionally, abnormalities that can be observed through Thorax CT Scan are mediastinum tumor, aneurysm, and abscesses, lesions on hilar or mediastinal or aortic surgery [1]. Important process that involves the mediastinum includes emphysema, bleeding and infection and many types of primary tumors and cysts. Systemic disorders such as metastatic carcinoma and many granulomatous diseases can also be involved in the mediastinum. Lesions which are primarily derived from the esophagus, trachea, heart and major blood

vessels are usually associated with a specific organic compounds involved rather than the mediastinum [2].

Examination of mediastinum tumor in the thorax cavity is to obtain information on the location, type and size and metastases of the tumor. These examinations require contrast medium which aims to see the difference in density with the surrounding tissue. The quality of images produced with the use of contrast medium is largely determined by the volume of contrast, injection rate and injection methods. The volume of contrast medium used in a Thorax CT Scan on mediastinum tumor is as much as 80-150 ml, the injection rate is 2-3 ml/sec with automatic injector, and the contrast volume used is between 80-100ml [3].

Thorax CT scan is performed by using slice thickness of 5-10 mm. Meanwhile, it should use the routine slice thickness of 10 mm. Slice thickness of 8-10 mm of coronal and sagittal images require reconstruction by thin slices of 1-1.5 mm and subsequently by applying 3D [4]. Thick slices can be between 5-10 mm depending on the size of lung lesion or make a combination of 10 mm in the area with no lesion and thin slices in the area of the lesion. Coronal and sagittal slices are obtained by MPR technique and thin slice between 2-3 mm is necessary [5].

Based on the observations at Radiology Installation of Semarang District General Hospital, Thorax MSCT examination procedure in all cases one of which mediastinum tumor is performed by using 50 cc of contrast medium, with axial and coronal slices alone and do not use sagittal and thin slice MPR and 3D on the area of abnormality. From the difference in examination technique between Radiology Installation in Semarang District General Hospital and the existing theories regarding the various uses of contrast medium and recommended slice thickness in the Thorax MSCT examination procedure in the case of mediastinum tumor. This study is to analyse the volume of contrast and slice thickness used in the examination of tumor mediastinum.

## **METHODS**

This study was a descriptive study with case study approach. The subjects of this study were 3 patients with thorax MSCT request in the case of mediastinum tumor, 3 radiographers and a 2 radiologist, 1 sender doctor. Data were collected in April 2013 and were resumed in July 2013.

The data collection method used was the author held a direct observation on the Thorax CT scan in the case of Mediastinum Tumor at Radiology Installation of Semarang District General Hospital, conducted direct interviews with radiographers and radiologists. The interviews were related to the subject matters, including collection of the data included radiographs, the request letter of CT-scan, photographs readings and other records related to the Thorax MSCT examination in the case of mediastinum tumor at Radiology Installation of Semarang District General Hospital. The data were collected in the form of interview transcripts and then were reduced. After data reduction open coding was carried out by analyzing them based on observations and interviews with respondents and data collection from observations. Coding was done in an effort to clarify the validity of the data collected. Coding was done to facilitate the analysis results describing so the author could draw conclusions.

## **RESULTS**

### ***Procedures***

#### ***a. Patient preparation***

Patient 1, 2 and 3 had the same preparation that is the guideline for Thorax MSCT examination in the case of mediastinal tumor in Radiology Installation of Semarang District General Hospital. The patient must fasting 6 hours before the test, bring the laboratory results of Blood Urine

Nitrogen (BUN) and creatinine serum (Sc). The lab results of urea, creatinine in 3 patients were normal, patient 1 had urea of 28.0 mg/dl and creatinine of 0.6 mg/dl; patient 2 had urea of 30.0 mg/dl and creatinine of 0.5 mg/dl; patient 3 had urea of 25,0 mg/dl and creatinine of 0.8 mg/dl. The patients' clothes were changed with a gown. Objects that can cause artifacts on the area to be examined (thorax) such as necklace and bra were removed. Before the examination the patients were asked to fill out an informed consent as an approval to perform MSCT examination by using contrast medium, and received a brief explanation of the examination procedure.

*b. Tools and materials preparation*

Tools and materials used in the Thorax MSCT examination in patients with mediastinum tumor are as follows: MSCT machine of Philip Brilliance 16 slices with kV max of 150 kV and mA max of 300 mA. A single syringe Mallinckrodt Injector was used, blankets, central oxygen, infusion standard, fixation devices, agfa printer, CT Scan films, Iopamiro contrast medium with the concentration of 300, 10 ml of NaCl.

*c. Patient position*

The patient position was supine on an exam table with both hands above his head and the patient was covered and fitted by fixation devices (straps) on the patient's body with his feet near the gantry (feet first). Mid Sagittal Plane (MSP) of the body was arranged parallel to the longitudinal indicator lights and Mid Coronal Plane (MCP) was arranged parallel to the horizontal indicator lights.

*d. Scanning technique*

After setting the position of the patient then the next step was to enter patient data into the computer data entry included: name, age, gender, number of CT scans, body weight, clinical diagnosis, sender doctor, radiologist reading the results, radiographer performing the examination, the type of inspection and the patient's position when he or she come in the gantry. After the patient data were entered, then arrangements of the axial slices were made with the slice thickness of 7mm with lung apex to the diaphragm/supra-renal, Scanning was performed pre contrast and post contrast.

*e. Filming technique*

After the post-contrast scanning then it was reproduced and printed as many as 20 images on one sheet of film and it took 3-4 sheets of film for pre and post contrast for axial and coronal slices.

**Thorax MSCT examination**

Shown in Figure 1, in Patient 1, mild tracheal deviation to the right, the narrowing of the trachea was invisible. The anterior mediastinum masses of DD thymoma/lymphoma. The main bronchus left was not narrowed, but the bronchus branching to the lower lobe of left pulmonary showed narrowing because it was depressed by a mass, and caused atelectasis at the entire lower left pulmonary. The whole left hemi thorax pleura seemed thickened mainly in the medial part near the mass of 2.2 cm and pleura in posterior-lateral part of the left of 1 cm. The heart was not enlarged but only seemed thickened on the left ventricular wall of 1 cm, while the right atrial wall was not thickened. Massive left pleural effusion, invisible bone destruction.

Recorded as in Figure 2, in Patient 2, in 1, 2, 3 and 6 segments of the right pulmonary: an image of infiltrates with the cavity and broncho-grams water therein in accordance with the image of active pulmonary tuberculosis. There was solid mass filled the superior mediastinum. There was a narrowing of the right superior lobar bronchus.

Figure 3 shown suspected tumor on left pulmonary of patient 3. Multiple infiltrates were scattered throughout the dextra or sinistra pulmonary. There was an image of solid multiple in the

mediastinum. Bronchiectasis in the upper field on some portion of left lung pleura was thickened. There was no lymphadenopathy in the thorax cavity. Invisible bone destruction.



Figure 1. The 6<sup>th</sup> and the 8<sup>th</sup> slice scanning result at patient 1. The arrow points the tumor

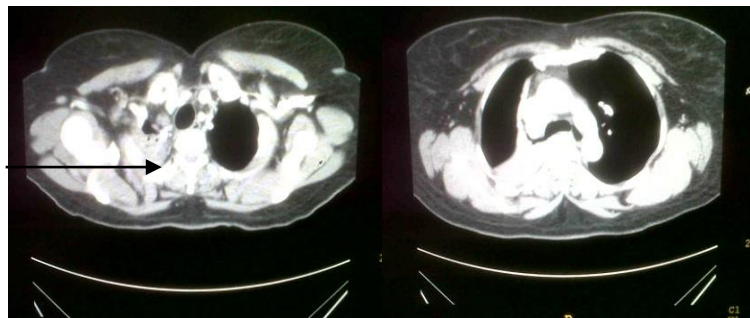


Figure 2. The 2<sup>nd</sup> slice and the 4<sup>th</sup> slice scanning results at patient 2. The arrow points the tumor

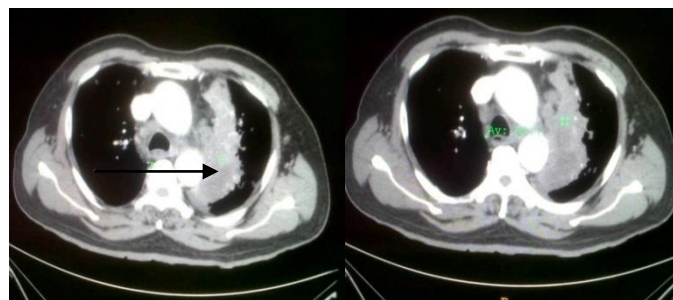


Figure 3. The 4<sup>th</sup> slice and the 6<sup>th</sup> slice scanning result at patient 3. The arrow points the tumor

## DISCUSSION

Thorax MSCT examination technique in the case of Mediastinum Tumor at Radiology Installation of Semarang District General Hospital only used axial and coronal slices alone. In the opinion of the author, to better see abnormalities and tumor mass one should use axial, coronal and sagittal slices. Axial and coronal slices can present an image of broncho-vascular on the right and left lung, how is the fibrosis and consolidation of the lung ground glass and irregular thickening of the left/right pleura and the existence of visible nodules or masses or tumors or other pathological lesions. Soft tissues such as the axillary and malignant lesions, aortic arch, hilum, coronary artery, aorta

pulmonary, lung parenchyma, pleura, bone destruction. Sagittal slices show nodules, lesions and lymphadenopathy in the thorax cavity because the sagittal slices will be obvious, usually the presence of mass is followed by lymphadenopathy enlargement. Preferably sagittal slice should be added in MSCT Thorax so that it can show the lymphadenopathy enlargement of the mediastinum tumor.

Thorax MSCT examination technique in the case of Mediastinum Tumor at Radiology Installation of Semarang District General Hospital used contrast medium volume of 50 cc by using Iopamiro Iodine concentration of 300 with flow rate of 2,8ml/sec. According to PDSRI Thorax CT-scan should use contrast medium volume of 80-150 cc. According to the author the volume of contrast medium injected, the time of injection rate and the concentration of iodine used greatly affect a tumor to show maximum enhancement so that the image is more optimal. It is characterized by the increase in Hounsfield Unit value of the tumor, because the tumor vascularization is very much, the original appearance of vascular that is gray or gray scale may become white when iodine contrast is injected and if it is measured, it would increase the original HU of 20HU to be 1000 HU. This description will hyper dense and equitable if all the tissues in the tumor are filled with contrast medium. Contrast medium which is evenly distributed in the tissues is determined from the number and volume of contrast injected.

Provision of contrast medium was in a flow rate of 3-4ml/sec required iodine with standard concentration (300-350). Provision of contrast medium was in a flow rate of 2,5-3ml/sec required high concentration of iodine (350-370) to provide a clear distinction between vascular and the other surrounding tissues, especially in arterial area and intraluminal abnormalities. According to PDSRI Thorax CT-scan should use contrast medium volume of 80-150 cc [10]. According to the author, to get better results, we should use contrast medium volume of at least 80 cc or according to the weight of the patient, and use a high iodine concentration of 370 to provide a good enhancement to the tumor.

Thorax MSCT examination technique in the case of Mediastinum Tumor at Radiology Installation of Semarang District General Hospital did not use thin slices MPR. According to the authors, Thorax CT scan for diagnosis is better using MPR, 3D and ROI. To see mass or lung lesions, one should use coronal and sagittal slices with a thin slice of 2-3 mm. Using thin reconstruction of 1-1.5 mm with 3D applications is more informative. To see nodules and lesions by using 2-3 mm will clarify the mediastinum tumor. 3D can also be used to see whether there is bone destruction and metastasis of the tumor. This is different from the theory according bontranger routine 10 mm slice thickness can not show bone destruction and disorder.

## **CONCLUSION**

Thorax MSCT examination technique in the case of Mediastinum Tumor at Radiology Installation of Semarang District General Hospital in this study was made by using a contrast medium volume of 50 cc, the flow rate of 2.8 ml/sec with iodine concentration of 300 and it could show abnormalities of mediastinum tumor. Thorax MSCT examination technique in the case of Mediastinum Tumor at Radiology Installation of Semarang District General Hospital which only used sagittal and coronal slices alone could diagnose, saved the use of CT-Scan film. Thorax MSCT did not use thin slice because it could reveal the location and size of the tumor and mediastinum tumor metastases.

Thorax MSCT examination should use contrast medium of at least 80 cc. Thorax MSCT examination in the case of mediastinum tumor should use coronal and sagittal axial slices, because the sagittal slice can show the lymphadenopathy enlargement so that the mediastinum tumor is clearly visible. The print out or filming results should be included the MPR or 3D to show the presence or absence of bone destruction and metastases.



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