Anatomic information of urinary tract MSCT using tracking and intravenous urography in case of urolithiasis

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Abstract. Urolithiasis is a stone in the urinary tract area. In previous studies, the use of reconstructed tracking on Multislice Computed Tomography (MSCT) non-contrast urography was able to produce an image of the urinary tract. Intravenous Urography (IVU) examination is a radiographic examination of the urinary system using positive contrast media that is inserted intravenously. This study aims to optimization of information on the anatomy of the urinary tract is needed to help diagnose urolithiasis. This type of research is an experimental observational approach with a comparison of the MSCT anatomical information tracking technique with an IVU examination. The subjects of this study were patients who performed an MSCT and IVU examination with 3 respondents from Radiology Specialists. The data collected is from April to November 2019. The sample used was 60 samples. Non-contrast urography MSCT with tracking technique obtained more optimal results in assessing each anatomy compared to IVU. The overall value of anatomical image non contrast urographic MSCT images with tracking techniques obtained a total value of 2179, While the overall value of the anatomical image on the IVU examination was 1977. MSCT non-contrast urography with tracking is more optimal in establishing the diagnosis in cases of urolithiasis, but IVU examination excels in assessing the function of the urinary tract.

1. Introduction
Urolithiasis is a condition in the urinary tract area in the form of crystal stones that settle in the urine. The first symptom occurs when some stones move up the ureter blocking the flow of urine and kidneys. The most common symptom is renal colic [1]. The CT scan modality can produce volumetric images so that it can detect abnormalities in the urinary tract cross-sectional and with a fast examination process [2].

Intravenous urography (IVU) is a radiographic examination of the urinary system with patient preparation and intravenous insertion of positive contrast media, aims to visualize the urinary tract and can show anatomy, estimate kidney function, evaluate the performance of the urinary system and abnormalities that occur in the urinary system [3]. The current problem, urinary tract examination is generally performed using positive contrast media, this can cause effects from the use of contrast media, from mild to moderate. the use of contrast media is more expensive and the radiation dose received by the patient is greater. Previous research said that the use of Reconstruction Tracking on non-contrast Multislice Computed Tomography (MSCT) Urography was able to produce an optimal urinary tract image [4]. As well as being able to identify the image of the urinary tract with the case of urolithiasis in
the form of stones in the ureter [5]. This study aims to optimization of information on the anatomy of the urinary tract is needed to help diagnose urolithiasis.

2. Methods
The design of this study is experimental study with an observational approach. The study subjects were 60 patients who underwent MSCT with Tracking and IVU techniques, and were assessed by 3 Radiology Specialist respondents as observers by assessing the validated anatomical image. Radiologist with at least 5 years experience in reading urinary tract MSCT images. Image quality evaluation is carried out through a qualitative method called VGA, to assess whether the image follows the predetermined criteria or not by performing a relative assessment, where the value is given to the image quality with the highest value being a better image, the value given is 1 - 5. MSCT urographic criteria, the classification system used in absolute visual assessment (VGA) analysis - Study [6]. The study was conducted at the RSI Radiology Installation Sultan Agung Semarang and RSUD Salatiga.

3. Results and discussions
3.1. Results
The results of the study obtained images non-contrast urographic MSCT examination with tracking techniques and IVU. Non-contrast urographic MSCT image with tracking technique on one image while. IVU image contains several image displays. The images non-contrast urographic MSCT examination with tracking techniques and IVU as shown in Figure 1 and 2.

![Figure 1. Non-contrast MSCT Uography with Tracking Technique. on the image can show the urinary tract as a whole, from the kidneys, ureters and bladder, and there is a stone in the ureter indicated by an arrow.](image)

a) b) c)
Figure 2. IVU examination is carried out sequentially taking pictures with a predetermined time of minutes. IVU radiograph image, a) FPA photo, b) 5 minutes, c) 30 minutes, d) 60 minutes, e) Post-Voiding

The results of the assessment of each non-contrast urographic MSCT anatomical image using the tracking technique and IVU by the respondent. The anatomical imagery assessed includes View of the dam grade / rock clogging, View of the location of the dam / blockage, Ureter view, PCS view, Bladder view. non-contrast urographic MSCT anatomical image assessment with tracking technique and IVU as shown in Table 1.

Table 1. The results of the overall assessment of anatomical images on non-contrast urography MSCT images with tracking techniques and IVU.

| Anatomical Assessment                  | Score | Score |
|----------------------------------------|-------|-------|
|                                        | Trackig | IVU   |
| View of the dam grade/ rock clogging  | 431    | 404   |
| View of the location of the dam/ blockage | 450   | 410   |
| Ureter view                            | 450    | 410   |
| PCS view                               | 398    | 393   |
| Bladder view                           | 450    | 360   |
| Total Score                            | 2179   | 1977  |

The value obtained on the display grade of the dam / blockage of rocks by tracking the value of 431 is obtained, while using the IVU the value is 404. So that the anatomical picture of the grade of the dam / blockage of stones is in non-contrast. Urographic MSCT with tracking techniques is more optimal than the IVU examination. In the location of the dam / rock blockage, the tracking value is 450, while the IVU value is 410, so that the anatomical description of the location of the dam / rock blockage on MSCT Urography is non-contrast with the tracking technique more optimal than IVU examination. The ureteric assessment using tracking obtained a value of 450 while using IVU obtained a value of 410, so that the anatomical image of the ureter on MSCT non-contrast urography with tracking techniques is more optimal than the IVU examination. The value of PCS using tracking is 398, whereas using IVU is 393, so that the PCS anatomical image on MSCT Urography does not contrast with the tracking technique which is more optimal than the IVU examination. The value on the bladder using tracking obtained a value of 450, while using IVU with a value of 360, so that the anatomical picture of the bladder on non-contrast urography MSCT with tracking techniques is more optimal than the IVU examination. While
the overall assessment of anatomical images on non-contrast urographic MSCT images with tracking techniques and IVU as shown in Figure 3.

![ANATOMY](image.png)

**Figure 3.** MSCT anatomical assessment non contrast with tracking and IVU.

The MSCT non-contrast Urography examination value with the tracking technique was obtained with a total value of 2179, while the IVU examination had a total value of 1977. So that the overall anatomical image on the non-contrast Urography MSCT with the tracking technique was more optimal than the IVU examination.

3.2. Discussions

3.2.1 Optimization of urinary tract MSCT anatomical image information using tracking and Intravenous Urography (IVU) in Urolithiasis Cases. The results of the anatomical assessment on the grade display of the dam/rock blockage using tracking, the value was 431, while the IVU value was 404. From these results, a significant value was obtained with a difference of 27 so that the MSCT examination with tracking techniques was higher than the IVU radiography examination. The use of MSCT with tracking techniques can show the grade of the dam/rock blockage is more optimal than the IVU examination. Assessment of the location of the dam/rock blockage using tracking obtained a value of 450 while using IVU obtained a value of 410, there is a significant value with a difference of 40, so that the results of using MSCT examination with tracking techniques can show the location of the dam/rock blockage is more optimal than the IVU examination. Assessment of the ureter using tracking obtained a value of 450 while using IVU obtained a value of 410, a significant value was obtained with a difference of 40, so that the use of MSCT with tracking techniques can show the ureter is more optimal than the IVU examination. Assessments on PCS using tracking obtained a value of 398 while using IVU obtained a value of 393, obtained an insignificant value with a difference of 5, on MSCT examination with tracking techniques and IVU radiography was able to show optimal PCS Assessment of the bladder using tracking obtained a value of 450 while using IVU obtained a value of 360, a significant value was obtained with a difference of 90, so the use of MSCT with tracking techniques can show the bladder is more optimal than the IVU examination.

The anatomical results of MSCT with tracking techniques can show a more optimal urinary tract anatomy compared to the IVU examination. This is following the statement of Sulaksono that the use of tracking reconstruction on urinary tract MSCT using tracking can produce optimal urinary tract images, and can identify urinary tracks images with cases in the form of stones in the ureter with contrast analysis [4,5].
3.2.2 The most optimal examination between urinary tract MSCT using tracking and Intravenous Urography (IVU) in Urolithiasis Cases. From the results of the overall score conducted by respondents 1, 2, and 3, the score for MSCT examination with tracking was obtained with a total value of 2179, while for the IVU examination with a total value of 1977. This shows that the non-contrast MSCT urography examination with tracking is more optimal in making the diagnosis in cases of urolithiasis. This shows that the MSCT urography without contrast with tracking is more optimal in making the diagnosis in cases of urolithiasis, and is able to produce optimal urinary tract images[4], and is able to identify urolithiasis patients in the form of stones in the urinary tract, with contrast analysis[5], according to Ludewig, with a comparison of non-contrast CT and intravenous urography in the diagnosis of urolithiasis and obstruction can detect ureterolithiasis more optimally [7].

The IVU examination can assess urinary tract function, but the IVU examination has difficulty assessing/diagnosing the presence of lucent stones so that it can cause misdiagnosis. Meanwhile, the MSCT tracking technique can assess the presence of opaque and lucent stones. The IVU examination also requires patient preparation, the use of positive contrast media, and a relatively long examination time with repeated image taking, this is in accordance with the statement of Lampignano and Kendrick that the Intravenous Urography (IVU) examination is a special examination that requires preparation, namely eating low in fiber, energetic, and required fasting before testing. Intravenous Urography (IVU) examination procedure begins with a plain abdominal radiograph (Plain Photo) anteroposterior projection (AP) and continues with a nephrotomogram/photo 1 minute AP projection after contrast media insertion, 5 minutes AP projection, 10 to 15 minutes AP projection, photographs 20 minutes with RPO or LPO 30° projection to show the other side of the kidney which is sometimes not visible on the AP projection, and post-micturating photo with PA projection [3].

4. Conclusion
MSCT examination urography with tracking is more optimal in assessing each anatomy compared to IVU, so as to be able to maximally show the anatomy view of the dam grade/rock clogging, view of the location of the dam/blockage, ureter view, PCS view, bladder view. MSCT examination with tracking can assess the presence of opaque and lucent stones, meanwhile the IVU examination requires patient preparation, the use of positive contrast media, and a relatively long examination time with repeated image taking.

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