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ANALYSIS OF WINDOW WIDTH VARIATION ON IMAGE ANATOMICAL INFORMATION MSCT STONOGRAPHY

Muhammad Izzudin(1), Hermina Sukmaningtyas(2), Nanang Sulaksono(3)
[1]*Rumah Sakit Ortopedi Dr. Soeharso*
[2]*Radiologist of dr. Kariadi Semarang Hospital*
[3]*Lecturer Major of Radiodiagnostic and Radiotherapy Health Polytechnic of Ministry Health of Semarang*

Corresponding author: Muhammad Izzudin
Email: izzuzu5@gmail.com

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ABSTRACT

Multi Slice Computed Tomography is a diagnostic imaging method that can display cross section anatomy in the axial, sagital, and coronal areas. MSCT Stonography imaging both visualizes the anatomy of the urinary tract and stone pathology supported by the presence of ureter tracking techniques and without using contrast media. On this method, the appropriate window width will produce an optimal anatomical picture. The Study aims to determine the effect of window width on anatomical image information on MSCT Stonography.

Type of research is quantitative experimental approach, conducted in January-February 2020 in Hasan Sadikin Bandung hospital, Bandung. Research with variations in window width 300 HU, 350 HU, 400 HU, 450 HU, and 500 HU on MSCT stonography og 10 patients. Patients with kidney stones were selected in this study inclusively. Result imagery rated two respondents, include parenchymal kidney, pelvic calices kidney, ureters, vesica urinary, and stones kidney. Then do Kappa test continued testing Friedman to know the highest mean rank and the influence og the window width oh the image og MSCT stonography.

Based on the result of the Friedman statistical test overall anatomy obtained significance value (p-value) = 0.000 < 0.05 means that there is an influence of window width value, the contrast resolution will increase and the better the firm boundary, but the resulting image will be more radioluscent. Based on Friedman's mean rank test result obtained the highest mean rank of 3,54 in a variation of window width 300. The most optical window displays anatomy information using window width 300.

Keyword : window width, MSCT stonography

Introduction

The urinary system or also known as the excretory system is an organ system that produces, stores and flows urine. In normal humans, this organ consists of the kidneys along with the pelvic system, ureters, bladder and urethra. The kidneys are a pair of urinary tract organs located in the upper retroperitonel cavity. The shape resembles a bean with its concave contents facing medial. The ureter is an organ that has a small tube shape and has a function as a place for urine to flow from the renal pelvis to the bladder. The vesica urinaria is a hollow muscular organ that functions as a storage container for urine. The urethra is a tube that channels urine out of the bladder through the micturition process (Purnomo, 2016). Diseases that commonly occur in the urinary system are urinary tract infections, incontinence, interstitial cystitis, kidney failure, and urolithiasis.

According to Mehmed & Ender (2015), urolithiasis is a condition in the urinary tract area in the form of crystal stones that settle in the urine. Many patients with urinary stones have no signs at all. 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, which is intense pain caused by obstruction or tension of the smooth muscles in the renal or urinary tract. To diagnose urolithiasis, the modalities used are ultrasound (ultrasonography), IVU (intravenous urography), and MSCT stonography.

Multislice Computed Tomography (MSCT) stonography is an examination of the urinary tract without using oral or intravenous contrast media (Shaaban and Kotb, 2015). MSCT is a modality for evaluating and diagnosing urinary tract abnormalities, especially in urolithiasis, so MSCT stonography is used as an alternative to IVU (intravenous urography) examination, because it cannot provide qualitative diagnostics (Niemann, T., et al, 2010). MSCT examination without contrast media in the urinary tract is the standard examination for the detection and characteristics of urinary tract stones (Shaaban and Kotb, 2015). The MSCT stonography examination is an examination carried out without intravenous and oral contrast media to see stones in the urinary tract (Maher et al, 2014). The parameters contained in MSCT are kilovoltage (kV), milliampere (mA), pitch, field of view (FoV), slice thickness, reconstruction algorithm, and reconstruction matrix, scan time (Bontrager, 2018).

Image quality in MSCT according to Bushberg (2012) must be able to show an appropriate anatomical image and can provide high diagnostic accuracy values. Meanwhile, according to Bontrager (2018) image quality includes all factors related to accuracy by showing the structure and tissue of organs in the image. The components that affect image quality are spatial resolution, contrast resolution, noise and artifacts. To obtain optimal image information, it must be able to display images with good contrast. One of the MSCT parameters that affect the contrast and brightness of the image is the window width and window level values (Bontrager, 2018).

Window width is a range of CT number values that are used to adjust the gray scale on the monitor. The process of changing the grayscale in MSCT by adjusting the window width and window level is called windowing. The window width value will affect the contrast of the image, the higher the window width is used, the contrast of the image will decrease or decrease. By selecting the right window width, the resulting MSCT image can provide optimal diagnostic information (Seeram, 2018).

In the MSCT stonography examination, the value of window width in the abdominal window is used, which is a value range of 300-500 HU (Bontrager, 2018). The current Window Width value is the reference for the stonographic 400 HU MSCT (Merrill, 2016). According to Seeram (2018), the window width value in the abdominal window used in the MSCT stonography examination is 350 HU. According to Chou et al. (2005), MSCT stonographic examination used a window width of 300 HU. According to research conducted by Romain et al. (2010), researchers used the MSCT modality to determine the characteristics of kidney stones in humans by examining abdominal MSCT using a window width value of 350 HU in the abdominal window. The use of window width in abdominal MSCT examination according to Andersson et al. (2012) to evaluate the estimation of kidney stone size using a window width value of 400 HU. Meanwhile, according to a research journal conducted by Yasir et al (2015) to measure the dimensions of stones in the kidney using a window width value of 400 HU.

In the Radiology Installation at RSUP dr. Hasan Sadikin Bandung during the period January 1, 2020 to February 29, 2020, the number of MSCT stonography examinations was 14 patients. Nine of them were patients with urolithiasis. This shows that in the Radiology Installation, dr. Hasan Sadikin Bandung performed a stonographic MSCT examination to detect urolithiasis. Based on the researchers' observations, the window width value on the abdominal window used was 400 HU. This value is the window width value found on the Hitachi Scenaria 128 slice aircraft, but radiographers sometimes change the window width value during filming to 350 HU to get a more optimal image. With the MSCT stonography examination, it is hoped that the anatomical information of the renal parenchyma, renal pelvic calices, ureters, bladder, and kidney stones can be clearly shown.

Methods

Type of research is quantitative experimental approach, conducted in January-February 2020 in Hasan Sadikin Bandung hospital, Bandung. Research with variations in window width 300 HU, 350 HU, 400 HU, 450 HU, and 500 HU on MSCT stonography og 10 patients. Criteria's patients is patients with clinical kidney stones, willing to be a research sample. Result imagery rated two respondents, include parenchymal kidney, pelvic calices kidney, ureters, vesica urinary, and stones kidney. Then do Kappa test continued testing Friedman to know the highest mean rank and the influence og the window width oh the image og MSCT stonography.

DISCUSSION

1. Descriptive Analysis

The results of cross tabulation between window width and anatomical information obtained information data on each anatomy, in the renal parenchymal anatomy obtained the highest unclear value of 30% in window width 500, the highest self-explanatory value of 40% in window width 400 and window width 450, and the highest very clear value is 70% in window width 300. Anatomy of the pelvic calices of the kidney, the highest value is 40% in window width 500, the highest self-explanatory value is 50% in window width 350, 400, 450, and 500, The highest very clear value is 40% in window width 300 and window width 350. Ureter anatomy is obtained unclear value of 20% in all variations of window width, the highest clear value is 70% in window width 450 and window width 500, and very The highest clear value is 60% in a window width of 300. Anatomy of the bladder, the highest value is 10% in a window width of 500, p is clear, the highest is 60% in window width 450 and window width 500, and the highest clear value is 80% in window width 300. For kidney stones, there is no clear value for each window width, the highest clear value is 30% in the window. width 500, and the highest very clear values are 80% in window widths of 300, 350, 400, and 450.

Based on these results shown that window width 300 gets the largest very clear value on the average of each assessed anatomy, meaning that window width 300 can display anatomical information the best compared to other window width variations by imaging the four anatomies with better contrast levels, clear sharpness, no there is a blurry image in the resulting image. In window width 350, the characteristic of the resulting image is almost the same as window width 300, of course, with quality below window width 300. In window width 350 it produces an anatomical image with good contrast, sharpness that is quite firm, and there is no blur in the resulting image. Whereas in window widths 400, 450, and 500 the average value is not clear and clear enough because the resulting anatomical image has poor contrast quality, less sharp sharpness, and there is blur due to image processing performed. Changes in the value of window width will show the value of the difference in image quality in each 50 HU range (Lampignano, 2018).

According to the researcher, using the right window width can provide good image contrast and produce an informative image, based on the results of the resulting image, it can be seen that the difference in image results in each variation of window width, the greater the window width value used, the resulting image contrast will be. decreases, conversely the greater the value of the window width used, the resulting image contrast will increase. Optimal image contrast is able to produce good image quality, because the higher or lower the contrast value of the resulting image will produce an image with poor quality so it is difficult to distinguish the clarity of the image from each anatomy. However, setting the window level can also improve the quality. from that image. Window level affects the brightness of an image.

So that when combined with the right window level it will produce an optimal image.

2. Bivariat Analysis

Based on the results of the Friedman statistical test carried out on the results of the overall assessment of anatomical information by respondents, the overall results are obtained in the table with a significance value (p-value) = 0.000 <0.05, so Ho is rejected and Ha is accepted, which means that there is an effect of window width variation on image information. anatomy of MSCT stonography.

Based on table 4:11 the results of the Friedman statistical test carried out on each anatomy, obtained in the renal parenchymal anatomy with a significance value (p-value) = 0.000 <0.05, meaning that there is an effect of window width variation on the quality of the renal parenchymal anatomy image, the higher the window width value. then the image contrast will increase and the sharpness of the kidney parenchyma will appear blurred and less defined. In the assessment of kidney pelvic calices with a significance value (p-value) = 0.000 <0.05, it means that there is an effect of window width variation on the quality of the kidney pelvic calices anatomy, the higher the window width value, the image contrast will increase and the sharpness of the kidney pelvic calices will look blurry and lack of firm. In the assessment of the ureter with a significance value (p-value) = 0.000 <0.05, it means that there is an effect of window width variation on the quality of the ureteral anatomy image, the higher the window width value, the image contrast will increase and the sharpness of the ureter will appear blurry and less pronounced. In the assessment of the bladder with a significance value (p-value) = 0.000 <0.05, it means that there is an effect of window width variation on the quality of the anatomical image of the bladder, the higher the window width value, the image contrast will increase and the sharpness of the bladder will look blurry and less pronounced. In the assessment of kidney stones with a significance value (p-value) = 0.000 <0.05, it means that there is no effect of window width variation on the image quality of kidney stones, the higher or lower the value of the window width, the kidney stones will still look in contrast and choose clear and clear sharpness.
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On stonographic MSCT, urolithiasis or kidney stones appear radiopaque or light white as the color of the bone. This is due to the very high density of kidney stones which results in a high HU value as well. Meanwhile, the renal parenchyma, renal pelvic calices, ureters, and bladder appear intermediate or the same as other abdominal organs. The four anatomies are soft tissue, causing a homogeneous HU value in the four anatomies.

According to Lampignano (2018), changing the window width value will show the value of the difference in image quality in each 50 HU range. The Abdomen Setting Window has a good range at the 300 HU-500 HU. The effect of changes in the value of window width, namely changes in the contrast value of resolution and noise. Resolution contrast is said to be good if it is able to show clear boundaries between objects that are close to each other. In addition, noise also needs to be considered because the higher the noise produced, the more blurry the resulting image will be.

According to Ballinger (2016), the effect of changing the window width value with a fixed window level value is that the higher the window width value, the image contrast will decrease / decrease, the lower the window width value, the image contrast increases / increases. A good image is an image that can produce optimal contrast so that the sharpness of the image can be seen. According to research conducted by Saifudin (2017), proper windowing settings can show clear boundaries between objects on CT stonography. However, this research not only discusses windowing settings, but also the use of ASIR software.

According to researchers, the contrast changes caused by changes in the value of the window width will affect the clarity of each anatomy, such as if the ureteric anatomical contrast resolution is too high or too low it will obscure the structural picture of the anatomy. Changing the variation in window width at the 300 HU and 350 HU tends to show clearer images and less noise. Anatomy that is considered capable of being shown well. Whereas in the window width variations of 400 HU, 450 HU, and 500 HU, they tend to show decreased resolution contrast. The sharpness of the assessed anatomy begins to be faint so it is not good for the radiologist to assess. However, changes in the window width value in the window setting range of the abdomen had no effect on kidney stones. The resolution contrast range in the abdominal setting window only changes the contrast resolution of the soft tissue tissue, because the density of kidney stones is so high that the HU value of kidney stones will also be high so it doesn't change the contrast of kidney stones. Kidney stones remain clear and sharpness is firm.

The results of the mean rank Friedman test that have been carried out on the results of the assessment of anatomical MSCT stonographic image information with window width variations obtained the highest mean rank at 3.54 at a variation of window width 300 (table 4.13) meaning that using window width 300 can display optimal anatomical information. on the stonographic MSCT image.

In the MSCT stonography examination, the value of window width in the window setting of the abdomen is used, namely the value range of 300-500 HU (Bontrager, 2018). The current Window Width value is the reference for the stonographic 400 HU MSCT (Merrill, 2016). According to Seeram (2018), the window width value in the abdominal window used in the MSCT stonography examination is 350 HU. According to Chou et al (2005), MSCT stonographic examination used a window width of 300 HU. According to research conducted by Romain et al. (2010), researchers used the MSCT modality to determine the characteristics of kidney stones in humans by examining abdominal MSCT using a window width value of 350 HU in the abdominal window. The use of window width in abdominal MSCT examination according to Andersson et al. (2012) to evaluate the estimation of kidney stone size using a window width value of 400 HU. Meanwhile, according to a research journal conducted by Yasir et al (2015) to measure the dimensions of stones in the kidney using a window width value of 400 HU.

According to researchers, using optimal window width can provide optimal resolution contrast values so that the sharpness of the anatomy to be assessed will look firm and will be of informative value. The results of these images imaged the anatomy on the stonographic MSCT that looked homogeneous with anatomy other than that assessed on the MSCT stonography, but the assessed anatomy was able to show good resolution contrast by distinguishing the border line from the anatomy assessed by its closest anatomy, and had a firm sharpness so that can display optimal anatomical clarity on the MSCT stonographic examination image, by using a window width of 300 HU.

Conclusion

Based on the results of the Friedman statistical test, the significance value (ρ-value) = 0.000 <0.05 then Ho is rejected and Ha is accepted, which means that there is an effect of changing window width variations on the stonographic MSCT anatomical image information. The effect of changing the window width variation is that the higher the window width value, the contrast resolution will decrease. Conversely, the lower the window width value, the higher the contrast resolution. High contrast resolution will cause the image to appear white, on the other hand, low contrast will cause the image to appear dark. Optimal image contrast will produce a good anatomical image with clear anatomical border lines and clear sharpness

Based on the results of the mean rank Friedman test, the highest value of 3.54 in the window width variation of 300 HU means that the window width that can display optimal anatomical image information on MSCT stonography is window width 300 HU, showing the anatomy of the renal parenchyma, renal pelvic calices, ureters. , and bladder with clear detail and clear boundaries between adjacent anatomies.

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