ASSESSMENT OF RENAL SIZE BASED ON PATIENT'S POSITION DURING ULTRASOUND SCANNING

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ABSTRACT

Introduction: The purpose of the study was to assess the size for both kidneys based on the position of patient during ultrasonography examination. Normal renal size measurement is very important to evaluate in determining a healthy kidney. Method: Thirty volunteers, consist of 15 males and 15 females were involved in this study. The patients were scanned in supine, oblique, and prone position. The readings were repeated for three times for each position. Results: The mean length of kidney in supine, oblique and prone were 99.03 mm, 96.32 mm and 95.94 mm, respectively. Meanwhile, the mean width of kidney were 44.30 mm, 44.31 mm and 46.65 mm, respectively. The renal length measurement in prone position was statistically significant with $p = 0.023$ ($p < 0.05$), while the renal width measurement in oblique and prone position were statistically significant with $p = 0.006$ and $p = 0.009$ respectively. Conclusion: This research emphasised the importance of investigating the different types of position of patient during the ultrasound scanning. The importance mentioned were the reduction of scanning time for patient and cost- effectiveness of the procedures. Besides, it also gave accurate result for the renal measurement.

KEYWORDS: Ultrasonography, kidney, renal size, renal length, renal width, patient positioning.

INTRODUCTION

Renal size is important to be assessed in clinical setting, to rule out any possibility of having kidney disease. In radiology, ultrasound machine becomes the primary tool in assessing the size of kidney. The main advantages of ultrasound modality as compared to other machines are the availability of machine, non-ionising radiation, less time consuming, easy to handle, and less cost required (Hammad, 2012). Based on previous literature, computed tomography (CT-scan) and magnetic resonance imaging (MRI) are the modalities that can give accurate renal size, in terms of sensitivity and specificity. But these two modalities have its own disadvantages to the patient, which both use ionising radiation and possibility of contrast media adverse effect.

Ultrasound can evaluate the renal size and volume by measuring the renal length and width. The instrument used is calliper and measured in the Systeme International (SI) unit of millimetre. The healthy kidney is determined based on the renal echogenicity and size. In sonogram images, kidney was shown to be less echogenic or equal when compared to the adjacent organs which are the spleen and liver (Dogra, MacLennan, Turgut, Canacci, & Onur, 2013). The size of both left and right kidneys is different; the left kidney is usually larger the right kidney. This is due to the anatomical structure in the right side of the body, where the liver is located above the right kidney and it compressed the right kidney. Unlike the left kidney, there's no large organ above it (Hwang et al., 2011). However, the difference in renal size between both kidneys should be less than 2 cm.

In the hospital setting, the accurate patient's position is very crucial to increase productivity in the department, in terms of number of patient examined per day and patient's waiting time. By studying the best patient's position for the best and accurate visualization of kidney, it will reduce the examination time per patient. Changing in patient's position influenced the visualization of kidney shape on monitor (Michel, Forster, Seifert, Willi, & Huisman, 2004). Therefore, the aim of this research was to study the renal size based on the position of patient during the ultrasonographic imaging.

METHODS

Experimental study was performed at the ultrasound room of the Department of Diagnostic Imaging and Radiography, Kulliyyah of Allied Health Science, International Islamic University Malaysia (IIUM). This study was conducted between November 2017 to March 2018 after the IREC (IIUM Research Ethics Committee) approval were obtained.

The ultrasound machine (Siemens Acuson X150) was used for patient's scanning in this study. The mode of the scan is a real time 2-dimensional (2D) grey scale ultrasound, and the transducer or probe that was used was a 2.5 MHz convex transducer. Thirty volunteers were involved in this study that consists of 15 males and 15 females. The volunteers were selected based on the inclusion and exclusion criteria. The inclusions criteria were healthy (evidenced by a normal appearance of kidney in ultrasound images) and no history of renal diseases or nephrectomy and were aged between 20 to 25 years old. The exclusion criteria were the presence of renal diseases and history of nephrectomy.

The volunteers were given consent form and were required to fast for at least eight hours prior to scanning. The scanning was done in the morning in the ultrasound room. The examination was performed in a room that was quiet, with dim light, and in temperature of about 22 °C. The ultrasound gel was warmed using a gel warmer before applying it to the patient for patient's comfort.

The scanning was done in 3 positions which are supine, oblique, and prone. The scanning began with the right kidney, followed by the left kidney. For the right kidney, the probe's pointer always pointing towards the patient's head and should be along to the right lateral subcostal margin, which was about lower right intercostal space in the anterior axillary line. While for the left kidney, the placement of probe was in the posterior axillary line or in left costophrenic angle. Both renal were identified, measured, and

recorded using the parameter: the length and width of the kidney. The measurements were repeated for three consecutive times for each position (supine, oblique, and prone).

The data collected was analysed using Statistical Package for Social Sciences (SPSS). Descriptive analysis was done to determine the size of both kidneys based on patient's position. The inferential statistics of One-Way ANOVA were then performed to look for significant difference between the renal length and width and the position of patient during the ultrasound scanning. Then, the post hoc (Scheffe test) was done to determine which patient's position show the statistical significant difference.

RESULTS

The total numbers of students volunteered in this study were 30, which comprises of 15 males and 15 females. Table 1 shows the mean of renal length and width according at different patient's position. From the data, the longest kidney measurement is in supine position, which is 99.03 mm. The second longest measurement is in oblique position, which is 96.32 mm, and the shortest is in prone position which is 95.94 mm. The width of kidney is the most when patient in prone position, which is 46.65 mm. Both supine and oblique positions share almost the same measurement which is 44.30 mm and 44.31 mm respectively.

Table 1 The mean of renal length and width at different patient's positions

***N* = 30**	**Patient's positions**		
	Supine (mm ± sd)	Oblique (mm ± sd)	Prone (mm ± sd)
Length of kidney (mm)	99.03 ± 9.09	96.32 ± 8.42	95.94 ± 11.32
Width of kidney (mm)	44.30 ± 6.69	44.31 ± 7.27	46.65 ± 5.21

The means for the renal length at different patient's position is tabulated in Table 2. From the table, the renal length which shows a statistically different is the left kidney with the value of 0.023. Then, post hoc (Scheffe test) was done to determine which patient's position of left kidney show the statistical different value for renal length. From table 3 it shows only in prone position show p- value for post hoc test less than 0.05 which was 0.023.

Table 2 The comparison for the means of renal length and patient's positions

Side of kidney / Patient position	**Renal length (mm)**			
	Supine	Oblique	Prone	p-value

Right kidney	96.84	94.89	96.35	0.759
Left kidney	103.63	100.98	97.56	0.023*

* $p < 0.05$, statistically significant

Table 3 The post hoc (Scheffe test) for renal length of left kidney

	Supine	**Oblique**	**Prone**
Left kidney	103.63	100.98	97.56
P-value Post hoc (scheffe test)	0.463	0.283	0.023*

* $p < 0.05$, statistically significant

All means for the renal width according to the gender and patient's position is tabulated in Table 4. From the table, the renal width which shows a statistically different is the right kidney with the value of 0.002. Then, post hoc (Scheffe test) was done to determine which patient's position of left kidney show the statistical different value for renal width. From table 5 it shows oblique and prone positions show p- value for post hoc test less than 0.05 which was 0.006 and 0.009 respectively.

Table 4 The comparison for the means of renal width according to the gender and patient's positions

	Renal width (mm)			
Side of kidney / Patient position	Supine	Oblique	Prone	p-value
Right kidney	37.73	37.49	43.41	0.002*
Left kidney	43.20	43.89	46.61	0.909

* $p < 0.05$, statistically significant

Table 5 The post hoc (Scheffe test) for renal width of right kidney

	Supine	**Oblique**	**Prone**
Right kidney	37.73	37.49	43.41
P- value Post hoc (Scheffe)	0.991	0.006*	0.009*

* $p < 0.05$, statistically significant

DISCUSSION

This study addressed the importance of accuracy of renal size based on patient's position during the ultrasound examination. The aim of the study was to find which patient's position was accessible in order to assess the kidney without affecting the accuracy of renal size. As obtained from the literature, the mean for renal length of the Asian was approximately 98.0 mm and above, due to small body built (Myint et al., 2016). From the finding of this study, it showed that the mean of renal length for patient in the supine position was 99.03 mm, which the data was closely related to the normal mean of renal size for the Asians as studied by Myint et al. (2016).

However, when the patient was in oblique and prone positions, the measurements were 96.32 mm and 95.94 mm, respectively. The findings in this current study are consistent with the previous research done in Chicago. As stated by Brandt et. al (1982), the mean of renal length for supine showed the longest as compared to oblique and prone positions. In the findings, the mean of renal length of supine was 111.0 mm, as compared to oblique (106.46 mm) and prone (107.43 mm). A part from the findings, Hammad (2012) suggested the way to measure the right and left kidneys in more accessible ways. For measurement of right kidney, the suggested position was in supine position and if the kidney can't be assessed, second option was in oblique position. For the left kidney, the reachable position for patient was in oblique position. However, if there were any difficulties, the prone position was suggested.

Besides, the width of kidney, prone position showed the widest (46.65 mm), followed by oblique (44.31 mm), and supine (44.30 mm). Hammad (2012) findings showed the similarity in renal width of supine, oblique, and prone positions, which were 52.1, 51.9, and 51.8 mm, respectively (table 5.1). In addition, the current study is also supported by Brandt et al. (1982). In the study the width of renal size in oblique and prone positions were 50.0 and 51.5 mm. Therefore, Brandt et al. (1982) have discussed in their research about the similarity of the finding of renal width between different patient's positions. It was due to the difficulty in finding a consistent point during the renal width measurement.

Previous researcher stated that there was a significant difference between the renal size and patient's position due to the anatomical change of the kidney during positioning. According to Hammad (2012), there was a difference in terms of renal size with different position. From this research, the supine position was the best in order to get the optimal right renal length. The second best position was in prone position. In contrast, for left kidney, oblique was the best position to measure the renal length followed by prone position. Prone position become as the second option in assessing left renal length if patient cannot tolerate the oblique position. Emamian et al. (1993) also emphasised the importance of investigating the different types of position. The importance mentioned were the reduction of scanning time for patient and cost- effectiveness of the procedures. Besides, it also gave accurate result for kidney measurement.

CONCLUSION

From this study, the finding was the comparison between the renal size and patient's position during scanning, which are in supine, oblique, and prone positions. The researcher suggested the supine position

for right kidney and oblique position for left kidney during the kidney size measurement. This is suggested so in order to reduce the scanning time and reproducibility of the ultrasound examination in the department.

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