CORRELATION OF PROSTATIC VOLUME MEASUREMENT BETWEEN TRANSABDOMINAL ULTRASOUND AND CT SCAN

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ABSTRACT

Objectives: *This study aims to determine correlation between measurement of prostatic volume and dimensions using transabdominal ultrasound (TAUS) and Computed Tomographic scan (CT scan) in male population ages 50 years and above.* **Material & method:** *Research was conducted at Radiology Department, Cipto Mangunkusumo Hospital, Jakarta. Twenty two patients who underwent whole abdominal CT from Desember 2013 to January 2014, were enrolled and examined using TAUS.* **Results:** *The calculation shows there is strong correlation between volume measurement, width, and height dimensions between TAUS and CT scan, where the Spearman correlation indicates r = 0.80 with p = 0.000 for volume measurement and r = 0.81 with p = 0.000 for width dimension and r = 0.64 with p = 0.001 for height dimension. There are also regression formula for estimating volume and dimensions measurements using TAUS.* **Conclusion:** *This study show strong correlation between volume and dimensions measurement using TAUS and CT scan.*

Keywords: *Transabdominal ultrasound, whole abdominal CT scan, prostate volume.*

ABSTRAK

Tujuan: *Penelitian ini bertujuan untuk menentukan korelasi pengukuruan volume prostat dan masing-masing dimensi menggunakan transabdominal ultrasound (TAUS) dan Computed Tomographic scan (CT scan) pada pria berusia lebih dari sama dengan 50 tahun.* **Bahan & cara:** *Penelitian dilakukan di Departemen Radiologi, Rumah Sakit Cipto Mangunkusumo, Jakarta. Terdapat 22 pasien yang menjalani pemeriksaan CT scan abdomen lengkap dan dilakukan TAUS dari bulan Desember 2013 sampai dengan Januari 2014.* **Hasil:** *Hasil perhitungan memperlihatkan korelasi yang kuat pada ukuran volume prostat dan dimensi lebar dan tinggi antara TAUS dan CT scan, didapatkan korelasi Spearman r = 0.80 dengan p = 0.000 untuk volume dan r = 0.81 dengan p = 0.000 untuk dimensi lebar dan r = 0.64 dengan p = 0.001 untuk dimensi tinggi. Terdapat pula formula regresi untuk estimasi ukuran volume dan masing-masing dimensi menggunakan TAUS.* **Simpulan:** *Penelitian ini menunjukkan korelasi yang kuat antara volume dan dimensi prostat menggunakan modalitas TAUS dan CT scan.*

Kata kunci: *Transabdominal ultrasound, CT scan abdomen lengkap, volume prostat.*

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INTRODUCTION

Benign prostatic hyperplasia (BPH) is the most common older male problem, especialy after 50 years old with incidence achieve about 50%. Its incidence increases with older age. About 90% of males aged 85 years old has probability of BPH.[1-5]

BPH is easily detected either by clinical manifestation or radiographic abnormalities, such as increase of prostatic volume. Many non invasive radiographic modalities can be used, such as transabdominal ultrasound (TAUS), Computed Tomography scan (CT scan), and Magnetic Resonance Imaging (MRI) to measure prostatic

volume. Invasive procedures such as transrectal ultrasound (TRUS) also can be used, but there are controversy over choice of the best modality.[6]

According to a study by Singh et al, TAUS has 91.66% accuracy in detection of benign prostatic lesions and BPH, but only 38.46% in detecting malignant lession. TAUS has low specificity of only 30%, thus other modalities were needed.[7] Some studies assessed correlation among modalities, measuring prostatic volume. Huang et al, reported good correlation (r = 0.84) between TAUS and transrectal ultrasound (TRUS) in evaluating prostatic volume,[8] whereas Hoffelt et al, also found good correlation (r = 0.92) between CT scan and TRUS.[9] Rahmouni et al assesed accuracy of MRI and TRUS in evaluating prostat volume.[10] However from reviewed literature, between CT scan and TAUS correlation in prostate volume measurement not yet been assessed, especialy in Indonesia.

The most common diagnostic modality found in primary healthcare centre is TAUS. According to Direktorat Jendral Bina Upaya Kesehatan, TAUS and CT scan are the most widely available diagnostic modalities found in healthcare centres or hospitals in Indonesia.[11]

OBJECTIVE

To assess correlation between TAUS and CT scan in evaluating prostate volume in males older than 50 years old.

MATERIAL & METHOD

This study is result of cooperation between radiology and urology residents. Radiology study assessed correlation between CT scan and TAUS in evaluating prostate volume, then Urology performed TRUS. Twenty-three sample were available and measured using TAUS who previously underwent whole abdominal CT scan and had no prostatic abnormalities detected. The patients neither had history of prostatic surgery nor taking 5 alpha reductase inhibitor drugs.

Prostatic dimensions on CT were assessed by genitourinary consultant radiologist, and prostate dimensions were assesed using TAUS by senior radiology resident to reduce bias and maintain quality in this study. Prostate volume were measured by using geometric ellipsoid formula manually either from CT (Figure 1B) or TAUS (Figure 1A).

Both numeric data were analyzed using Wilcoxon rank test. Correlation was tested according to Pearson in normal distribution data or Spearman in abnormal distribution. Linear regresion were assesed. All analyses were done using SPSS 11.5. The Ethics Committee of the Faculty of Medicine University of Indonesia had given the approval for this study.
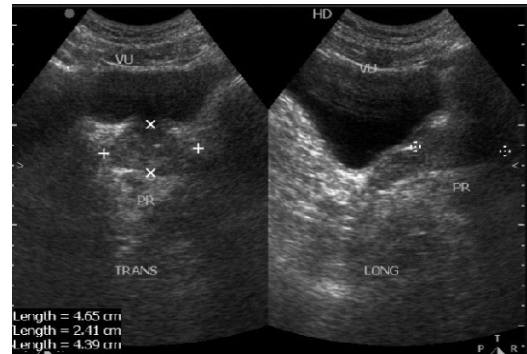

Figure 1A. TAUS prostate dimension measured, in transverse plane (right), width and height dimensions. Length was measured in sagittal plane. All were performed while bladder (VU) is filled 100-200 cc.
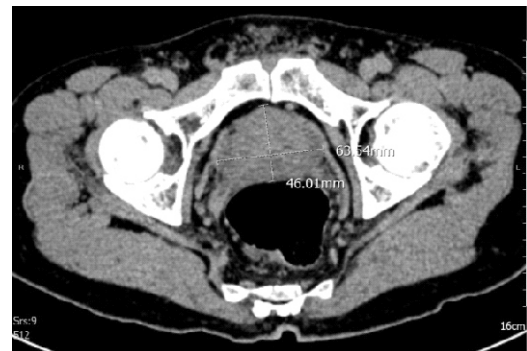

Figure 1B. On CT scan, prostate dimensions were measured in axial plane, width and transverse plane.

Figure 1C. CT scan prostate dimension measured in coronal plane, length plane.

RESULTS

There was a significant difference (p = 0.000) between prostate volume measured by CT and TAUS. There were also significant difference among length dimension (p = 0.002), width dimension (p = 0.000), and height dimension (p = 0.000) between those modalities. Furthermore, there was strong and significant correlation between prostate volume measured by CT and TAUS (r = 0.80; p = 0.000). There were also strong and significant correlation for width dimension (r = 0.81; p = 0.000), whereas height dimension (r = 0.64; p = 0.001) and length dimensions (r = 0.53; p = 0.010). In the calculation of the regression between prostate volume measurement between CT scan (Y) and TAUS (X), a regression formula Y = 4.23 + 1.61X was obtained (Figure 2). In the calculation of each dimensions, a regression formula for length Y = 2.78 + 0.44X was obtained (Figure 3A). A regression formula for width dimension Y = 1.44 + 0.67X was obtained (Figure 3B). Then for height dimension, a regression formula Y = 0.95 + 0.98X was obtained (Figure 3C).
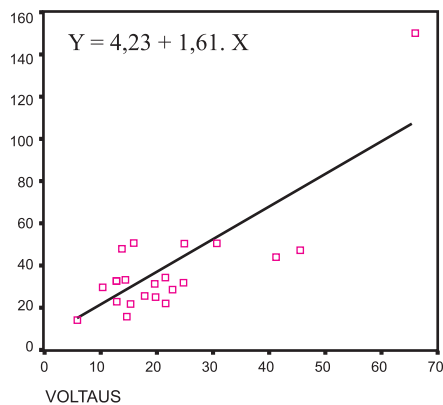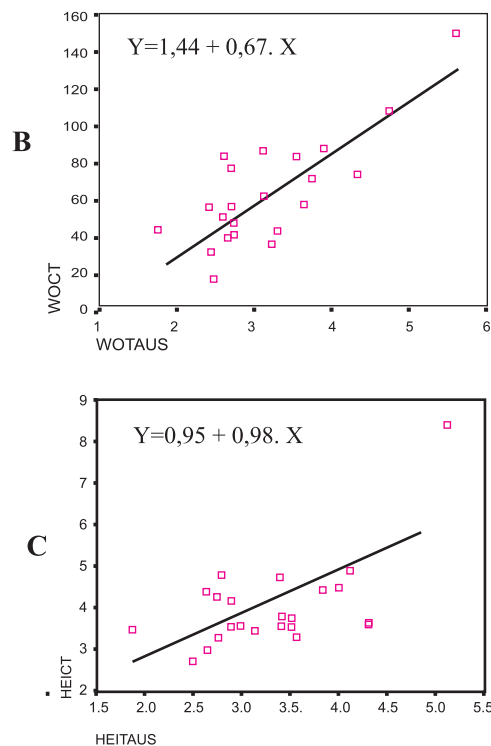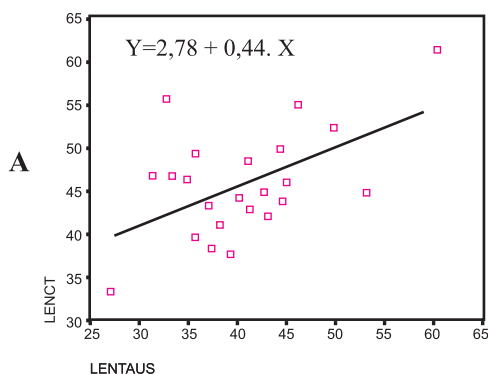

Figure 2. Regression curve between prostate volume measurement using CT and TAUS.
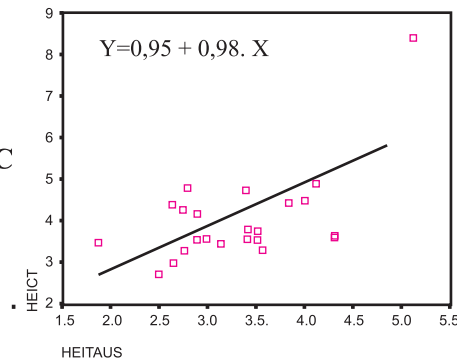

Figure 3. Regression curve between length dimension (A), width dimension (B), and height dimension (C) of prostate.

DISCUSSION

In this study, mean patient age was 64.1 with the most common between 60 and 61 years old. According to study by Xia et al, there was second rapid growth of prostate in 50–90 years old male around 0.5–1.2 gram per year.[12] Mean prostate volume in this study 38.8 cc using CT scan, there was no significant difference with study from Yang et al.[13]

Mean prostate volume in this study 21.4 cc, there was significant difference between another studied by Xia et al,[12] in around 50 years old male (22.30 cc ± 0.30), 60 years old (24.55 cc ± 0.30), and 70 years old and above (27.67 cc ± 3.00). This significant difference was caused by operator dependent factors. Ozden et al, in their study reported mean age 66.5 year old male have 65.9 cc ± 35.9 prostate volume measurement.[14] There was strong correlation of prostate volume measurement between CT and TAUS (r = 0.80), similar to study by Yang et al (r > 0.87).[13]

Strong correlation was found in width dimension of prostate (r = 0.81). Ozden et al, also found strong correlation (r = 0.79) between TAUS and TRUS, but there was no study assessing those

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dimensions using CT and TAUS.[14] Height dimension of prostate was correlated (r = 0.64) in this study. There was difference according Ozden et al study have strong correlation (r = 0.86),[14] again there was not yet study assesed those dimension between CT and TAUS. Length dimension had the lowest correlation (r = 0.53) in this study could be caused by different measurement on acquisition plane between CT and TAUS. CT scan length dimension measured on coronal section, whereas TAUS used sagital plane. Other important factor such as operator dependent in TAUS also causing low correlation between both modalities.

CT scan caused overestimation of prostate volume, especialy in delineating apical prostate limit are difficult. This result similiar with Yang et al study,[13] they stated that CT could overestimate 30–50% in prostate volume measurement. This statement was also found in Kalkner KM et al study.[15]

Other factor that also caused significant difference is heterogenous bladder volume in subject study. Although subject instructed should drink to fullfill the bladder between 100-200 cc. Yuen et al, found strong correlation (r = 0.77) prostate volume measurement betwen TRUS and TAUS in 100 cc bladder volume.[16]

Rahmouni et al, found that strong correlation in MRI (r = 0.85) and TRUS (r = 0.81) with prostate weight in malignancy.[10]

CONCLUSION

Strong correlation of prostate volume measurement using CT and TAUS was found in this study especially in transverse dimension. Prostate volume was overestimated using CT scan. Though significant difference in prostate volume measurement, regression formula was obtained.

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