Impact of Variations in Bony Pelvic Dimensions on Performing Radical Retropubic Prostatectomy

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OBJECTIVES To investigate the impact of variations in bony pelvic dimensions observed from preoperative magnetic resonance imaging on operative time, intraoperative blood loss, and surgical margin status on performing open radical retropubic prostatectomy.

METHODS A prospective study was undertaken in which preoperative magnetic resonance imaging was performed in 190 patients who were diagnosed with clinically localized prostate cancer before radical retropubic prostatectomy. Using the magnetic resonance image findings, various bony pelvic dimensions were measured. The associations of the measured pelvic dimensions and various clinicopathologic factors with the operative time, estimated blood loss, and surgical margin status were analyzed on multivariate analyses.

RESULTS For operative time, none of the individual pelvic dimensions measured demonstrated significant associations on univariate analysis. In contrast, only the newly developed parameter, the pelvic dimension index, approached significance ($P = 0.095$). Only body mass index (BMI) proved to be independently associated with the operative time on multivariate analysis ($P = 0.030$). Also, only the prostate volume ($P = 0.015$) was independently associated with the estimated blood loss. For the surgical margin status, the preoperative PSA level ($P = 0.041$), pathologic Gleason score ($P = 0.015$), and BMI ($P = 0.020$), along with the pelvic dimension index ($P = 0.048$), demonstrated significant associations on univariate analyses. However, only the PSA level ($P = 0.071$) and BMI ($P = 0.059$) approached significance on multivariate analysis.

CONCLUSIONS Our results have demonstrated that variations in the bony pelvic dimensions might have some impact, but not significantly so, on open radical retropubic prostatectomy compared with other patient-related baseline factors such as the BMI or prostate volume. UROLOGY 69: 907–911, 2007. © 2007 Elsevier Inc.

Currently available data have suggested that patient-related factors such as obesity and prostate size could have significant effects on performing radical retropubic prostatectomy (RRP).[1–5] Performing RRP in obese men can be challenging because of the relative difficulty in obtaining adequate access to the pelvic organs. Recently, obesity has also been mentioned in published reports as having certain effects during laparoscopic radical prostatectomy and robotic-assisted laparoscopic radical prostatectomy.[6–8] As for prostate volume, larger prostates are generally accompanied by increased vascularity, which intuitively can translate into increased intraoperative blood loss, leading to surgical difficulty.

Also, some have raised the possibility that performing RRP might actually be easier in a wide and shallow pelvis.[5,6] Additionally, it has been suggested that a large prostate and/or the patient's obesity might not be significant obstacles in performing RRP when the pelvic dimensions are hospitable, as aforementioned. Even for the surgical excision of rectal cancer, some have suggested that the dimensions of bony pelvis might have significant influence on the surgical outcome.[9] However, although anatomic variations in the pelvic dimensions might have a certain impact on RRP, the relevant objective data supportive of such a view have been lacking.

Radiologic measurement of the pelvic bony dimensions, pelvimetry, has been performed for many years, mainly in obstetrics.[10–12] Colcher and Sussman[13] first reported their x-ray pelvimetry method in 1944. Magnetic resonance imaging (MRI) provides an excellent depiction of the pelvic anatomy, including the prostate,

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Table 1. Patient characteristics

Mean age (yr)	63.8 ± 7.1
Mean BMI (kg/m^2)	24.9 ± 3.67
BMI (n)	
<23 kg/m^2	46 (24.2)
23–27.5 kg/m^2	117 (61.6)
>27.5 kg/m^2	27 (14.2)
Mean serum PSA (ng/dL)	9.68 ± 6.17
Serum PSA (n)	
<4.0 ng/dL	38 (15.9)
4.0–9.9 ng/dL	86 (45.3)
>10.0 ng/dL	66 (34.7)
Pathologic Gleason score (%)	
6	65 (34.2)
7	120 (63.2)
≥8	5 (2.6)
Pathologic stage (n)	
T2a	32 (16.8)
T2b	14 (7.4)
T2c	129 (67.9)
≥T3	15 (7.9)
Mean prostate volume (g)	36.5 ± 11.3
Mean operative time (min)	124 ± 25
Mean estimated blood loss (mL)	442 ± 350
Positive margin (%)	20.5

BMI = body mass index; PSA = prostate-specific antigen.
Data presented as mean ± SD or numbers of patients, with percentages in parentheses.

and MRI pelvimetry has recently been gaining in popularity.[14–16] Thus, we investigated the impact of variations in pelvic dimensions observed on preoperative MRI on the operative time, estimated blood loss (EBL), and surgical margin status in patients who underwent RRP at our institution.

MATERIAL AND METHODS

This was a single-institutional prospective study. All patients who were scheduled to undergo open RRP for prostate cancer at our institution by a single surgeon from January 2005 to April 2006 were recruited. Excluding those with history of pelvic trauma or surgery before the scheduled RRP, pelvic MRI was performed preoperatively in all patients (n = 190) who gave written informed consent. Our institutional review board approved the study. None of the 190 patients had undergone radiotherapy or hormonal therapy preoperatively. The patient characteristics are listed in Table 1. The mean patient age was 63.8 years (range 43 to 78), and the mean body mass index (BMI) was 24.9 kg/m^2 (range 18 to 34). The mean preoperative serum prostate-specific antigen (PSA) level was 9.68 ng/mL (range 0.8 to 26). In assessing the BMI of the patients, we used the BMI cutoff points recommended by the World Health Organization for Asians to categorize the patients.[17]

MRI was performed on a 1.5-T scanner (Gyroscan Intera 1.5T, Philips Medical Systems, Best, The Netherlands) using a SENSE_FLEX_M coil (Philips Medical Systems). The mean interval from MRI to surgery was 17 days (range 5 to 45). All MRI scans were reviewed by two radiologists who were unaware of the intraoperative and postoperative status of the patients. From the MRI films, various bony pelvic dimensions likely to reflect the pelvic width or depth were measured. As shown in Figure 1, the widely used obstetric dimensions of the interspinous distance (ISD) at the pelvic midplane and intertuberous distance at the pelvic outlet were measured to assess the cross-sectional width of the pelvis. Also, the anteroposterior diameters of the pelvis measured at the pelvic outlet and midplane were measured. To assess the pelvic depth observed by the surgeon at open RRP as objectively as possible, we developed a new MRI-based parameter of apical depth (AD). The AD was defined as the craniocaudal distance from the most proximal margin of the symphysis pubis to the level of distal margin of the prostatic apex as measured on the mid-sagittal image from MRI. Using these parameters, we developed a new variable of pelvic dimension index (PDI; ISD in centimeters divided by the AD in centimeters), which might be representative of the overall spaciousness near the level of the prostate in the pelvic cavity. Thus, a wide and shallow pelvis will have a greater PDI and a narrow and deep pelvis might have a relatively lower PDI. Data on the intraoperative EBL and operative time were taken from the anesthesiology records. Pathologic data regarding surgical margin status were collected by reference to the final pathologic report.

The Statistical Package for Social Sciences, version 11.0 (SPSS, Chicago, Ill) was used for statistical analysis. The relationship between two variables was assessed using a bivariate correlation analysis, and multivariate analysis was performed through logistic regression analysis. The pelvic dimension variables with $P > 0.2$ on univariate analysis were not included in the multivariate analyses. To assess the intraobserver variability between the two radiologists reviewing the MRI scans, Kendall's tau B, gamma, and kappa values were obtained. $P < 0.05$ was considered significant.

RESULTS

Overall, as measured on MRI, the mean ISD was 8.92 cm (range 7.31 to 11.19), the mean intertuberous distance was 10.46 cm (range 7.82 to 13.61), the mean anteroposterior diameter of the pelvis measured at the pelvic midplane was 10.02 cm (range 7.50 to 13.74), the mean anteroposterior diameter of the pelvis measured at the pelvic outlet was 8.02 cm (range 5.65 to 10.74), and mean AD was 3.11 cm (range 1.89 to 5.12). Consequently, the mean PDI value was 2.92 (range 1.70 to 5.67). None of the measured pelvic dimensions nor the PDI had a significant association with other various baseline patient-related factors such as age, body weight, height, BMI, or prostate volume (data not shown).

For the operative time, none of the individual pelvic dimensions measured demonstrated significant associations on univariate analysis, although the PDI approached significance ($P = 0.095$). On multivariate analysis of various factors, only the BMI proved to be independently associated with the operative time (Table 2). Concerning the EBL during RRP, none of the measured pelvic dimensions displayed a significant association on univariate analysis. The nonpelvic dimensional factors of prostate volume and BMI were significant on univariate analysis, but only prostate volume ($P = 0.015$) was independently associated with EBL on multivariate analysis. For surgical margin status, the preoperative PSA level ($P = 0.041$), pathologic Gleason score ($P = 0.015$), BMI ($P = 0.020$), and PDI ($P = 0.048$) demonstrated a significant association on univariate analysis.