ORIGINAL ARTICLE

Influence of prostate weight, obesity and height on surgical outcomes of robot-assisted laparoscopic radical prostatectomy in Korean men

Minji Jennifer Kim · Sung Yul Park · Koon Ho Rha

Abstract The purpose of this study was to determine if different body habitus, including prostate weight, body mass index (BMI) and height, are associated with surgical outcomes in patients undergoing robot-assisted laparoscopic radical prostatectomy (RLRP). Between July 2005 and June 2007, 135 patients underwent RLRP by a single surgeon. Information was collected retrospectively on prostate weight, BMI and height. Surgical outcome was assessed by total operative time, estimated blood loss (EBL) and surgical margin as parameters of technical difficulty. When statistically analyzed, prostate size was significantly related to total operative time ($P = 0.001$) and EBL ($P = 0.033$). But prostate size was not significantly related to the surgical margin. Patient BMI and height did not appear to affect surgical outcomes. Despite a shift in body frames towards the western standard, most Asians still have shorter stature, lower BMI and smaller prostates. We have found from our experience that different body habitus is not significantly related to surgical outcomes of RLRP, and therefore, it seems promising to operate successfully on Asian patients. However, it is important to obtain long-term outcomes on a larger cohort of patients in order to confirm our findings.

Keywords Robotics · Prostatectomy · Obesity

Introduction

Recent medical advances have made a significant change of scene in operating rooms. Laparoscopic radical prostatectomy (LRP), which was introduced only just over a decade ago, was thought to be an effective method of controlling prostate cancer, but it still had technical difficulties [1]. Surgeon's 2D vision and rigid instrumental movements limited the surgical field, especially in patients with physical variation [2]. Now robot-assisted laparoscopic radical prostatectomy (RLRP) is an emerging surgical option for patients with prostate cancer.

RLRP is an innovative version of LRP. Since the introduction of RLRP a few years ago, a number of studies have shown that its minimally invasive approach has overcome the technical challenges faced by LRP, although less is known about its patient feasibility [3, 4]. Advantages of RLRP became especially valuable in more complicated cases such as operating on obese patients [5–7].

Recent reports claim that the technical difficulties resulting from physical variation have been overcome, but at this stage, it remains controversial. Most Asians have shorter stature, lower BMI and smaller prostates [8, 9]. These differences from the western population may lead to varied surgical outcomes of RLRP. The objective of this study is to assess the hypothesis that the size of the prostate, obesity and height influence surgical outcomes. Our research focuses on Korean patients undergoing RLRP, and we hope this study will contribute towards the expanding field of RLRP among the Asian population.

Materials and methods

Between July 2005 and June 2007, 135 patients underwent RLRP by a single surgeon. This was a non-randomized,

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retrospective study evaluating all of our RLRP patients, and we did not limit surgical candidacy by previous surgical history or body habitus. Information was recorded using patient charts retrospectively on prostate weight, body mass index (BMI) and height. Technical difficulties and overall surgical outcomes were assessed based on total operative time, estimated blood loss (EBL) and surgical margin status. In all cases, at least two of three data sources were reviewed.
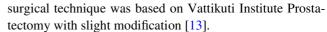
Patients were divided into three groups according to their pathologic prostate weight. Patients were classified as having a small prostate if it weighed less than 30 g (group 1), normal between 30 and 50 g (group 2) and large if greater than 50 g (group 3).

The World Health Organization describes BMI as a simple index of weight for height that is commonly used to classify underweight, overweight and obese adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). However, the values are based on western populations, and it may not be exactly suitable to use in Asians. Therefore, we used a different BMI scale specifically designed to be applicable to Asian males that was announced recently. The current WHO Classification of BMI states that patients over 25 kg/m are considered overweight [8]. In our study, we used 23 kg/m^2 instead as the cutoff point, which was introduced by WHO experts. Patients were considered to be of normal weight with a BMI greater than 23 kg/m^2 (group 1), overweight with greater than 23 kg/m^2 but less than 27.5 kg/m^2 (group 2), and obese with 27.5 kg/m^2 or greater (group 3).

Individuals were considered to be of short stature (group 1) if their height was equal to or less than the first lower quartile of the height distribution of the population of the same gender. Individuals whose heights fell in the second and third quartiles were classified as being of normal or average stature (group 2). Individuals above the third quartile were classified as tall (group 3) [10]. Statistical values of height were obtained from the Korea National Statistical Office. The average height of Korean males above the age of 60 was 161 cm [11]. Patients below 161 cm were classified as being short (group 1), between 161 and 168 cm as being average height (group 2), and tall (group 3) above 168 cm.

Surgical outcome was assessed by total operative time, EBL and surgical margin as parameters of technical difficulty. Total operative time was defined as the time between the start of Veress needle insertion and skin closure including the time spent for robot preparation and docking [12]. The attending anesthesiologist recorded EBL during surgery based on the amount of fluid collected by the suction device. Surgical margin status was divided into positive or negative.

RLRP was performed using the da Vinci Robotic System™ (Intuitive Surgical, Mountain View, CA). Our surgical technique was based on Vattikuti Institute Prostatectomy with slight modification [13].

Statistical evaluation was made using SPSS, and comparative analysis was done using Spearman correlation coefficient and ANOVA, with $P < 0.05$ considered as statistically significant.

Results

The mean age and preoperative prostate-specific antigen (PSA) of 135 patients undergoing RLRP were 64 and 8.0 ng/ml, respectively. The mean BMI, prostate weight and height of 135 patients were 24.3 kg/m^2, 5.5 g and 169 cm, respectively. The mean operative time was 220 min (range 149–418). Total operative time was significantly related to prostate weight ($P = 0.001$). It appeared from statistical analysis that heavier prostate weight was significantly related to longer operative time. BMI and height did not significantly affect total operative time. The mean EBL was 413 ml (range 50–2,700). The EBL was not significantly related to BMI or height. When compared within different prostate weight groups, EBL was not significantly related to prostate weight ($P = 0.329$). However, a significant positive relationship was found between prostate weight and EBL when different parameters were compared ($P = 0.033$). The positive margin rate was present in 41 cases out of a total of 135 patients. Margin status was not significantly related to surgical outcomes either within groups or between parameters. The relationship between surgical outcomes and each variable is shown in Table 1.

Discussion

Soon after Schuessler et al. [1] first attempted LRP in 1992, massive worldwide interest in minimally invasive surgery was initiated, and many drawbacks of open prostatectomy were overcome [14]. However, reduced tactile feedback and inability of the surgeon to control the view of the surgical fields and two-dimensional vision remained as potential disadvantages of LRP [2, 15].

Extensive studies have been done to investigate relationship between patient body habitus and perioperative complications in LRP patients. This has been reported by other LRP series using different techniques [16–19]. Chang et al. [20] reported significantly longer operative times for 400 patients undergoing LRP within larger prostate weight groups. However, Boczko et al. [21] described that the only significant difference in operative parameters of RLRP was a small increase in blood loss in patients with large prostate size. No impact was seen on total positive margin status

Table 1 Surgical outcomes of RLRP according to different body habitus

	Prostate weight groups[a]				BMI groups[b]				Height groups[c]			
	Group 1	Group 2	Group 3	P value	Group 1	Group 2	Group 3	P value	Group 1	Group 2	Group 3	P value
OT (min)	215	222	253	0.043	217	221	227	0.825	241	228	212	0.069
EBL (ml)	398	389	604	0.329	424	410	415	0.984	440	483	377	0.382
SM (%)	27.1	41.7	23.1	0.569	23.7	31.3	38.5	0.268	37.5	30.6	28.9	0.53

RLRP robot-assisted laparoscopic radical prostatectomy, *OT* operative time, *EBL* estimated blood loss, *SM* surgical margin

[a] Prostate weight groups 1, small (under 30 g); 2, normal (between 30–50 g); 3, large (over 50 g)

[b] BMI groups 1, normal (under 23 kg/m); 2, overweight (23–27.5 kg/m); 3, obese (over 27.4 kg/m)

[c] Height groups 1, short (under 161 cm); 2, normal (161–168 cm); 3, tall (over 168 cm)

and operative times. In our experience, we have found that the operative parameters affected by increasing prostate size were operative times and EBL. Surgical margin status was not influenced by varying prostate size.

LRP is no different from other operations in that thin patients are normally easier to operate on compared to obese patients [17, 22]. Whether or not this has an effect on perioperative outcomes is not clear.

Not long after the development of LRP, Binder and Kramer [23] performed the first RLRP at Frankfurt University using the Da Vinci System™ in May 2000. RLRP is more favorable compared to LRP in that it has a more gradual learning curve. Technical factors of RLRP that may direct towards a favorable position include 3D vision of the surgical field, increased degrees of free movement and filtered hand tremor. While RLRP appears to be an effective surgical option for prostatectomy, lack of dexterity remains a major disadvantage. Other obstacles to be overcome include its high cost and the bulky machinery itself [2, 4, 15, 24]. With regard to RLRP and patient outcomes, the current data available are not completely mature. Nevertheless, it has been suggested that body habitus may lead to a less favorable outcome. Hemal et al. [25] emphasize that subtle adjustments to standard port placement are required for patient consideration and optimal surgical results. Ahlering et al. [26] reported on their results comparing patients undergoing RLRP classified by their BMI (over 30 kg/m as obese). Greater blood loss and longer operative time were noted in 19 obese patients than in 81 who were not obese. Obese patients may require longer instruments. However, in a recent study done by Zorn et al. [19] differences in prostate weight did not affect surgical outcomes of RLRP significantly.

Despite its unknown feasibility, RLRP has been adapted by medical centers worldwide since its first trial. In Korea, the first RLRP was performed and documented by Lee et al. [27]. Prostate cancer is a relatively less common type of cancer in Korea compared to western countries. Among men over the age of 65 years, it is the fifth most common cancer. However, despite its low rates, a recent study done by Park et al. [28] showed a trend of increasing incidences of prostate cancer in most parts of Korea. Although no clear explanation has been made, factors including fast westernization and change in diet, such as increased meat and fat intake, are linked to elevated prostate cancer risk. It is therefore crucial to have a structured understanding of the disease and its effective treatment specific to Koreans.

Although we have not encountered any major complications due to different body habitus among patients, it must be emphasized that the present technique of RLRP is designed to suit western physiques.

Conclusion

A review of the published MEDLINE literature is currently insufficient to determine the surgical feasibility of RLRP in the Asian population. Despite a shift in body frame towards western standards, most Asians still have shorter stature, lower BMI and smaller prostates. We have found from our experience that different body habitus is not significantly related to surgical outcomes of RLRP, and therefore it seems promising to operate successfully on the Asian population. However, if the trend of westernization is to be continued, different consequences may follow. It is therefore important to obtain long-term outcomes on a larger cohort of patients in order to confirm our findings. Furthermore, it must be emphasized that the data used in this study are non-randomized and intra-institutional. Caution must be taken when interpreting the results and understanding their limits.

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