ELSEVIER

Urologic Oncology: Seminars and Original Investigations 32 (2014) 40.e9–40.e16

UROLOGIC ONCOLOGY

Original article

Robotic-assisted laparoscopic prostatectomy in men with metabolic syndrome

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Received 2 March 2013; received in revised form 11 April 2013; accepted 18 April 2013

Abstract

Objectives: Metabolic syndrome (MetS), the constellation of obesity and related risk factors for cardiovascular disease, is an expanding epidemiologic concern in the United States and the developed world. However, the relationship between MetS and prostate cancer remains to be definitively assessed. We evaluated the association between obesity and MetS with prostate cancer pathology and surgical and functional outcomes.

Materials and methods: A total of 2,639 patients underwent robotic-assisted laparoscopic prostatectomy (RALP) for localized prostate cancer between March 2003 and July 2012. Of them, 186 patients met the criteria for MetS as defined by the presence of obesity (body mass index [BMI] $\geq$ 30 kg/m^2) in conjunction with 2 or more of the following: hypertension (HTN), dyslipidemia (D), and diabetes (DM). Additionally, reference cohorts of (1) 663 nonobese men without HTN, D, or DM; (2) 184 obese patients without HTN, D, or DM; and (3) 211 obese men with solitary risk factors were identified for comparison. Demographic, histopathologic, and perioperative clinical parameters were compared.

Results: In comparison with patients without MetS, patients with MetS had larger prostates (Odds Ratio (OR) = 1.609, 95% Confidence Interval (CI) = 1.04–2.49, P = 0.03), increased blood loss (OR = 1.592, 95% CI = 1.15–2.21, P = 0.01), and surgical complexity (OR = 4.940, 95% CI = 2.29–10.69, $P < 0.001$). There was no statistical difference observed between these groups in regard to complication rates, pathologic grade, stage, and postoperative continence or erectile function. With the exception of larger prostates found among men with MetS, men with obesity alone and obesity with 1 additional risk factor appeared similar to those with MetS.

Conclusions: Patients with MetS had similar perioperative, histopathologic, and functional outcomes compared with reference cohorts undergoing RALP. RALP is safe, feasible, and efficacious in men with MetS.

Keywords: Prostatic neoplasms; Metabolic syndrome x; Obesity; Prostatectomy; Robotics

1. Introduction

The increasing prevalence of metabolic syndrome (MetS), the constellation of obesity and associated metabolic risk factors, parallels the ascent of the obesity epidemic in the United States and the developed world [1]. The recognition of adipose tissue as the mediator for obesity-linked metabolic changes, including insulin resistance, hypertension, dyslipidemia, and atherosclerosis, implies a nuanced relationship between these disease states [2]. Adipokines, metabolically active signaling molecules, appear to facilitate low-grade inflammatory states that are linked with increased levels of C-reactive protein and interleukin-6 and the development of type 2 diabetes [3–5]. Considerable investigation has demonstrated that metabolic dysfunction related to obesity may result from endogenous adipose-generated inflammation that underlies endocrine and cardiovascular diseases and may be implicated in cancer development and mortality [6].

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1078-1439/$ – see front matter
http://dx.doi.org/10.1016/j.urolonc.2013.04.008

Early studies in urologic diseases have suggested that MetS may play a role in the pathogenesis and progression of benign prostatic hyperplasia, prostate cancer, hypogonadism, nephrolithiasis, and erectile dysfunction [7–10]. Although obesity alone has been recognized as a risk factor for adverse histopathology at the time of radical prostatectomy, the relationship between MetS and prostate cancer remains to be definitively assessed. Within this framework, we sought to define the relationship between MetS and its constituent clinical contributors in a large population of men with clinically localized prostate cancer treated with robot-assisted laparoscopic prostatectomy (RALP).

2. Materials and methods

2.1. Study populations

Under institutional review board approval, eligible study participants were selected from a prospectively maintained prostate cancer database that was analyzed retrospectively. The source population consisted of 2,639 men with clinically localized prostate cancer treated with RALP between March 2003 and July 2012. Relevant clinical, histopathologic, and demographic information, including height, weight, comorbidities, and medications, were registered at enrollment. Of them, 1,244 patients with clinical and pathologic records were considered eligible for inclusion into the study.

Potency was defined by The Sexual Health Inventory for Men (SHIM) score greater than or equal to 17 [11]. Continence was defined as zero to 1 pad [12]. Postoperative erectile function and urinary continence were assessed among preoperatively functional patients, with erectile function having been measured in patients with a minimum of 3 months of follow-up. Surgical complexity was registered by a single surgeon following prostatectomy and was recorded in a binary fashion as complex vs. typical based on the 22 modifier, a system of designated variations from the standard procedure for modified reimbursement [13]. The Clavien-Dindo classification system was utilized to assess surgical complications and was dichotomized as grade II or above vs. grade I or none; grade I complications were not considered as such because they required minimal interventions [14].

2.2. Metabolic syndrome criteria

A modified version of the new International Diabetes Federation criteria, a consensus diagnostic tool widely utilized in clinical and epidemiologic research, was utilized to define MetS. The requirements included central obesity in addition to any 2 of the following 4 conditions warranting treatment: (1) raised triglyceride level, (2) reduced high-density lipoprotein (HDL) cholesterol, (3) hypertension, or (4) type 2 diabetes [15,16]. Consistent with International Diabetes Federation guidelines, body mass index (BMI) greater than 30 kg/m^2 was used as a surrogate for abdominal circumference. Because dyslipidemia treatment targets multiple lipid abnormalities, the distinction between reduced HDL cholesterol and raised triglyceride level was not made and these 2 conditions were consolidated into one. Hence, MetS ($n = 186$) was defined as the presence of obesity (BMI ≥ 30 kg/m^2) in conjunction with 2 or more of the following: hypertension, dyslipidemia, and type 2 diabetes.

A primary reference cohort of nonobese men without hypertension, dyslipidemia, or diabetes was identified for statistical comparison ($n = 663$). Secondary reference cohorts were selected to study the contribution of the individual comorbid risk factors that comprise MetS. These included (1) obese patients without hypertension, dyslipidemia, or diabetes ($n = 184$) and (2) obese patients with 1 additional metabolic risk factor ($n = 211$). The latter cohort comprised 118 men with obesity and hypertension, 83 with obesity and dyslipidemia, and 10 with obesity and diabetes.

2.3. Statistical analysis

Statistical analyses were performed using SPSS version 19 (SPSS IBM, Armonk, NY). Statistical significance was assigned for 2-sided $P < 0.05$. The distributions of demographic, clinical, and pathologic values were assessed using means for continuous variables and proportions for

Table 1
Baseline demographics and characteristics of overall study population

Age, y: Mean (range)		59.6 (32–79)
Race: *n* (%)	White	979 (79.7)
	Black	134 (10.8)
	Other	115 (9.2)
BMI, kg/m^2: Mean (range)		29.4 (18.2–48.5)
ASA: *n* (%)	1	41 (3.4)
	2	801 (66.5)
	3	354 (29.4)
	4	8 (0.7)
Prevalence of obesity: *n* (%)	Overall	681 (46.7)
	Obesity + Hypertension	297 (23.9)
	Obesity + Diabetes	65 (5.2)
	Obesity + Dyslipidemia	257 (20.7)
D'Amico risk: *n* (%)	Low	601 (48.4)
	Intermediate	505 (40.6)
	High	137 (11.0)
PSA, ng/ml: Mean (range)		6.1 (0.5–53)
Erectile function: *n* (%)	SHIM < 17	270 (28.6)
	SHIM ≥ 17	675 (71.4)
Clinical stage: *n* (%)	≤T1c	943 (83.5)
	≥T2a	187 (16.5)
Biopsy Gleason score: *n* (%)	≤6	640 (51.5)
	7	491 (39.5)
	≥8	112 (9.0)
Total number of patients: *n*		1244

PSA = Prostate Specific Antigen.