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SERUM LOW DENSITY LIPOPROTEIN CHOLESTEROL / HIGH DENSITY LIPOPROTEIN CHOLESTEROL RATIO AS A PREDICTOR OF BLADDER DYSFUNCTION.

Hypothesis / aims of study
It is well known that the causes of lower urinary tract symptoms (LUTS) are multifactorial and involve many pathophysiological mechanisms. Recently, it is reported that lower high-density lipoprotein cholesterol (HDL-C) predicted the progression of voiding LUTS[1]. Several basic studies have also demonstrated that chronic hyperlipidemia contributes to the bladder dysfunction. However, there has been little clinical evidence showing the association between hyperlipidemia and bladder dysfunction. On the other hand, attention has focused on the low density lipoprotein cholesterol (LDL-C) / HDL-C ratio as a predictor of cardiovascular disease (CVD). It is well known that an elevated LDL-C concentration in plasma is atherogenic and a high HDL-C level is cardioprotective. Recent studies have reported that LDL-C/HDL-C ratio more accurately predicts CVD risk than LDL-C or HDL-C levels and that elevated LDL-C/HDL-C ratio is associated with progression of atherosclerosis[2]. The aim of this study is to investigate the effect of hyperlipidemia on the bladder function by evaluating association between the LDL-C/HDL-C ratio and urodynamic findings of the patients without bladder outlet obstruction.

Study design, materials and methods
Patients with localized prostate cancer who underwent robot-assisted radical prostatectomy (RARP) in our hospital between February 2013 and April 2014 were included in this study. Urodynamic study was performed before RARP. Exclusion criteria were diabetes mellitus (HbA1c > 6.2) and Schäfer nomogram obstruction 3 – 5. The association between the LDL- C / HDL - C ratio and urodynamic findings were prospectively analysed. According to Schäfer nomogram contraction, patients were divided into two groups, weak contraction (contraction W-,W+, N-) group and strong contraction group (contraction N+, ST) to evaluate the association between the LDL- C / HDL - C ratio and bladder contraction. All values were expressed as mean ± standard deviation. An unpaired t test was used for the categorical variable and linear regression analysis was used for continuous variables. P-values of <0.05 were considered to be statistically significant.

Results
A total of 52 patients (66.5 ± 5.4 years) entered the study. The patients' characteristics are shown in Table 1.The LDL-C / HDL-C ratio of patients was 2.4 ± 0.8. The IPSS (6.7 ± 5.6) and QOL index (2.7 ± 1.4) of patients were mild. Table 2 shows the correlation between the LDL-C / HDL-C ratio and urodynamic findings. Bladder compliance (*P*=0.049, *C.C*=0.318) and voided volume (*P*=0.041, *C.C*=0.329) were significantly associated with the LDL-C / HDL-C ratio. The LDL-C / HDL-C ratio was significantly less in the strong contraction group than in the weak contraction group (strong contraction group vs weak contraction group: 1.9 ± 0.5 vs 2.5 ± 0.8, *P*=0.047).
Postvoid residual urine volume and the presence of detrusor overactivity were not associated with the LDL-C / HDL-C ratio.

Interpretation of results
We demonstrated that elevated LDL-C/HDL-C ratio increased bladder compliance and impaired bladder contraction. However, the mean postvoid residual urine volume was little and the mean IPSS and QOL index were mild in this study. So we consider that the bladder function of the patients were in compensated state. Some basic studies have indicated that diabetes mellitus (DM) induced increased bladder compliance and bladder hypocontractility in compensated bladder function[3]. It is possible that hyperlipidemia causes bladder dysfunction in the same way as DM. Our results may suggest that hyperlipidemia first cause a larger bladder capacity with good compliance, but less contractility

Concluding message
Bladders may have a larger capacity with good compliance, but less contractility on compensated stage of hyperlipidemia related bladder dysfunction. It is possible that LDL-C/HDL-C ratio is useful to a useful marker of bladder dysfunction.

References
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Disclosures
Funding: non **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** The Ethical Committee of Fukushima Medical University School of Medicine **Helsinki:** Yes **Informed Consent:** Yes

Table 1. Patients' characteristics

Age (years)		66.5 ± 5.4 (48 - 76)
BMI (kg/m^2)		24.3 ± 2.6 (18.6 - 29.3)
IPSS		6.7 ± 5.6 (1 - 25)
QOL index		2.7 ± 1.4 (0 - 6)
Prostate volume (ml)		29.3 ± 13.3 (12.1 – 65.0)
LDL-C / HDL-C ratio		2.4 ± 0.8 (1.2 – 4.8)
Schäfer nomogram obstruction	0	1 (2 %)
	1	26 (50 %)
	2	25 (48 %)

BMI: body mass index, LDL-C: low density lipoprotein cholesterol,
HDL-C: high density lipoprotein cholesterol,
IPSS: International prostate symptom score

Continuous data are presented as mean ± standard deviation (range) and
discrete data as numbers of patients (%)

Table.2

a) Correlation between LDL-C / HDL-C ratio and urodynamic findings using linear regression analysis

	Mean ± SD (range)	LDL-C / HDL-C ratio	
		P	C.C
First Desire to void (mL)	153 ± 83 (54-476)	0.165	0.206
Strong Desire to void (mL)	299 ± 146 (119-959)	0.068	0.269
Bladder compliance (mL/cm H$_2$O)	50.8 ± 39.0 (11.0-193.1)	**0.049***	0.318
Maximum flow rate (mL/sec)	12.9 ± 4.7 (4.4-28.7)	0.420	-0.119
Voided volume (mL)	341 ± 149 (145-959)	**0.041***	0.329
Postvoid residual urine volume (mL)	12 ± 33 (0-150)	0.712	0.057

SD: standard deviation, LDL-C: low density lipoprotein cholesterol,
HDL-C: high density lipoprotein cholesterol, C.C: correlation coefficient
*Denotes statistical significance at p<0.05 level

b) Correlation between LDL-C / HDL-C ratio and urodynamic findings using an unparied t test

	n	LDL-C/HDL-C ratio	
		Mean ± SD	P
Detrusor overactivity			0.168
Negative	48 (92.3 %)	2.4 ±0.8	
Positive	4 (7.7 %)	1.9 ±0.6	
Schäfer nomogram contraction			**0.047***
Weak contraction (W-,W+,N-)	41 (79 %)	2.5 ± 0.8	
Strong contraction (N+, ST)	11 (21 %)	1.9 ± 0.5	

LDL-C: low density lipoprotein cholesterol,
HDL-C: high density lipoprotein cholesterol,
n: number of patients (%), SD: standard deviation
*Denotes statistical significance at p<0.05 level