Value of Pelvic Index for prediction of anastomotic leakage after laparoscopic low anterior resection in male rectal cancer

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INTRODUCTION

Some difficulties for laparoscopic surgical management of rectal cancer still remain. Because surgical performance is limited in the pelvic cavity, laparoscopic low anterior resection sometimes becomes a difficult procedure. Especially anastomotic leakage is the most important postoperative issue that all surgeons should resolve. Some risk factors have been reported, including sex. Generally, the male pelvic structure has a tendency to be narrower than the female pelvic structure. In particular, laparoscopic low anterior resection is limited in the available working space depending on the situation of the male patient's pelvic cavity.

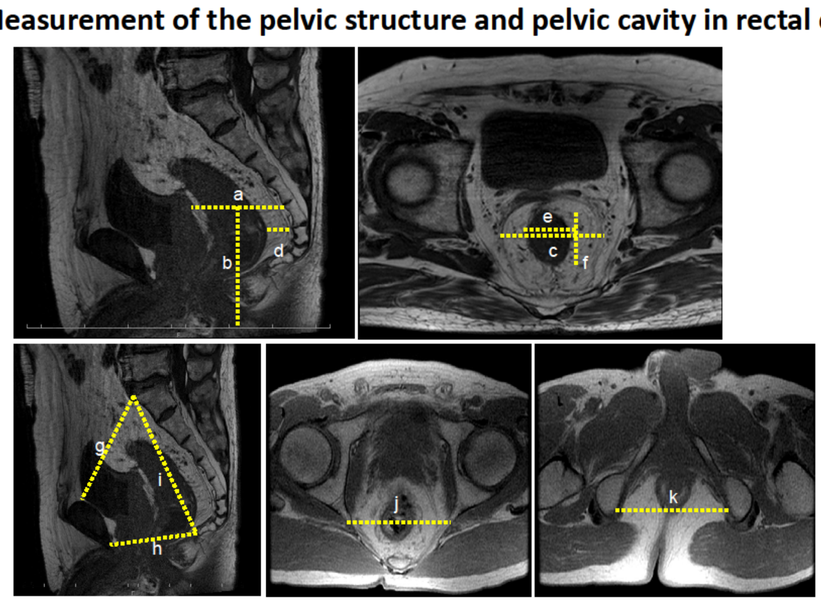
This study aimed to evaluate the degree of the effect of pelvic anatomical factors, including the amount of fat and tumor factors, on postoperative anastomotic leakage, and convert this degree into numerals as the pelvic index.

MATERIALS AND METHODS

Patients

We studied 43 consecutive male patients who underwent laparoscopic low anterior resection with double-stapling technique (DST) anastomosis for rectal cancer. This study was conducted between July 2007 and January 2013 at the Department of Gastroenterological Surgery of Comprehensive Cancer Center, Saitama Medical University International Medical Center. Cases of direct invasion into adjacent organs and distant metastasis, such as in the liver and lungs, were excluded. Moreover, none of the patients had received neoadjuvant chemo-radiotherapy. All of the patients underwent pelvic magnetic resonance imaging (MRI) for assessment of the preoperative clinical stage of rectal cancer. The median age of the patients was 65.6 years (range, 41–88 years), and the median body mass index was 23.4 kg/m^2 (range, 17.7–36.5 kg/m^2). Comorbidities included hypertension (n=16), diabetes mellitus (n=7), arrhythmia (n=4), respiratory illness (n=3), heart disease (n=2), and previous cerebral infarction (n=2). The American Society of Anesthesiologists Physical Status was 1 in 28 patients, 2 in 14, and 3 in 1 patient. The median carcinoembryonic antigen level was 7.0 ng/ml (range, 1.1–58.0 ng/ml).

Measurement of the pelvic structure and pelvic cavity in rectal cancer patients



a : inlet of cavity of lesser pelvis; the length between the inferior margin of 4th sacral vertebra and bottom edge of seminal vesicle
b : depth of cavity of lesser pelvis; length between the middle point of line 'a'
c : diameter of mesorectum; transverse diameter of the mesorectum and the lower rectum at the level of seminal vesicle
d : thickness of mesorectum; the distance between surface of the sacrum and posterior wall of lower rectum
e : transverse diameter of lower rectum at the level of seminal vesicle
f : longitudinal diameter of lower rectum at the level of seminal vesicle
g : pelvic inlet; the length from the superior aspect of the pubic symphysis to the sacral promontory
h : pelvic outlet; the length from the inferior aspect of the pubic symphysis to the coccyx
i : length of sacrum; the distance from the sacral promontory to the coccyx
j : interspinous distance; the narrowest distance between the ischial spines
k : intertuberous distance; the distance between the lowest aspect of the ischial tuberosities

RESULTS

Patients'characteristics

	Anastomotic leakage (−)	Anastomotic leakage (+)	p value
Age	65.7	65.1	0.9048
BMI	23.6	22.9	0.5017
ASA (n)			
1	23	5	0.1924
2	11	3	
3	0	1	
Underlying disease (n)			
0	14	2	0.7434
1	10	4	
2	7	2	
3	2	1	
4	1	0	
CEA (ng/ml)	4.9±5.2	15.2±17.7	0.0214

Surgical outcme

	Anastomotic leakage (−)	Anastomotic leakage (+)	p value
Operative time (mins)	271.6±77.7	307.0±86.6	0.2209
Blood loss(ml)	38.9±51.6	42.8±70.1	0.6267

Tumor characteristics

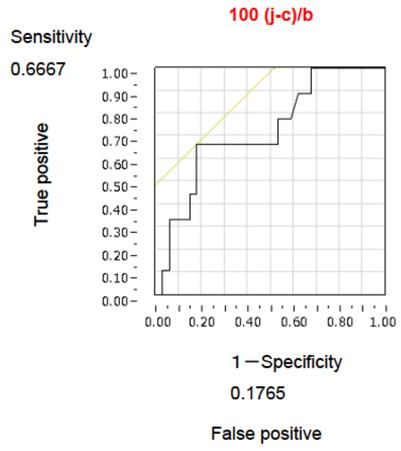
	Anastomotic leakage (−)	Anastomotic leakage (+)	p value
T(n)			
is	1	0	0.5157
1	8	2	
2	10	1	
3	15	6	
N (n)			
0	24	3	0.0453
1	7	2	
2	3	4	
Size of tumor (cm)	4.2±2.1	5.2±2.6	0.2074
Stage (n)			
0	1	0	0.3792
1	12	2	
2	10	1	
3a	7	2	
3b	3	3	
4	1	1	

Pelvic parameters

Index (mm)	Anastomotic leakage (−)	Anastomotic leakage (+)	p value
a. inlet of cavity of lesser pelvis	60.3±12.4	61.6±9.2	0.3862
d. thickness of mesorectum	15.2±6.3	16.2±6.2	0.3257
e. transverse diameter of lower rectum	33.1±7.4	37.6±8.4	0.0857
f. longitudinal diameter of lower rectum	35.6±8.1	40.0±7.4	0.0708
g. pelvic inlet	105.7±12.7	105.1±5.7	0.4163
h. pelvic outlet	84.9±9.3	91.4±12.4	0.0867
i. length of sacrum	127.9±13.1	125.9±11.1	0.3249
k. intertuberous distance	85.7±9.7	86.0±8.2	0.4685

Pelvic parameters (continued)

Index (mm)	Anastomotic leakage (−)	Anastomotic leakage (+)	p value
b. depth of cavity of lesser pelvis	83.4±9.8	86.7±8.6	0.3394
c. diameter of mesorectum	70.7±9.1	78.0±9.2	0.0488
j. interspinous distance	90.3±7.5	91.0±8.5	0.4208
j-c	19.6±9.7	12.9±7.5	0.0488
100 (j-c)/b (PI:Pelvic Index)	23.8±11.4	15.4±9.6	0.038



PI:Pelvic Index **100(j-c)/b**

anastomotic leakage	100(j-c)/b 13>	100(j-c)/b 13≦	n	p value
−	7	27	34	0.007
+	6	3	9	
n	13	30	43	

We considered that the bigger the gap between the interspinous distance and the diameter of mesorectum at the level of seminal vesicle (i.e., "j-c"), and the smaller the depth of the lesser pelvis, ("b"), the easier the surgical procedure in the pelvic cavity should be.
Therefore, the pelvic index [100 × (j−c)/b] was created as a new indicator that would express how easy the operation would be.

CONCLUSION

The pelvic index proposed in this study would give one important preoperative information in laparoscopic rectal surgery in males whether the pelvis is narrow or not.
A pelvic index greater than or equal to 13.0 indicates that the risk of postoperative anastomotic leakage is low.
Consequently, preoperative measurements with pelvic MRI and calculation of the pelvic index could predict a narrow pelvis, and contribute to avoidance or risk.

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