RESEARCH ARTICLE

Reduced Port Surgery for Prostate Cancer is Feasible: Comparative Study of 2-port Laparoendoscopic and Conventional 5-port Laparoscopic Radical Prostatectomy

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Abstract

Background: While 5-port laparoendoscopic radical prostatectomy is standard practice, efforts have been focused in developing a single port surgery for cosmetic reasons. However, this is still in the pioneering stage considering the challenging nature of the surgical procedures. We have therefore focused on reduced port surgery, using only 2-ports. In this study, we compared 2-port laparoendoscopic radical prostatectomy (2-port RP) and conventional 5-port laparoscopic radical prostatectomy (LRP) for clinically localized prostate carcinoma and evaluated the potential advantages of each. Materials and Methods: From January 2010 to December 2010, all 23 patients with clinically localized prostate cancer underwent LRP. Starting November, 2010, when we introduced the reduced port approach, we performed this procedure for 22 consecutive patients diagnosed with early-stage prostate cancer (cT1c, cT2N0). The patients were matched 1:1 to 2-port RP or LRP for age, preoperative serum PSA level, clinical stage, biopsy and pathological Gleason grade, surgical margin status, pad-free rates and post-operative pain. Results: There was a significant difference in operative time between the 2-port RP and LRP groups (286.5±63.3 and 351.8±72.4 min: p=0.0019, without any variation in blood loss (including urine) (945.1±479.6 *vs* 1271.1±871.8ml: p=0.13). The Foley catheter indwelling period was shorter in the 2 port RP group, but without significance (5.6±1.8 *vs* 8.0±5.6 days: p=0.057) and the total perioperative complication rates for 2 port RP and LRP were comparable at 4.5% and 8.7% (p=0.58). There was an improvement in pad-free rates up to 6 months follow-up (p=0.090), and significantly improvement at 1 year (p=0.040). PSA recurrence was 1 (4.5%) in 2-port RP and 2 (8.7%) in LRP. Continuous epidural anesthesia was used in most of LRP patients (95.7%) and in early 2-port RP patients (40.9%). In these patients, average total amount of Diclofenac sodium was 27.8mg/patient in 2-port RP and 50.0mg/patient in LRP. Conclusions: Thus the reduced port approach is as efficacious as LRP in terms of many outcome measures, with significant cosmetic advantages and reduction in post surgical pain. This method can be readily performed safely and therefore can be recommended as a standard laparoscopic surgery for prostate cancer in the future.

Keywords: Laparoendoscopic radical prostatectomy - reduced port surgery - feasibility

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Introduction

At present there are several definitive surgical options for managing clinically localized prostate cancer, including radical retropubic prostatectomy (RRP), laparoscopic RP (LRP), and robot-assisted RP (RALP). Nowadays, robotic-assisted laparoscopic radical prostatectomy (RALP) is spreading worldwide (Menon et al., 2004; Joseph et al., 2005; Rozet et al., 2007; Hakimi et al., 2009). However, RALP needs five to seven ports and one 4-5cm wound is necessary. Interest has therefore focused on reducing the number of ports and in fact several reports of laparoendoscopic single site surgery (LESS) in the urological speciality have appeared in the literature (Castellucci et al., 2008; Desai et al., 2008; 2009; Kaouk et al., 2008; Aron et al., 2009; White et al., 2009; Autorino et al., 2011; 2012). Nevertheless, even with the use of laparoscopic curved or articulating instruments, significant 'clashing' with both the camera and other instruments can increase operative times and require significant laparoscopic skills especially for intracorporeal suturing.

Kaouk et al. (2008) firstly described LESS-RP performed for four strictly selected early stage prostate cancer patients (T1c), without previous pelvic surgery and having a body mass index (BMI) ≤35kg/m. In this pioneering work, all surgery could be completed successfully without conversion to a standard laparoscopic approach. The authors therefore concluded that single-port

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LRP is challenging but feasible, although two patients had positive margins noted at the site of extracapsular extension and one developed a rectourethral fistula. In 2010, LESS endoscopic extraperitoneal radical prostatectomy was reported by Rabenalt et al. and he concluded that while technically challenging it could be accomplished. However, this kind of approach is still in the pioneering stage considering the challenging nature of the surgical procedures, especially for suturing.

To overcome the problems, we have focused on reduced port surgery, 2-port laparoendoscopic radical prostatectomy (2-port RP). In this study, we compared two series of consecutively operated patients, the more recent undergoing 2-port RP and the other conventional 5-port laparoscopic radical prostatectomy (LRP) for clinically localized prostate carcinoma. Potential advantages of the 2-port RP are discussed.

Materials and Methods

From January 2010 to December 2010, 23 patients with clinically localized prostate cancer underwent 5-port LRP at J. A. Aichi Anjo Kosei Hospital. From November, 2010, we changed the operating method to the reduced 2-port approach for the next consecutive 22 patients with early-stage prostate cancer (cT1c, cT2N0). Diagnosis of these patients was accomplished by transrectal ultrasonography, digital rectal examination, computed tomography and magnetic resonance imaging in our hospital until August, 2011 (Table 1) including nine cases who had undergone previously abdominal surgery.

LRP was performed by the intraperitoneal approach reported by Guillonneau and Vallancien as the Montsouris technique (Guillonneau and Vallancien, 2000). In 2-port RP, as we previously described (Nakane et al., 2013), a multichannel port was inserted extraperitoneally through a 2.5-cm lower umbilical "U" incision (Figure 1A). In order to decrease instrument interference and apply standard laparoscopic instruments, we have used three 5-mm ports (no 12mm port) in a multi-channel trocar (E·Z ACCESS®, E·Z trocar 5mm®, Lap protector®, Hakko). An additional 12-mm port was then placed in the left iliac fossa (Figure 1B) so as to have an adequate working angle for facilitation of all surgical procedures and to be able to insert needles. We have used standard laparoscopic instruments, harmonic scalpel (Harmonic ACE®, Ethicon End Surgery), WECK Hem-o-lok® ligation clip and applier (Teleflex Medical, NC). The dorsal vein complex was ligated using a 2-0 absorbable suture and a left hand suturing technique (Figure 1C). After the bladder neck was incised and peeled, the urethral catheter was removed and the metal angle-bougie was inserted to draw the prostate in an anterior direction (Figure 1D). An urethrovesical anastomosis was completed after posterior reconstruction of the rhabdosphincter. 2-0 Monocryl double armed running sutures (about ten to twelve) were performed (Figure 1E). The anastomosis was confirmed to be watertight.

Biochemical recurrence was defined as one serum PSA level of >0.3 ng/mL and subsequent continuous elevation. Clinical local recurrence was defined as the development of a palpable nodule on digital rectal examination, or a pelvic lesion identified on CT in conjunction with a detectable serum PSA level, and was accomplished by Kaplan-Meier survival analysis. Statistical analysis was accomplished of the 2-port RP and LRP groups using the T test and chi-square test, and in all tests $p<0.05$ was taken to indicate significance.

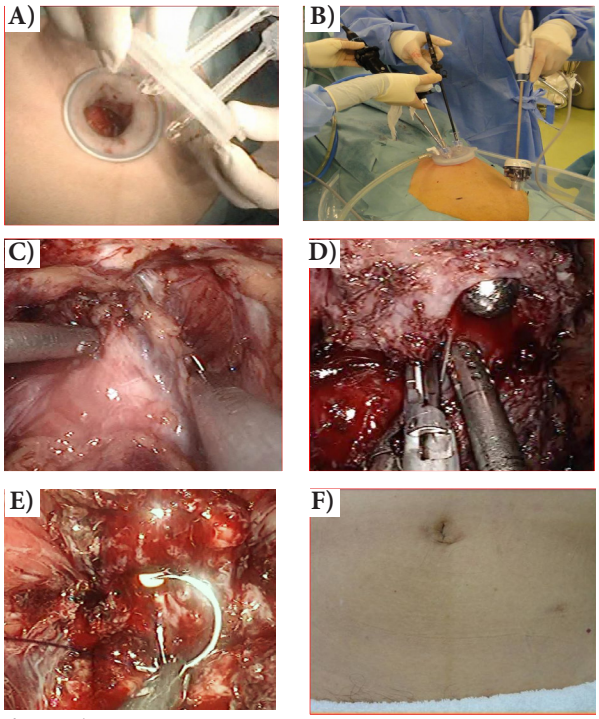

Figure 1. A) Multi-channel trocar (E·Z ACCESS®, E·Z trocar 5mm®, Lap protector®); **B)** Intra-operative photograph; **C)** Ligation of the dorsal vein complex using a left hand suturing technique; **D)** Retraction of prostate using the metal angle-bougie; **E)** Urethrovesical anastomosis; and **F)** Post-operative scar

Results

The 2-port RP could be successfully completed in all cases, without any necessity for conversion to a standard laparoscopic approach and open surgery, excluding one additional 5mm port case for blood suction. Both groups had several cases with previous abdominal surgery. The clinical characteristics of both comparative groups are shown in Table1. Average follow-up was 11.6±2.4months for the 2 port RP group and 22.9±2.4 months for the LRP group. There was no cancer death in our series. The 2-port RP group was aged slightly higher ($p=0.02$), but there was no difference in other categories between the groups. Our series were slightly higher biopsy and pathological Gleason scores compared with the literature (Menon et al., 2002; Rozet et al., 2007; Willis et al., 2011). There were no significant differences in pathological stage, pathological Gleason scores, margin positivity and PSA recurrence (see Table 1, Figure 2).

However, there was a significant difference in operative time between the 2-port RP and LRP groups (286.5±63.3, 351.8±72.4min: $p=0.001$) without variation in blood loss including urine (945.1±479.6 *vs* 1271.1±871.8ml: $p=0.13$). The Foley catheter indwelling period was

shorter in the 2-port RP group, but was not significant (5.6±1.8 *vs* 8.0±5.6 days: p=0.057). Peri-or intraoperative complications were as follows, in 2-port RP group only one case needed an additional port (3-port RP) for blood suction, in LRP group, one bladder injury case and one rectal injury case occurred and needed laparoscopic repair. Surgical site infections and wound hernias were absent in both groups. The total peri-or intraoperative complication rates for 2-port RP and LRP were comparable at 4.5% and 8.7%, respectively (p=0.58). There was an improvement in pad-free rates up to 6 months follow-up, and significantly improvement at 1 year, 2-port RP: LRP, 54.6%: 47.8% (3 months p=0.090), 95.5%: 78.3% (6 months, p=0.090), 100%: 82.6% (1 year, p=0.040).

Continuous epidural anesthesia was used in almost LRP patients (n=22, 95.7%) and in early 2-port RP patients (n=9, 40.9%). Nonsteroidal anti-inflammatory drug (Diclofenac sodium) was administered as necessary at patient request. Pain was assessed for each patient by total amount of Diclofenac sodium until 1 week after operation. Patients who received continuous epidural anesthesia (4 days) were 9 in 2-port RP group and 22 in LRP group. In these patients, average amount of Diclofenac sodium was 27.8±50.7mg/patient in 2-port RP group and 50.0±78.7mg/patient in LRP group (Table 1). Furthermore, after post-operative day 4, when epidural anesthesia was removed, total Diclofenac sodium was 0 mg/patient in 2-port RP and 27.3 mg/patient in LRP. In the 2 port RP group, 6 patients (66.7%) did not receive Diclofenac sodium compared with 13 (59.0%) in the LRP group who received continuous epidural anesthesia.

Table 1. Patient Characteristics and Surgical Results

	Laparoscopic radical prostatectomy		p*
	2-port (n=22)	LRP (n=23)	
Patients Characteristics			
Age (yr)	67.6±5.2	63.6±5.8	0.02
BMI (kg/m^2)	23.5±2.5	23.8±2.5	0.62
PSA (ng/ml)	6.8±1.8	6.7±3.1	0.92
Biopsy Gleason Score, n (%)			
≤6	6 (27.3)	9 (39.1)	0.54
7	1 (4.5)	2 (8.7)	
≥8	15 (68.2)	12 (52.2)	
Clinical stage, n (%)			
T1c	12 (54.6)	12 (52.2)	0.91
T2a	8 (36.4)	8 (34.8)	
T2b	2 (9.1)	3 (13.0)	
Past-History, n (%)	8 (36.4)	4 (17.4)	
Surgical Results			
NVB preserved operation, n (%)	4 (18.2)	6 (26.1)	0.72
Prostate volume (g)	43.1±12.0	43.8±13.0	0.86
Operation time (min)	286.5±63.3	351.8±72.4	0.001
Blood loss including urine (ml)	945.1±479.6	1271.1±871.8	0.13
Complication, n (%)	1 (4.5)	2 (8.7)	0.58
Pathological Results			
Pathological Gleason Score , n (%)			
≤6	3 (13.6)	1 (4.3)	0.53
7	5 (22.7)	5 (21.7)	
≥8	14 (63.6)	17 (73.9)	
Extracapusular extension, n (%)	7 (31.8)	7 (30.4)	0.92
Seminal vesicle invasion, n (%)	0	1 (4.7)	
Positive surgical margin, n (%)	9 (40.9)	7 (30.4)	0.46
pT2	2 (13.3)	0	
pT3	7 (100)	6 (85.7)	
Post-operative Results			
Continuous epidural anesthesia, n (%)	9 (40.9)	22 (95.7)	
Total amount of Diclofenac sodium (mg)*	27.8±50.7	50.0±78.7	0.36
Catheter free days	5.6±1.8	8.0±5.6	0.057
Pad free rate, n (%)			
<1 month	6 (27.3)	6 (26.1)	0.93
<3 months	12 (54.6)	11 (47.8)	0.65
<6 months	21 (95.5)	18 (78.3)	0.090
<12 months	22 (100)	19 (82.6)	0.040
PSA recurrence, n (%)	1 (4.5)	2 (8.7)	0.58
Average follow up (month)	11.6±2.4	22.9±2.7	

*p value by t-test, chi-square test; ** total amount of Diclofenac sodium until 1 week after operation par patient who received continuous epidural anesthesia (4 days)

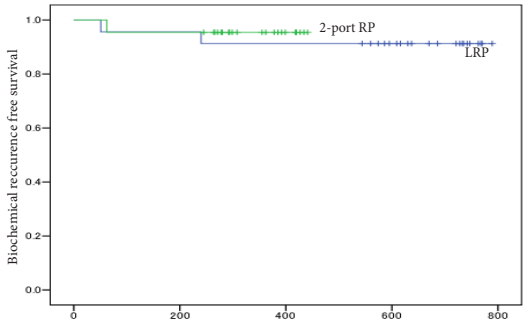

Figure 2. Biochemical Recurrence (BCR)-free Survival was Estimated using the Kaplan-Meier Method

Discussion

The present comparison of two series of cases with very similar background pathology and staging showed that 2-port has distinct advantages over 5-port with regard to operation time and improvement of catheter free days, pad free rate, less pain without any disadvantage of oncological outcome.

Of obvious importance, given the increasing enthusiasm towards performing major abdominal and retroperitoneal procedures with no visible incision or scar, the cosmetic outcome was much superior. Clearly LESS might be optimal in this regard, but only very selected patients are indicated for this approach, certainly provides improved aesthetics. Other practical advantages include improved pain control and decreased intra-abdominal adhesions and post surgical pain. A combination of articulating and bent instruments can allow the surgeon to partially overcome the loss of triangulation and 'clashing' of instruments (White et al., 2009). However, LESS RP is challenging surgical procedure (Kaouk et al., 2008; Rabenalt et al., 2010). Surgeons have embraced the concept that patient safety comes first.

Consequently, we selected reduced port laparoendoscopic radical prostatectomy which could be friendly to surgeons and performed in all clinically organ-confined prostate cancer patients. Our experience with this reduced port approach showed the procedure to be as feasible as conventional LRP, with significant cosmetic advantages (Figure 1F) and post surgical pain. In addition, our procedure can be performed for previous abdominal surgery patients and easily changed from conventional LRP. In the present study, patients were matched 1: 1 to 2-port RP or LRP for age, preoperative serum PSA level, clinical stage and biopsy Gleason grade. Using this design, we found at that the early follow-up oncological outcomes were not significantly different between the 2-port RP- and

LRP-treated patients. Overall early peri or intraoperative complications were not significantly different between the two groups and there was no wound hernia and bladder neck stricture. Interestingly, despite a recognized effect of experience in the 2-port RP group, oncological outcomes were similar to those in the LRP group. In the present study margin positivity rates in pT2 patients were equivalent between 2-port RP and LRP (13.3% *vs* 0%) and are comparable to results reported previously for LRP and RARP (Guilloneau et al., 2001; Murphy et al., 2010; Coelho et al., 2010). However, our positive margin rate in prostatic capsular penetration cases was higher than previous reports. Various factors influence margin positivity, including surgical technique and specimen handling. Furthermore, one of the possible reasons might be higher biopsy and pathological Gleason score than previous reports. Longer follow-up is still required because of the nature of prostate cancer recurrence for exact prognosis.

Postoperative pain is the only one outcome measure to consider after radical prostatectomy and few patients would consider it the most important one. Our results demonstrated that 2-port RP seemed to be superior compared with LRP in postoperative pain. To confirm these results, randomized clinical trial is needed.

In conclusion, there were no significant differences in early complications between the 2 port RP and LRP groups. Furthermore, at the 1-year follow-up there was no difference in self-reported continence rates between the two groups. Oncological efficacy in terms of margin positivity was not significantly different between the two groups. Likewise, at the early follow-up, differences in biochemical PFS among patients in this matched comparison were not significant.

In conclusion, from this study, our 2-port RP can be readily performed safely and may become one of the standard laparoendoscopic surgeries for prostate cancer in the near future. Additional investigations are now needed to further evaluate the longer term safety and oncologic adequacy of this approach.

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