Endoscopic Extraperitoneal Radical Prostatectomy (EERPE): A New Approach for Treatment of Localized Prostate Cancer

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Laparoscopic radical prostatectomy is usually performed by transperitoneal approach. Patients may encounter, intraperitoneal organs injury, and prolonged ileus during recovery period. The authors firstly performed endoscopic extraperitoneal radical prostatectomy (EERPE) in Thailand, which is mimicking open radical prostatectomy, the gold standard for treatment of localized prostate cancer.

Objective: *Assess and evaluate the feasibility and early outcomes of the authors' experience in endoscopic extraperitoneal laparoscopic radical prostatectomy (EERPE).*

Material and Method: *From December 2005 to May 2006, 27 cases of EERPE were performed at the authors' institute for clinically localized prostate cancer by one surgeon (group I). Operative data was compared to those 55 patients who underwent open radical prostatectomy from February 2001 to August 2005 for early prostate cancer by the same surgeon (group II). Early postoperative results, clinical outcomes and complication were analyzed between the two groups using Chi-Square, student unpaired t-test and Mann-Whitney U tests.*

Results: *Patients' age and clinical staging were not different between the two groups. Mean operative time was longer in the EERPE group (268 minutes vs 157 minutes; $p < 0.01$). Median blood loss was 500 mls and 1000 mls in the EERPE and open groups, respectively ($p < 0.001$). The likelihood of transfusion rate in the open group was higher than the EERPE group, with odd ratio of 8.75 (95%CI = 2.09-39.86), $p = 0.001$. Hospitalization time and pathological stage were not different between the two groups. In the EERPE group, there were two rectal complications, including rectal injury and rectal necrosis, which were treated laparoscopically and conservatively without long-term problems.*

Conclusion: *The authors' early experience has shown that EERPE is feasible. Although operative time was longer, the patients may gain benefit of minimally invasive surgery and decreased operative blood loss. In EERPE group, oncological outcomes are equal to open surgery, however, more cases and long-term follow up are required to evaluate the efficacy of such an approach.*

Keywords: *Endoscopic extraperitoneal radical prostatectomy, Prostate cancer, Laparoscopy*

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In the last decade, open surgeries moved towards minimally invasive one, namely, laparoscopy. After laparoscopy, patients may gain benefit from less trauma to tissue, less pain, less bleeding, shorter hospital stay, and faster recovery period. Open retropubic radical prostatectomy has been accepted as one of the standard treatments in clinically localized prostate cancer for many decades[1]. The authors reported 20 cases of laparoscopic radical prostatectomy in Thailand[2]. Since then the number of laparoscopic radical prostatectomy has increased dramatically at Siriraj Hospital. Using the trans-peritoneal approach adapted from

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Montsuris technique[3], the authors encountered many problems including unfamiliar anatomy (as surgeons normally perform this operation using extraperitoneal approach), risk of bowel injuries, intraperitoneal conta-mination of urine, and prolonged postoperative ileus. Furthermore, patients with previous abdominal surgery may be contraindicated in laparoscopic radical prostatectomy using trans-peritoneal approach. To reduce those problems the authors started using the extra-peritoneal approach to laparoscopic radical prostatectomy. Early postoperative results were analyzed and compared to those of open radical prostatectomies.

Material and Method

From December 2005 to May 2006, 27 patients, with clinically localized and transrectal ultrasound biopsy proving prostate cancer, underwent endoscopic extraperitoneal radical prostatectomy (EERPE) by a single surgeon (S Srinualnad) at the department of surgery, faculty of medicine Siriraj Hospital. Operative technique was modified by that reported by Stolzenburg as described[4]:

EERPE is usually performed with the patient under general anesthesia. Patients are placed in a dorsal supine position with 10-15 head down tilt. In contrast to transperitoneal laparoscopic radical prostatectomy, the bowel does not interfere with this procedure. An extreme head down tilt position is therefore not required to improve visualization in the operative field. In addition, even very long operating times can be managed without cardiopulmonary limitations.

The first step in the procedure is to create a preperitoneal space and the placement of the first trocar. A paraumbilical incision and incision of the anterior rectus sheath is followed by a blunt dissection of the rectus muscle and "finger dissection" of the preperitoneal space. A balloon catheter is introduced along the posterior rectus sheath and insufflated Next, the balloon catheter is exchanged for an optical trocar (Hassan type). The authors then place the second 5 mm working trocar 2-3 fingers left lateral to the midline. This position avoids interaction between the instruments inserted into this trocar and the optical system. In addition, it is more comfortable for the surgeon because he does not have to lean over the patient and stands in a more relaxed position. The third -5 mm working trocar is placed in the right iliac fossa two fingers medially to the anterosuoperior iliac spine. The fourth -5mm assisting trocar is placed at the right para-rectal region. Finally, the fifth trocar is 12 mm size, placed in the left iliac fossa three fingers medially to the anterosuoperior iliac spine.

Where indicated, pelvic lymph node dissection is performed as a staging procedure within the following anatomical landmarks: bifurcation of common iliac artery (cranial border), iliac vein (lateral border), medial umbilical ligament (medial border), pubic bone (caudal border) and obturator nerve (posterior border).

The first step in the procedure is the dissection of the space of Retzius. The anterior surface of the bladder neck, the anterior surface of the prostate and the endopelvic fascia are exposed and the fatty tissue overlying these structures is gently swept away. Often, a superficial branch of the deep dorsal vein complex runs along the anterior aspect of the prostate and divides at the bladder neck into two branches. This vein is fulgurated with bipolar forceps and divided. Then, the endopelvic fascia is incised on both sides exposing the fibers of the levator ani muscle.

Puboprostatic ligaments are divided sharply. After this step, the urethra and the dorsal vein complex can be easily visualized at the level of the prostatic apex. The prostate is now retracted caudally by the assistant for good access to the Santorini plexus. The Santorini plexus is ligated with 0 Vicryl by selective passage of the needle underneath the plexus from left to right.

The bladder neck can be identified after the removal of all of the prevesicular fatty tissue. It overlaps the prostate in the shape of a triangle. The dissection starts at a 12 o'clock position at the tip of this triangle. Palpation with the forceps can help to identify the border between the mobile bladder neck and the solid prostate in difficult cases. The incision of the bladder neck is enlarged from the 10 to the 2 o'clock position, and the urethra is developed. The urethra is incised and the deflated balloon-catheter is pulled up into the retropubic space by the assistant under continuous tension. The dissection is now continued in the lateral direction, in the plane between bladder neck and prostate.

Once, the bladder neck is completely dissected, care is taken to carry down the dissection in the correct plane between the prostate and the bladder neck in order to avoid any intraprostatic penetration. This pitfall may occur in the case of a penetration directed too caudally. The bladder neck is first completely divided between the 5-7 o'clock position, this is then extended bilaterally by blunt and sharp dissec-

tion. After this step, the anatomical landmarks of the ampullae and the seminal vesicles are visualized.

After complete dissection of the bladder neck, the prostate is elevated anteriorly by the assistant. The seminal vesicles are easily identified and completely dissected. However, the tips of the seminal vesicles can be left in place in order to avoid damage to the neurovascular bundles that run in close proximity to them. After dissection of the seminal vesicles, the assistant holds the right ampulla and the right seminal vesicle, the surgeon the left ampulla and the left seminal vesicle in a craniolateral direction. With this maneuver, a "window" is developed which reaches from the dorsal aspect of the prostate to the prostatic pedicles. Between these structures, the posterior layer of Denonvillier's fascia is incised and the prerectal fatty tissue visualized. The dissection is continued as far as possible towards the apex of the prostate, strictly in the midline in order to avoid injury to the neurovascular bundles. Laterally to the seminal vesicles, prostatic pedicles are ligated with 12 mm clips and divided. The urethra is sharply divided at the apex. Coagulation of the urethral stump is to be avoided to prevent damage to the external striated sphincter. In case of minor bleeding in this area, the CO2-pressure can be increased temporarily to 16-18 mmHG.

For creation of the urethrovesical anastomosis, the authors use a needle holder (right hand of the surgeon) and a forceps (left hand of the surgeon) and 2-0 Vicryl with a UR-6 needle. The first stitch starts at the 8 o'clock position (backhand-backhand) followed by stitches at the 7, 6 and 5 o'clock positions (forehand at the bladder neck, backhand at the urethra). Starting at the bladder neck (outside-in), the assistant pulls up the catheter anteriorly. The anastomotic stitches are then completed at the urethra inside-out. Between the two stitches, the needle has to be rotated 180 . After each urethral stitch, the catheter needs to be pulled back in order to rule out fixation by the anastomotic suture. The 4 o'clock stitch is then done forehand (bladder neck)-forehand (urethra). After the dorsal circumference has been completed, the catheter is placed into the bladder and the anastomosis is completed anterolaterally and ventrally. On the left side, the stitches are thrown backhand-backhand and on the right side forehand-forehand. All ties are thrown intracorporally.

If a bladder neck preserving technique cannot be applied, a bladder neck reconstruction ("tennis-racket" reconstruction) is performed at the 12 o'clock position.

The magnification of the laparoscope allows good visibility throughout the creation of the anastomosis, allowing the anastomosis to be performed correctly, watertight and safely. The water-tightness of the anastomosis is finally checked by filling the bladder with 200 ml of sterile water. At the end of the procedure, a Jackson drainage catheter is placed into the retropubic space.

Open radical prostatectomy is performed using the technique as previously described[5]. Cystography is performed on postoperative day 7,10, 14 and a urethral catheter is removed if there is no leak of contrast media from urethro-vesicle anastomosis.

Patients' data was collected and compared to those 55 patients who underwent open radical prostatectomy from February 2001 to August 2005 for clinically localized and transrectal ultrasound biopsy proved prostate cancer. All 82 patients had neither previous transurethral resection of the prostate nor previous hormonal treatment prior to surgeries and had the same postoperative protocol of care. Peri-operative data, operative results, clinical outcomes and complication were analyzed between the two groups using Chi-Square, student unpaired t-test, and Mann-Whitney U tests. The odds ratio and 95% confident interval were also calculated to present the risk factor. A p-value of less than 0.01 is considered as statistically significant difference.

Results

The mean age of the patients was 68.76 $\pm$ 6.84 years and 68.07 $\pm$ 5.5 years in the radical prostatectomy (open RP) group and the endoscopic extraperitoneal radical prostatectomy (EERPE) group, respectively. Median PSA was 15 (4-242) ng/ml and 9.4 (0.4-60) ng/ml in open RP and EERPE groups, respectively. In the EERPE group the average operative time was significantly longer than in the open RP group (268.52 $\pm$ 100.19 minutes in EERPE and 157.26 $\pm$ 43.91 minutes in open RP, $p < 0.001$). Median blood loss is reduced in EERPE compared to that of open RP [500 (100-2200) ml vs 1000 (400-4000 ml), $p < 0.001$]. Furthermore, transfusion rate was significantly higher in the open radical prostatectomy group with odd ratio of 8.75 (95%CI = 2.09-39.86), $p = 0.001$. Median catheterization time was shorter in the EERPE group [14 (7-30) days vs 7.5 (5-35) days, $p = 0.007$]. Median hospital stay was not different between the two groups at 7 (3-23) days and 8 (6-38) days in open RP and EERPE groups, respectively. Mean prostatic weight was slightly higher in EERPE than in open RP, but it did not reach statistically significant

level (56.25 ± 25.97 gm in EERPE and 49.48 ± 23.8 gm in open RP). All data is shown in Table 1 and 2.

Surgical margin was positive at the rate of 39.1% in EERPE but was slightly higher in open RP at the rate of 50.9%. This was not significantly different using Chi-Square test. Extra-prostatic disease was only 13% in EERPE but 31.5% in the open group, (p = 0.16), as shown in Table 3.

Table 4 shows the early result of continence rate at 3 months. There was no difference between the two groups (54.55% vs 46.15%, p = 0.85, in open RP and EERPE, respectively).

Table 5 shows complication in both groups. In the EERPE group, one case of rectal injury was immediately repaired using one layer suturing with vicryl 2-0 interrupted stitches. One case of late recto-urethral fistula was successfully treated by conservative measures including, one week of nothing via mouth, and cystostomy tube placement. There was no open conversion in the EERPE group. In the EERPE group, there were no complications after removal of the urethral catheter, as opposed to those three cases of hematuria in the open group.

Discussion

Laparoscopic radical prostatectomy was first reported in 1997[6]. Patients gain benefit of minimally invasive surgery, and the procedure has become more

Table 1. Shows mean values of Age, OR time, Prostatic weight in boths group

	Open RP (n = 55)	EERPE (n = 27)	p-value
Age (years)	68.76 ± 6.84	68.07 ± 5.5	0.65
OR time (minutes)	157.26 ± 43.9	268.52 ± 100.19	<0.001
Prostatic weight (gram)	49.48 ± 23.8	56.25 ± 25.97	0.284

Note: p-value by unpaired t-test

Table 2. Shows median varies of PSA, Blood loss, Catheter time, Hospital stay in both groups

	Open RP (n = 55)	EERPE (n = 27)	p-value
PSA (ng/ml) (range)	15 (4-242)	9.4 (0.4-60)	0.017
Blood loss (ml)	1000 (400-4000)	500 (100-2200)	<0.001
Catheter removal time (days)	14 (7-30)	7.5 (5-35)	0.007
Hospital stay (days)	7 (3-23)	8 (6-38)	0.73

Note: p-value by Mann-Whitney U test

Table 3. Shows pathological results in both groups

	Open RP (n = 55)	EERPE (n = 23)	p-value
Surgical Margin positive	50.9%	39.1%	0.48
Extraprostatic disease	31.5%	13.0%	0.16

Note: p-value by Chi-square test

Table 4. Shows continence rate at 3 months in both group

	Open RP (n = 33)	EERPE (n = 13)	p-value
Continence Rate	18/33 (54.55%)	6/13 (46.15%)	0.85

Note: p-value by Chi-square test

Table 5. Peri-operative and immediated post-operative complications

	RRP (n = 55)	EERPE (n = 27)
UTI	0	1
Rectal injury	0	1
Late Rectal necrosis with Recto-Urethral fistula	0	1
Prolong drainage	4	2
Diarrhea	0	1
Ileus	2	0
Hematuria post catheter removal	3	0
Pulmonary embolism	1	0
Wound infection	1	0
Upper hemorrhage	1	0
Sepsis	1	0

popular among urologists all over the world[7-12]. In those series, the authors reported the transperitoneal approach. The authors first reported their initial experience of transperitoneal laparoscopic radical prostatectomy in 2005[2]. It is the authors' belief that using the extraperitoneal approach is much more beneficial to the patients, as the patients had lower risks of bowel injuries, intraperitoneal contamination of urine, and prolonged postoperative ileus. Furthermore, patients with previous abdominal surgery can undergo laparoscopic radical prostatectomy using the extraperitoneal route[13]. Extraperitoneal laparoscopic radical prostatectomy was first reported in 1997[14]. It was popularized in Europe[15-17]. The present study reports the authors' early experience in endoscopic extraperitoneal radical prostatectomy (EERPE) at Siriraj Hospital compared with the open radical prostatectomy done by the same surgeon.

There was no difference between the two groups including age, pre-operative level of serum prostate specific antigen, clinical staging, hospital stay, and size of the prostate gland.

In the EERPE group the average operative time was significantly longer than in the open RP group (268.52 $\pm$ 100.19 minutes in EERPE and 157.26 $\pm$ 43.91 minutes in open RP, $p < 0.001$). This is probably due to the authors' early experience in such an approach. The authors believe that the operative time can be shortened as experience increases. EERPE has been reported to have a shorter operative time compared to transperitoneal laparoscopic radical prostatectomy[14].

Fig. 1 Surgical scar of abdominal wall after EERPE (one week)

Fig. 2 Cystography before removal urethral catheter shows no leakage of contrast media around bladder neck

Median blood loss is reduced in EERPE compared to those of open RP [500 (100-2200) ml vs 1000 (400-4000) ml, $p < 0.001$]. Moreover, the transfusion rate was significantly higher in the open radical prostatectomy group with an odd ratio of 8.75 (95%CI = 2.09-39.86). This is due to pneumo-extraperitoneal-pressure created by air insufflators during EERPE helping in compressing the venous bleeding during the procedure.

Oncological outcome was not different between the two groups. The present result of positive surgical margin in the EERPE group is 39.1%. This is higher than a world series which was reported to be 10.8-26.4%[10,12,16,19]. Obviously, this needs to be improved. However, long-term follow up is essential as positive surgical margin can do no harm in some cases[20].

In the EERPE group, there was no postoperative prolonged ileus found, particularly in two cases of prolonged drain leakage. This can be explained by the fact that operation through the extraperitoneal route has little effect on returning of bowel function during the postoperative period. This is confirmed that using the transperitoneal route postoperative ileus can be found up to 10% of cases.

There were two cases of rectal complication in the EERPE group. This was happened in the early stage of the authors' experience as laparoscopic surgery reduced tactile sensation during the operation particularly at the posterior apical dissection. The authors therefore recommend preparing the large bowel prior to the operation, particularly with less experienced laparoscopic urologists, and in locally advanced patients undergoing laparoscopic radical prostatectomy. To prevent late rectal necrosis, cauterization should be used as minimal as possible particularly at the anterior rectal wall[21].

Using laparoscopic approach may enhance postoperative continence and reduce impotency rate after the operation. The authors believe that the longer length of urethra and neuro-vascular bundles can be better preserved with the help of magnification from a laparoscopy lens. Eden et al reported from 100 cases of EERPE with a 56% continence rate at 3 months following the operation, and 12-month total continence rate was 96%[15]. In the authors' present study 3-month continence rate was not much different between the two groups and it looked as though open RP provided a slightly better outcome (54.55% vs 46.15), but it did not reach statistically significant difference. However, long-term follow up is needed to evaluate the patients' quality of life including, incontinence and impotency rates.

Conclusion

Laparoscopic radical prostatectomy is a feasible option of treatment for patients with localized prostate cancer. There is no doubt that patients can gain the benefit of a minimally invasive procedure. Endoscopic extraperitoneal radical prostatectomy can mimic the gold standard treatment of localized prostate cancer, namely, open radical prostatectomy. Patients who undergo endoscopic extraperitoneal radical prostatectomy have a lower chance of getting transfusion with equal oncological outcomes and quality of life to those undergoing open radical prostatectomy in the early postoperative period. However, the authors' technique needs to be refined in order to reach an international standard particularly positive surgical margin rate.

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การผ่าตัดส่องกล้องเพื่อรักษามะเร็งต่อมลูกหมากโดยวิธีผ่านช่องนอกเยื่อบุผนังช่องท้อง: การรักษาแบบใหม่สำหรับมะเร็งต่อมลูกหมากในระยะเริ่มต้น

สิทธิพร ศรีนวลนัด, ไชยยงค์ นวลยง, สุทธิพล อุดมพันธุรัก, วรรณวิมล คงสุวรรณ

การผ่าตัดส่องกล้องเพื่อรักษามะเร็งต่อมลูกหมากในระยะเริ่มต้นนั้นในประเทศไทยโดยปกติจะทำการผ่าตัดผ่านทางช่องท้อง ซึ่งผู้ป่วยอาจมีปัญหาเรื่องท้องอืด, อันตรายต่ออวัยวะต่าง ๆ ในช่องท้อง เช่น ลำไส้ และการฟื้นตัวช้ากว่าปกติ เนื่องจากปัญหาดังกล่าวผู้เขียนได้ทำการผ่าตัดส่องกล้องเพื่อรักษามะเร็งต่อมลูกหมากโดยอยู่หน้าต่อกระเพาะปัสสาวะนอกเยื่อบุผนังช่องท้องเป็นครั้งแรกในประเทศไทย ซึ่งเป็นการผ่าตัดเลียนแบบการผ่าตัดแบบเปิดเพื่อรักษามะเร็งต่อมลูกหมาก

***วัตถุประสงค์**: ศึกษาถึงความเหมาะสม และผลการผ่าตัดมะเร็งต่อมลูกหมากโดยการส่องกล้องผ่านทางช่องนอกเยื่อบุผนังช่องท้อง เปรียบเทียบกับการผ่าตัดแบบเปิด*

***วัสดุและวิธีการ**: ระหว่างเดือนธันวาคม พ.ศ. 2548 – 2 พฤษภาคม พ.ศ. 2549 ผู้เขียนได้ทำการผ่าตัดส่องกล้องเพื่อเอามะเร็งต่อมลูกหมากออกโดยผ่านทางช่องนอกเยื่อบุผนังช่องท้อง (กลุ่ม 1) ผลของการผ่าตัดได้นำมาศึกษาเปรียบเทียบกับผู้ป่วย 55 คน ที่ได้รับการผ่าตัดมะเร็งต่อมลูกหมากโดยใช้การผ่าตัดแบบเปิด (กลุ่ม 2) ระหว่างเดือนกุมภาพันธ์ พ.ศ. 2544 ถึงเดือนสิงหาคม พ.ศ. 2548 โดยศัลยแพทย์คนเดียวกัน ข้อมูลผลของการผ่าตัดได้นำมาศึกษาเปรียบเทียบกันทั้ง 2 กลุ่ม โดยใช้เครื่องมือทางสถิติ คือ Chi-Square, student unpaired t-test และ Mann Whitney U tests*

***ผลการศึกษา**: อายุเฉลี่ยและระยะของมะเร็งทางคลินิก ไม่มีความแตกต่างกันในผู้ป่วยทั้ง 2 กลุ่ม ค่าเฉลี่ยของระยะเวลาการผ่าตัดในกลุ่มที่ทำผ่าตัดแบบส่องกล้องจะยาวกว่ากลุ่มที่ทำการผ่าตัดแบบเปิด (268 นาที เปรียบเทียบกับ 157 นาที; $p < 0.001$), ค่ามัธยฐานของการสูญเสียเลือดระหว่างผ่าตัดนั้นมีค่าเท่ากับ 500 มิลลิลิตร และ 1,000 มิลลิลิตร ในกลุ่มที่ใช้การส่องกล้องและกลุ่มที่ผ่าตัดแบบเปิดตามลำดับ, $p < 0.001$ โอกาสในการสูญเสียเลือดจำเป็นต้องได้รับการให้เลือด ในกลุ่มที่ทำผ่าตัดแบบเปิดนั้นสูงกว่าถึง 8.75 เท่า ระยะเวลาการอยู่โรงพยาบาล และผลของการตรวจทางพยาธิสภาพไม่พบความแตกต่างกันในทั้งสองกลุ่ม ในกลุ่มที่ทำการผ่าตัดแบบส่องกล้องพบว่ามีการทะลุเข้าทวารหนัก จำนวน 2 ราย ซึ่งสามารถรักษาได้โดยการแก้ไขระหว่างการผ่าตัด และโดยการใช้การรักษาแบบประคับประคอง*

***สรุป**: ผลการศึกษาบ่งชี้ว่า การผ่าตัดมะเร็งต่อมลูกหมากชนิดเริ่มต้นโดยใช้กล้องผ่านช่องนอกผนังเยื่อบุช่องท้องได้ผลเป็นที่น่าพอใจ ถึงแม้ว่าระยะเวลาการผ่าตัดจะนานขึ้นกว่ากลุ่มที่ใช้การผ่าตัดแบบเปิด แต่ผู้ป่วยจะมีการสูญเสียเลือดน้อยลงเมื่อเทียบกับการผ่าตัดแบบเปิด นอกจากนี้พบว่าผลของการควบคุมมะเร็งได้ผลใกล้เคียงกับการผ่าตัดแบบเปิด โดยจะเห็นได้จากผลตรวจทางพยาธิวิทยาหลังผ่าตัดไม่มีความแตกต่างกันในผู้ป่วยทั้งสองกลุ่ม อย่างไรก็ตาม จำนวนผู้ป่วยที่มากขึ้นและการติดตามการรักษาในระยะยาวจะมีประโยชน์ในการวัดผลสำเร็จของการผ่าตัดแบบส่องกล้องได้ดียิ่งขึ้น*