



Assessment of Technical Difficulty and Complications of Urological Laparoscopic Operations According to "European Scoring System": 228 Cases

228 Olgu; Ürolojide Laparoskopik Ameliyatlarda Teknik Zorluk ile Komplikasyonların Avrupa Skorlama Sistemi'ne Göre Değerlendirilmesi

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What's known on the subject? and What does the study add?

Assesment of urological laparoscopic operations and complications as a standard way.

ABSTRACT

Objective

Standardization is important for the assessment of technical difficulty and complications in laparoscopic urology surgery. In this study, our laparoscopic operations and complications were evaluated retrospectively by using the European Scoring System and Clavien classification system.

Materials and Methods

We evaluated a total of 228 laparoscopic urology procedures performed between 2002 and 2007. The first 114 cases were named as group 1 and the second 114 cases as group 2. Both of the groups were classified regarding technical difficulty according to the European Scoring System. Complications were divided into two groups: major and minor. Postoperative complications were evaluated by the Clavien classification system.

Results

The rate of difficult operations was 24.5% and 56.1% in group 1 and group 2, respectively. In group 1, major and total complications were more common in difficult operations than in easy operations ($p=0.045$, $p=0.006$). Minor complications were similar ($p=0.064$). In group 2, complication rates were similar for both difficult and easy operations. ($p=0.694$, $p=0.509$, $p=0.273$). Complication rates per case was 0.21 (0-3) in group 1 and 0.19 (0-3) in group 2 and there was no significant difference between the two groups ($p=0.790$). Postoperative complications were classified using the Clavien classification system. 17% ($n=4/23$) of 23 complication was grade 1, 48% ($n=11/23$) was grade 2, 26% ($n=6/23$) was grade 3a, 9% ($n=2/23$) was grade 3b. There were no grade 4 and 5 complications. 3% of the cases were converted to open surgery and no statistically difference was found between the groups ($p=0.446$).

ÖZET

Amaç

Ürolojik laparoskopik operasyonlarda teknik zorluk ve komplikasyonların değerlendirilmesinde standartizasyon önemlidir. Bu çalışmada laparoskopik operasyonlarımızı ve komplikasyonlarımızı Avrupa skorlama sistemi ve Clavien sistemi kullanılarak retrospektif olarak değerlendirildi.

Gereç ve Yöntem

2002-2007 yılları arasında yapılan 228 ürolojik laparoskopik prosedür değerlendirildi. İlk 114 olgu grup 1, ikinci 114 olgu ise grup 2 olarak adlandırıldı. Her iki grup teknik zorluk açısından Avrupa skorlama sistemine göre sınıflandırıldı. Karşılaşılan komplikasyonlar majör, ve minör olarak ayrıldı. Postoperatif komplikasyonlar ise Clavien sınıflaması ile değerlendirildi.

Bulgular

Grup 1'de yapılan operasyonların %24,5'ini zor operasyonlar oluştururken, grup 2'de bu oran %56,1 idi. Grup 1 olgularda, majör ve toplam komplikasyonlar zor ameliyatlarda, kolay ameliyatlara göre fazla bulundu ($p=0,045$, $p=0,006$). Minör komplikasyonlar ise benzerdi ($p=0,064$). Grup 2'de ise tüm komplikasyonlar benzer bulundu ($p=0,694$, $p=0,509$, $p=0,273$). Gruplar, olgu başına düşen komplikasyon oranları açısından incelendiğinde grup 1'de 0,21 (0-3), grup 2'de ise 0,19 (0-3) olarak bulundu ve gruplar arasında istatistiksel anlamda fark bulunmadı ($p=0,790$). Ayrıca görülen postoperatif komplikasyonlar Clavien derecelendirme sistemine göre sınıflandırıldı. Yirmi üç komplikasyonun %17'si ($n=4/23$) grade 1, %48'i ($n=11/23$) grade 2, %26'sı ($n=6/23$) grade 3a, %9'u ($n=2/23$) grade 3b iken, grade 4 ve grade 5 komplikasyon izlenmedi. Yüzde 3 olguda açık cerrahiye dönüldü ve gruplar arasında istatistiksel olarak fark bulunmadı ($p=0,446$).

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ABSTRACT

Conclusion

We assume that the European Scoring System and the Clavien classification system are important in the assessment of difficulty of the cases and standardization of the analysis of postoperative complications.

Key Words

Laparoscopy, complication, European scoring system, Clavien system

ÖZET

Sonuç

Olguların zorluk derecelerinin değerlendirilebilmesinde ve postoperatif komplikasyonların analizinin standartizasyonun sağlanabilmesi için Avrupa skorlama sisteminin ve Clavien sınıflamasının önemli olduğunu düşünüyoruz.

Anahtar Kelimeler

Laparoskopi, komplikasyon, Avrupa skorlama sistemi, Clavien sistem

Introduction

Laparoscopic applications in urology has started with pelvic lymph node dissection in 1991 and had a wide area of usage increasingly in the following years (1). The evaluation of the laparoscopic surgical approaches for the degree of difficulty has been done via the European Scoring System (ESS) (2). Thus, the standardization of laparoscopic surgical procedures and the objective assessment of complications were hoped to be provided. Although they are less invasive applications, it must be kept in mind that laparoscopic surgeries are major surgical applications which may have very serious complications (3). Postoperative complications have been categorized according to the length of hospitalization period until now (4). The median duration of hospital stay is not used for evaluation nowadays because it varies between different clinics and, instead of that, evaluation is being done objectively by a postoperative complication scoring system which was published in 1992 and validated in 2004 by Clavien et al. (5,6). In this article, 228 urological procedures performed in our clinic were assessed using the ESS, while the complications were classified according to the Clavien classification system and the results were evaluated retrospectively.

Materials and Methods

A total of 228 laparoscopic urology procedures performed in our clinic between 2002 and 2007 were evaluated. Group 1 included 114 cases operated between January 2002 and June 2005, and group 2 included 114 cases operated between July 2005 and December 2007. Both groups were classified according to the ESS (2). By using this classification system, easy and mild difficult surgical procedures were all named as easy operations (EO); whereas the pretty difficult, difficult and highly difficult operations were named as difficult operations (DO). Complications were classified as major and minor. While the major complications were accepted as complications that needed significant additional treatment and hospitalization more than 2 days (Clavien grade 3-5); minor complications were considered as ones that needed minimal additional treatment and hospitalization not more than 2 days (Clavien grade 1-2) (7). Postoperative operations were also classified by the Clavien classification system. This classification included 7 groups; grade 1: No need for additional treatment; grade 2: Need for medical treatment including blood transfusion and total parenteral nutrition; grade 3: Need for endoscopic surgery and radiological intervention (grade 3a: no need for general anaesthesia, grade 3b: need for general anaesthesia); grade 4: need for intensive care-life threatening (grade 4a: single organ disorder including

hemodialysis, grade 4b: multi-organ disorder); grade 5: death due to the complications (6).

Analysis of data was performed via SPSS 11.5 program. Descriptive statistics were expressed as mean \pm standard deviation (minimum-maximum); for continuous variables and nominal properties were expressed as number of cases and as percentage (%). The significance of the difference between the groups due to the mean ages were assessed by student's t-test; operation difficulty score and the significance of the difference due to complication number per each case were evaluated via the Mann-Whitney U test. Whether there was a statistically significant difference or not between the groups considering nominal features were assessed by using chi-square test or Fisher's exact probability test. A p value of less than 0.05 was considered statistically significant.

Results

The mean age of the group 1 and the group 2 was 42.2 ± 22.95 years (1-82) and 41.8 ± 21.72 years (2-78), respectively. There was no statistically difference in mean age and gender between the groups ($p=0.882$, $p=0.412$, respectively) (Table 1). A statistically significant difference was detected in ESS score range and mean score per unit case between the groups ($p<0.001$) (Table 1). Details of the ESS distribution of group 1 and group 2 are demonstrated in Table 2. While 24.5% of the operations in group 1 were DO ($n=28/114$), this rate was 56.1% ($n=64/114$) in group 2 (Figure 1). Classification of major and minor complications are shown in Table 3. According to detailed analysis of group 1 and group 2 regarding complications; when the number of cases with major and total complications were investigated from the aspect of EO and DO, the number of cases with DO was found to be significantly larger in group 1 ($p=0.045$,

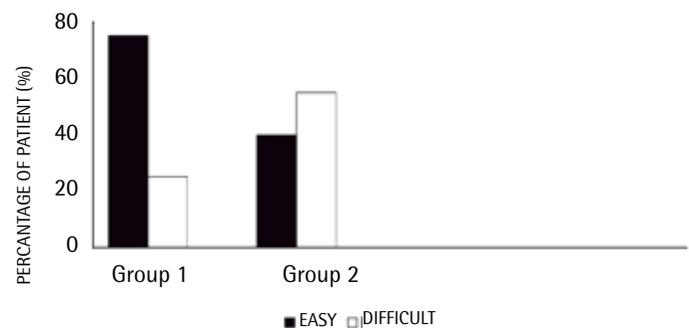


Figure 1. Distribution of operations according to difficulty level

p=0.006, respectively). However, minor complications in the same group were similar regarding DO and EO (p=0.064). When group 2 was investigated considering DO and EO, the number of cases having major, minor and total complications were similar (p=0.694, p=0.509, p=0.273, respectively) (Table 4). In group 2, major complications were detected to decrease compared to group 1; from 10.7% (n=3/28) to 6.3% (n=4/64), however, this result was not found to be statistically significant (p=0.431) (Table 4). In 30 cases from each group, a total of 46 complications were seen. When the two groups were compared for the total number of complications, 24 complications in group 1 and 22 complications in group 2 were recorded. The rate of complications per unit case was found to be 0.21 (0-3) in group 1 whereas it was 0.19 (0-3) in group 2, and no statistically significant difference

was detected between the groups (p=0.790). The postoperative complications were classified according to the Clavien scoring system. 17% of 23 complications were (n=4/23) grade 1, 48% (n=11/23) were grade 2, 26% (n=6/23) were grade 3a, and 9% (n=2/23) were grade 3b, while no complication was seen in grade 4 and grade 5 (Table 5). Open surgery was essential in 3% of cases (n=7/228). Five (5) of these cases were in group 1, two (2) cases were in group 2. There was no statistically significant difference between the groups (p=0.446). However, it was important that although DO rate in group 2 was high, the rate of open surgery was decreased.

Discussion

Laparoscopic surgery in urology has been very popular in the past 15 years (8,9,10,11). Nowadays, it is routinely being applied in many health centers in reconstructive and ablative surgery cases (12,13). As a result of long-term experience, various studies comparing laparoscopic surgery to open surgery have been performed and it was suggested that laparoscopic surgery is preferable (14,15). Meanwhile, studies comparing the complications of laparoscopic surgery and open surgery defined no difference between the complication rates (8,16). Until the late 1990s, only complications in specific interventions and low number of cases of complication were reported (11,13,16,17). In recent years, complications with large number of cases and complications of various laparoscopic procedures have been investigated (7,18,19,20). The investigations reporting complication rates in a wide range from 4.4% to 19% have been recently published (10,15,17,21). For example, in two different case series, one with 1769 cases and other with 2966 cases have

Table 1. The demographics of groups and distribution of operations according to difficulty level

| | Group 1 (n=114) | Group 2 (n=114) | p |
|------------------|-------------------|-------------------|--------|
| Age | 42.2±22.95 (1-82) | 41.8±21.72 (2-78) | 0.882 |
| Gender | | | 0.412 |
| Male | 74 (64.9%) | 68 (59.6%) | |
| Female | 40 (35.1%) | 46 (40.4%) | |
| Total score | 771 | 1039 | |
| Score per case | 8.8±14.33 (3-13) | 11.8±12.55 (3-19) | <0.001 |
| Difficulty level | | | <0.001 |
| Easy | 86 (75.4%) | 50 (43.9%) | |
| Difficult | 28 (24.6%) | 64 (56.1%) | |

Table 2. Classification of cases according to European scoring system and scores

| Easy Operation | | | Group 1 | Group 2 |
|----------------------|---|-------------------|---------|---------|
| Easy | Cryptorchidism (diagnostic) | 4 | 5 | |
| Easy | Varicocele | 2 | - | |
| Easy | Resection of cortical renal cyst | 55 | 20 | |
| Slightly difficult | Cryptorchidism (therapeutic) | 19 | 14 | |
| Slightly difficult | Resection of parapelvic renal cyst | 6 | 8 | |
| Slightly difficult | Ureterolithotomy | - | 3 | |
| | | Subtotal (n) | 86 | 50 |
| Difficult operations | Fairly difficult | Adrenalectomy | 2 | 4 |
| Fairly difficult | Nephrectomy (benign) | 19 | 37 | |
| Difficult | Nephroureterectomy | - | 4 | |
| Difficult | Pyeloplasty (resection -suture) | 1 | 3 | |
| Difficult | Radical nephrectomy (T1) | 6 | 8 | |
| Very difficult | Partial nephrectomy | - | 1 | |
| Extremely difficult | Lumboaortic lymphadenectomy (post chemotherapy) | - | 1 | |
| Extremely difficult | Radical prostatectomy | - | 5 | |
| Extremely difficult | Radical cystectomy* | - | 1 | |
| | | Subtotal (n) | 28 | 64 |
| | | Total Numbers (n) | n=114 | n=114 |

*(Not defined in European scoring system)

reported complication rates as low as 1.9% and 0.46%, respectively, however in these series, procedures were particularly easy descriptive interventions (22,23).

By using the ESS, it is possible to evaluate the relationship of laparoscopic surgeries with various difficulty degrees and the complications more comprehensively. For example in a study of 2407 cases with 63% easy and mild difficult cases, the total complication rate was reported as 4.4% (24). Similarly in a study of 350 cases with 67% having particularly easier operations like pelvic lymph node dissection, urinary bladder neck suspension, and varicocelectomy, the complication rate was found to be 5.4% (25). Whereas Colombo et al. reported complications rate of 12.5% in a study of 1867 cases composed of difficult, very difficult and highly difficult procedures (26). Similarly, Parson et al. found a complications rate of 13.2% in a study of 894 cases with 73% difficult and very difficult operations (18). If we had reported the complication rate in our cases without classifying according to ESS, we would face a complication rate of 13%. However, in our cases, complication rate for EO and DO was 8% (n=11/136), and 20% (n=19/92), respectively. There are various opinions and results about complication rates as the experience in laparoscopic surgery increases (18,27). Vallancien et al. suggested that at least 50 difficult cases must be operated to gain the sufficient laparoscopic proficiency, as a conclusion of a study investigating

laparoscopic urological complications in 1311 cases and reported that a complication rate of 13.3% in first 100 cases has decreased to a lower degree of 3.6% in latter cases (19). Similarly in a study of 2775 cases, it has been reported that complication cases decreased from 22.1% to 17% despite increasing difficulty (7). Whereas Colombo et al. and Parson et al. found no statistically significant, decrease in complication rates (18,26). In our study, the mean difficulty point per unit case according to the ESS was found to be 8.8 (n=771/114) in group 1, and 11.8 (n=1039/114) in group 2. This result was statistically significant (p<0.001). Despite the larger number of very difficult operations in group 2, total complication rates were similar between the groups (12.3%, 14%) (p=0.695). Although major complication rates in group 1 and group 2 for DO values decreased from 10.7% (n=3/28) to 6.3% (n=4/64), this decrease was not found to be statistically significant (p=0.431) (Table 4).

The Clavien classification system that was validated in 2004 is recently being used to describe the serious complications and to standardization of evaluation for postoperative complications (6,20,28,29). Exclusion of the intra-operative complications has been reported to be the disadvantage of this classification (30). Perpomb et al. have suggested modification of the Clavien system to include intraoperative complications (7). Teber et al. have found that the complication rate for grade 3a was higher as 1.8% (n=13/692) (20). Grade 3a and higher postoperative complications were found as 3.5% (n=8/228) in our study. The port sites, including fascia were closed surgically. Nevertheless, port hernia cases were repaired with local anaesthesia. In our study, there was no death due to surgery.

Vessel injury is reported to be the most common complication during peroperative dissection (25,31,32). Teber et al. reported vessel injury rate as 1.7% and organ injury rate as 0.25% (20). In our study, vessel injury rate was 3.5% (n=8/228), and organ injury rate was 0.87% (n=2/228). In a study performed in 2007, converting to open surgery during laparoscopic urological procedures was considered to be a major complication (20). In some studies, need for open surgery was not regarded as a complication, thus, it was not included in complication group (26,33). Also in our study, converting to open surgery was not considered a complication. Totally, 7 patients (3%; n=7/228) have undergone open surgery. Four (4) of these 7 cases were in group 1, and 3 in group 2. The reasons for open surgery were

| Table 3. Classification of major and minor complications | |
|--|--|
| Major Complications | |
| Vascular injury | |
| Adjacent organ injury | |
| Testicular ischemia | |
| Extended lymph drainage | |
| Minor Complications | |
| Ileus | |
| Neuromuscular pain | |
| Wound infection | |
| Port hernia | |
| Arrhythmia | |
| Hypercapnia | |

| Table 4. Difficulty level of operations and rates of complications according to European scoring system | | | | | | | | |
|---|-----------------------|----------------------------|----------------|----------------|----------------|----------------|----------------|-------|
| | Easy operations group | Difficult operations group | p ^a | p ^b | | | | |
| Group1 (n=86) | Group 2 (n=50) | p ^c | Group 1 (n=28) | Group 2 (n=64) | p ^d | Easy Difficult | Easy Difficult | |
| Major complication | 1 (1.2%) | 2 (4.0%) | 0.554 | 3 (10.7%) | 4 (6.3%) | 0.431 | 0.045 | 0.694 |
| Minor complication | 5 (5.8%) | 3 (6.0%) | 1.000 | 5 (17.9%) | 7 (10.9%) | 0.502 | 0.064 | 0.509 |
| Total complication | 6 (7.0%) | 5 (10.0%) | 0.532 | 8 (28.6%) | 11 (17.2%) | 0.215 | 0.006 | 0.273 |

a- Comparison of complications between easy and difficult operations for group 1
b- Comparison of complications between easy and difficult operations for group 2
c- Comparison of complications between group 1 and group 2 for easy operations group
d- Comparison of complications between group 1 and group 2 for difficult operations group

Table 5. Classification of post operative complications according to Clavien grading system

| Grade 1 | Complication number (n) |
|-------------------------|-------------------------|
| Emphysema | 3 |
| Temporary hematuria | 1 |
| Grade 1 | |
| Extended lymph drainage | 1 |
| Neuromuscular pain | 3 |
| Ileus | 6 |
| Wound infection | 1 |
| Grade 3A | |
| Colon fistula | 1 |
| Port hernia | 5 |
| Grade 3B | |
| Renal fistula | 1 |
| Testicular ischemia | 1 |
| Grade 4-5 | |
| Multi Organ Disfunction | 0 |
| Total Number (n) | 23 |

vessel injury (vena cava, renal vein) in 2 cases, colon perforation in 1 case, and prolongation of operation time due to technical and experience deficiency in 4 cases. Colon injury was repaired by perioperative open surgery. Colonic fistula in postoperative period healed spontaneously following short-term slow drainage. There are studies reporting open surgery rates of 0.09%, 1.4% and 2.7% in the literature (7,20,26). Several studies have reported that laparoscopic intervention was applied for many complications occurring during the operation (34). These results are supported by many studies with the rates of converting to open surgery decreasing from 28% to 0% values (24,34). In our cases, 8 cases had serious vessel injury and 6 of them were solved by laparoscopic restoration.

Laparoscopic surgery has been recommended for many urological procedures nowadays. Although it is less invasive, the fact that it is still a major surgery should be kept in mind. In many centers, although highly difficult cases are being operated, it was reported that the complication rates are decreasing and successful results are being obtained as the experience is increasing. We also did not detect any increase in complication rates because of the increase in our surgical experience. We suggest that the European Scoring System and Clavien classification are important for the evaluation of difficulty degrees of cases and to provide standardization for accurate analysis of postoperative complications.

Ethics Committee Approval: We dont think it necessary for Ethics Committee approval and informed consent by reason of our study is a retrospective evaluation.

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Data Collection or Processing: Murat Topcuoğlu

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References

- Schuessler WW, Vancaillie TG, Reich H, Griffith DP. Transperitoneal endosurgical lymphadenectomy in patients with localized prostate cancer. *J Urol* 1991;145:988-991.
- Guillonneau B, Abbou CC, Doublet JD, Gaston R, Janetschek G, Mandressi A, Rassweiler JJ, Vallancien G. Proposal for a 'European Scoring System for laparoscopic operations in Urology. *Eur Urol* 2001;40:2-7.
- Soulié M, Salomon L, Seguin P, Mervant C, Mouly P, Hoznek A, Antiphon P, Plante P, Abbou CC. Multi-institutional study of complications in 1085 laparoscopic urologic procedures. *Urology* 2001;58:899-903.
- Baniel J, Foster RS, Rowland RG, Bihle R, Donohue JP. Complications of primary retroperitoneal lymph node dissection. *J Urol* 1994;152:424.
- Clavien PA, Sanabria JR, Strasberg SM. Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery* 1992;111:518-526.
- Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004;240:205-213.
- Permpongkosol S, Link RE, Su LM, Romero FR, Bagga HS, Pavlovich CP, Jarrett TW, Kavoussi LR. Complications of 2775 Urological laparoscopic procedures: 1993 to 2005. *J Urol* 2007;177:580-585.
- Abbou CC, Cicco A, Gasman D, Hoznek A, Antiphon P, Chopin DK, Salomon L. Retroperitoneal laparoscopic versus open radical nephrectomy. *J Urol* 1999;161:1776-1780.
- Abbou CC, Salomon L, Hoznek A, Antiphon P, Cicco A, Saint F, Alame W, Bellot J, Chopin DK. Laparoscopic radical prostatectomy: preliminary results. *Urology* 2000;55:630-634.
- Guillonneau B, Vallancien G. Laparoscopic radical prostatectomy: The Montsouris experience. *J Urol* 2000;163:418-422.
- Rassweiler JJ, Seman O, Frede T. Retroperitoneoscopy: experience with first cases. *J Urol* 1998;160:1265-1269.
- Gill IS, Clayman RV, McDougal EM. Advances in urological laparoscopy. *J Urol* 1995;154:1275-1294.
- Gill IS, Clayman RV, Albala DM, Aso Y, Chiu AW, Das S, Donovan JF, Fuchs GJ, Gaur DD, Go H, Gomella LG, Grune MT, Harewood LM, Janetschek G, Knapp PM, McDougall EM, Nakada SY, Preminger GM, Puppo P, Rassweiler JJ, Royce PL, Thomas R, Urban DA, Winfield HN. Retroperitoneal and pelvic extraperitoneal laparoscopy: an international perspective. *Urology* 1998;52:566-571.
- Gill IS, Matin SF, Desai MM, Kaouk JH, Steinberg A, Mascha E, Thornton J, Sherief MH, Strzempkowski B, Novick AC. Comparative analysis laparoscopic versus open partial nephrectomy for renal tumors in 200 patients. *J Urol* 2003;170:64-68.
- Meraney AM, Gill IS. Financial analysis of open versus laparoscopic radical nephrectomy and nephroureterectomy. *J Urol* 2002;167:1757-1762.
- Ono Y, Kinukawa T, Hattori R, Yamada S, Nishiyama N, Mizutani K, Ohshima S. Laparoscopic radical nephrectomy for renal cell carcinoma: a five-year experience. *Urology* 1999;53:280-286.
- Gagner M, Pomp A, Heniford T, Pharand D, Lacroix A. Laparoscopic adrenalectomy : lessons learned from 100 consecutive procedures. *Ann Surg* 1997;226:238-247.
- Persons K, Varkarakis I, Rha KH, Jarrett TW, Pinto PA, Kavoussi LR. Complications of abdominal urologic laparoscopy: Longitudinal five-year analysis. *Urol* 2004;63:27-32.

19. Vallancien G, Cathelineau X, Baumert H. Complications of transperitoneal laparoscopic surgery in urology: Review of 1311 procedures at a single center. *J Urol* 2002;168:23-26.
20. D Teber, A Tefekli, S Eskicorapci, AS Gözem, Svetlana Bujosevic, Marto Sugiono, Christian Stock, Jens J. Rassweiler. Retroperitoneoscopy: A versatile Access for many urologic indications. *Eur Urol Suppl* 2006;5:975-982.
21. Rassweiler J, Fornara P, Weber M, Janetschek G, Fahlenkamp D, Henkel T, Beer M, Stackl W, Boeckmann W, Recker F, Lampel A, Fischer C, Humke U, Miller K. Laparoscopic nephrectomy: the experience of the Laparoscopy Working Group of the German Urologic Association. *J Urol* 1998;160:18-21.
22. Leng J, Lang J, Huang R. Complications in laparoscopic gynecologic surgery. *Zhonghua Fu Chan Ke Za Zhi* 2001;36:146-150.
23. Chapron C, Pierre F, Querleu D, Dubuisson JB. Complications of laparoscopy in gynecology. *Gynecol Obstet Fertil* 2001;29: 605-612.
24. Fahlenkamp D, Rassweiler J, Fornara P, Frede T, Loening SA. Complications of laparoscopic procedures in urology: Experience with 2407 procedures at 4 German centers. *J Urol* 1999;162:765-771.
25. Soulie M, Seguin P, Richeux L, Mouly P, Vazzoler N, Pontonnier F, Plante P. Urological complications of laparoscopic surgery: experience with 350 procedures at a single center. *J Urol* 2001;165:1960-1963.
26. Colombo JR, Haber GP, Jelovsek E. Complications of laparoscopic surgery for urological cancer: A single institution analysis. *J Urol* 2007;178:786-791.
27. Cadeddu JA, Wolfe JSJ, Nakada S, Chen R, Shalhav A, Bishoff JT, Hamilton B, Schulam PG, Dunn M, Hoenig D, Fabrizio M, Hedician S, Averch TD. Complications of laparoscopic procedures after concentrated training in urological laparoscopy. *J Urol* 2001;166:2109-2111.
28. Gonzalgo ML, Pavlovich CP, Trock BJ, Link RE, Sullivan W, Su LM. Classification and trends of perioperative morbidities following laparoscopic radical prostatectomy. *J Urol* 2005; 174: 135.
29. Guillonneau B, Rozet F, Cathelineau X, Lay F, Barret E, Doublet JD, Baumert H, Vallancien G. Perioperative complications of laparoscopic radical prostatectomy: The Montsouris 3-year experience. *J Urol* 2002;167:51-56.
30. Stolzenburg JU, Rabenalt R, Do M, Lee B, Truss MC, Schwaibold H, Burchardt M, Jonas U, Liatsikos EN. Categorisation of complications of endoscopic extraperitoneal and laparoscopic transperitoneal radical prostatectomy. *World J Urol* 2006;24:88-93.
31. Siqueira TM, Kuo J RL, Gardner TA, Paterson RF, Stevens LH, Lingeman JE, Koch MO, Shalhav AL. Major complications in 213 laparoscopic nephrectomy cases: The Indianapolis experience. *J Urol* 2002;168:1361-1365.
32. Gill IS, Kavoussi LR, Clayman RV, Ehrlich R, Evans R, Fuchs G, Gersham A, Hulbert JC, McDougall EM, Rosenthal T. Complications of laparoscopic nephrectomy in 185 patients: multi-institutional review. *J Urol* 1995;154:479-483.
33. Matthew D, Shuford MD, Elspeth M, LaFleur BJ, Smith JA Jr, Cookson MS. Complications of contemporary radical nephrectomy: comparison of open vs. laparoscopic approach. *Urol Oncol* 2004;22:121-126.
34. Desai M, Strzempkowski radical nephrectomy B, Matin SF. Prospective randomised comparison of transperitoneal versus retroperitoneal laparoscopic. *J urol* 2005;173:38-41.