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A nationwide survey on gynecologic endoscopic surgery in Japan, 2014–2016

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Abstract

Aim: Since 2014, Japan Society of Gynecologic and Obstetric Endoscopy and minimally invasive therapy (JSGOE) conducted a nationwide survey on gynecologic endoscopic surgery. We aimed to evaluate the current status and complications associated with endoscopic surgery by Japan gynecologic and obstetric endoscopy-database registry system (JOE-D).

Methods: Electrical medical records concerning the endoscopic surgery were generated from the daily use of reporting system. The subjects were all patients who underwent gynecologic endoscopic surgery. In addition to assessment of actual numbers, diagnosis, and operative methods, adverse events were registered.

Results: Total 203 970 patients performed laparoscopic, hysteroscopic and falloposcopic surgery for 3 years, 2014–2016. The numbers of endoscopic surgeries conducted in 2016 were increased more than 67 000, 13 000 or 450 cases, respectively. Incidence rates of complications involving these three types of surgeries in each year were approximately 3.1%. Incidences of intraoperative complications were relatively high in malignant diseases, laparoscopic-assisted vaginal hysterectomy (LAVH) and myomectomy (LAM). In total laparoscopic hysterectomy/laparoscopic hysterectomy (TLH/LH) performed from 2014 to 2016, ureteral injury as intra and postoperative complication occurred in 0.35%. In the past 3 years, the rates of vascular injury, urinary tract, and bowel injury as intraoperative complications caused by laparoscopic surgery were approximately 0.1%. In the hysteroscopic surgery, the rates of total intra- and postoperative complications were 0.78%.

Conclusion: We exhibited the current status by the nationwide survey of gynecologic endoscopic surgery all over Japan. Severe intra or postoperative complications were identified over the 3 years at a rate of 0.04%.

Key words: complication, endoscopic surgery, nationwide data entry system.

Introduction

Nowadays, the number of demanding gynecologic endoscopic surgery has been increased across the world. Gynecologic endoscopic surgery is adopted and widespread besides the traditional open access, however, it has been insufficient for the clinicians to know the present status and the accurate information. During the last decade endoscopic surgical procedures have been constantly evolving. Gynecologic

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surgeons have made many efforts to improve the skill thereby shortening the learning-curve for surgery and improve the clinical outcomes, reducing iatrogenic injuries, excessive blood loss, hospitalization days and recovery time.

This project aims to contribute to the improvement of quality in endoscopic surgery by analyzing the data concerning clinical factors, such as operative methods, adverse events and prognosis in Japan. Reduction of complications due to the endoscopic surgeries would not only improve the quality of life (QOL) for the patients but also have the influence on the public health economy. Also, a nationwide and comprehensive survey regarding the gynecologic endoscopic surgery has not been conducted yet. In 2016, approximately 3500 laparoscopic surgeries for gynecologic malignant diseases have been carried out. Adverse events associated with endoscopic procedures are generally low frequencies, however, with increasing operative complexity, it is apparent that they are experienced more often. Therefore, the large scale-registry system has been required to evaluate the current status of endoscopic treatments and the incidence of operative complications.

Japan Society of Gynecologic and Obstetric Endoscopy and minimally invasive therapy (JSGOE) has implemented Japan gynecologic and obstetric endoscopy-database (JOE-D) as an endoscopic surgery-database. This type of data-accumulation system concerning the gynecologic endoscopic surgery on a nationwide scale is the first attempt all over the world.

Methods

The institutional review board of Tottori university faculty of medicine approved this project (No. 2291, obtained on October 19, 2015). Written and informed consents were taken for all patients who underwent the surgery in Japan. Data of the endoscopic surgery, i.e. laparoscope, hysteroscope or falloposcope, for 3 years (from January 2014 to December 2016) in the facilities of all over Japan were registered annually by the JOE-D system. The information concerning the surgical complication in each case was included. This registry system is critically involved in the JSGOE-certified systems, that is, (i) the system as the approved training-facilities for gynecologic endoscopic surgery and (ii) the license system as the approved gynecologic endoscopic surgeons. This entry system was conducted by using the same application software, File Maker Pro (FileMaker Inc). Data from each institute were collected by the offline-system without using the internet. In consideration of the risk of erroneous input on this system, the specific passwords for registration were set in every years. The input items include age, identification number of patients, major surgical indications, operative method, the major intra and postoperative complications, treatments in case of complications, and postoperative outcomes. If the cases had multiple complications in an operation, the data was collected and submitted.

In terms of laparoscopic surgery, as the intraoperative complications, massive bleeding was defined as more than 500 mL, and bladder, ureter, bowel injuries, vascular injuries (major vessels or abdominal wall vessels) and other complications resulting in additive procedures or treatment during surgery were classified. In addition, the postoperative complications such as peritonitis, wound infection, bleeding or hematoma, vagina stump-dehiscence, intestinal complication (ileus and hernia), ureteral injury and bladder injury were categorized. Peritonitis or wound infection was defined as those requiring antibiotics treatment or drainage for abscess formation. In the complications of hysteroscopic surgery, uterine perforation, water intoxication, massive bleeding (more than 500 mL), infection and adhesion in uterine cavity were classified.

Results

The number of facilities (346, 402 and 440 per year) and cases (56 233, 67 059 and 80 678 per year) performed the gynecologic endoscopic surgeries in Japan were gradually increased in the past 3 years. Among total 203 970 cases registered from 2014 to 2016, a total of 6399 complications occurred in intra and/or postoperatively. As shown in Table 1, the rates of complications in each year were similar, approximately 3.1%.

In Table 2a,b, the lists of laparoscopic surgery performed from 2014 to 2016 with 17 indications for surgery and 23 operative methods, were arranged in descending order. The frequent indications for laparoscopic surgery were uterine fibroid (58 328 cases, 33.7% in total 172 986 cases), benign ovarian tumor (48 550 cases, 28.1%) or endometriosis and ovarian endometrioma (27 125 cases, 15.6%) as presented in Table 2aa and Figure 1a. In Table 2b, total laparoscopic hysterectomy/

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Table 1 Annual numbers of gynecologic endoscopic surgery and incidence of complications in Japan

Year	Number of facilities	Number of surgery	Case of complications	Rate of complications (%)
2014	346	56 233	1751	3.11
2015	402	67 059	2110	3.15
2016	440	80 678	2538	3.15

laparoscopic hysterectomy (TLH/LH) (16 940 cases, 25.0%), and cystectomy for ovarian tumor (excluding chocolate cyst) (10 786 cases, 15.9%) were mainly performed more than 10 000 cases in 2016, and the cases conducted these operations increased gradually every year. In Figure 2a,b, the

Table 2 Classification of gynecologic endoscopic surgery performed in Japan – Laparoscopic surgery

(a) Classification by indication for surgery

Diagnosis	2014	2015	2016
Uterine fibroid	16 319	19 381	22 628
Benign ovarian tumor (except for ovarian endometrioma)	13 675	16 355	18 540
Endometriosis and/or ovarian endometrioma	8016	8973	10 136
Ectopic pregnancy	2645	2938	3096
Adenomyosis	1637	1940	2564
Uterine endometrial cancer	1134	1773	2290
Tubal obstruction or hydrosalpinx	787	825	999
Pelvic organs prolapse	590	804	1184
Ovarian cancer	413	517	708
Uterine cervical cancer	351	499	492
Adhesive adnexa	277	319	409
Polycystic ovary	282	265	284
Inspection of pelvic cavity	149	218	255
Ovarian bleeding	150	194	192
Congenital malformation in reproductive organs	38	49	66
Others	1461	2254	3915
Total	47 924	57 304	67 758

(b) Classification by operative method

Operation	2014	2015	2016
Total laparoscopic hysterectomy or laparoscopic hysterectomy(TLH or LH)	9783	12 823	16 940
Cystectomy for ovarian neoplasm (excluding chocolate cyst)	8129	9631	10 786
Laparoscopic myomectomy (LM)	6864	7896	8776
Adnexectomy (excluding ovarian endometrioma)	6192	7520	9365
Cystectomy for ovarian endometrioma	5315	5774	5922
Surgery for ectopic pregnancy	2591	2848	3023
Adnexectomy (ovarian endometrioma)	1642	2085	2342
Laparoscopically assisted myomectomy (LAM)	1521	1576	1434
Surgery for malignant tumor (containing lymph-adenectomy)	952	1454	2037
Laparoscopically assisted vaginal hysterectomy (LAVH)	1219	1239	1491
Removal of endometriosis lesions	724	768	906
Laparoscopic sacrocolpopexy (LSC)	364	555	342
Inspection of pelvic cavity	390	474	559
Intrapelvic adhesiolysis	413	461	594
Ovarian drilling for PCOS	268	248	261
Laparoscopic supra vaginal hysterectomy	179	205	224
Tuboplasty	190	149	240
Removal of adenomyosis lesion	85	112	92
Tubal ligation	34	50	14
Colpoplasty	10	18	29
Others	1060	1350	2382
Total	47 925	57 236	67 758

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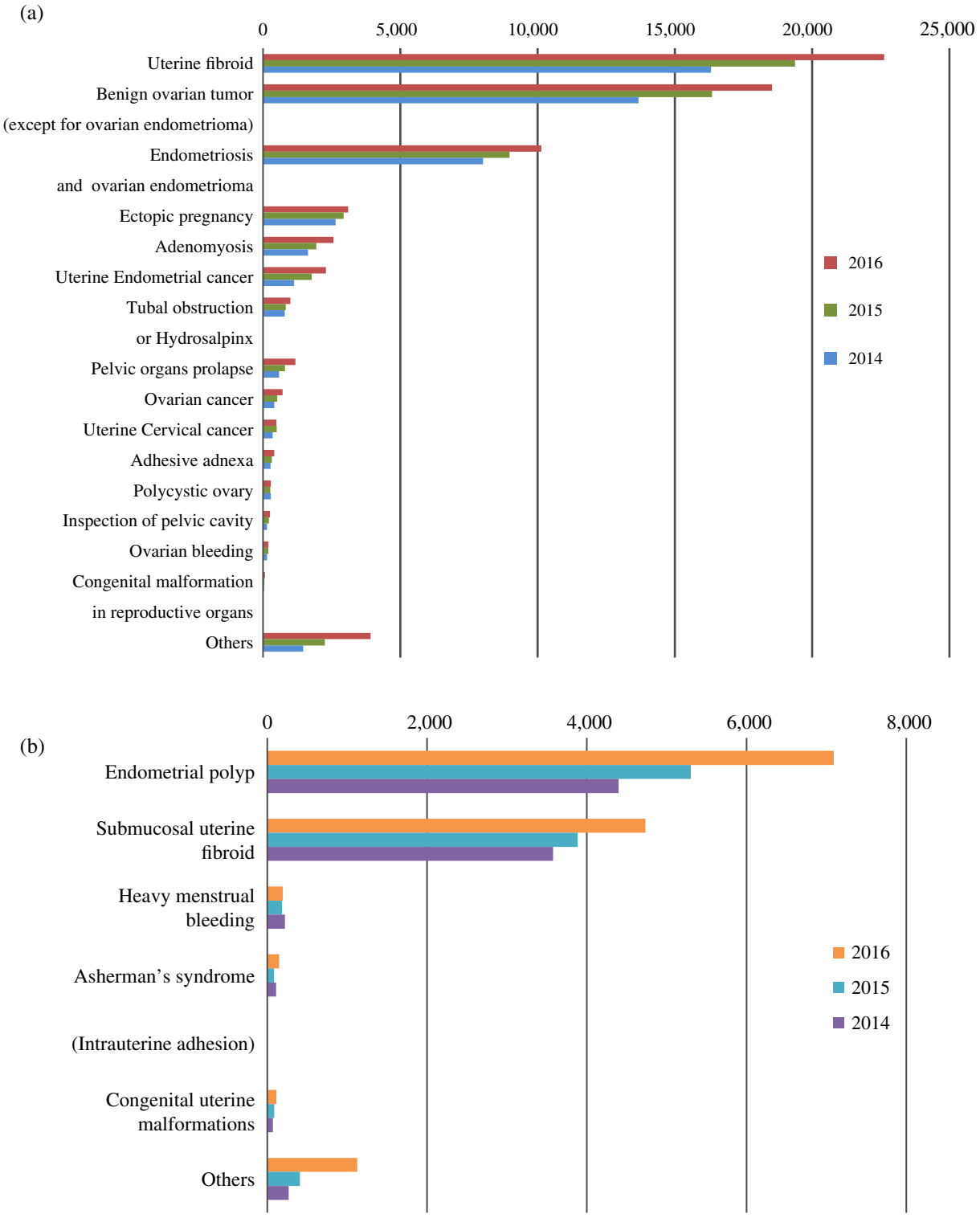

Figure 1 Annual numbers classified by indications for (a) laparoscopic surgery, and (b) hysteroscopic surgery performed in Japan from 2014 to 2016.

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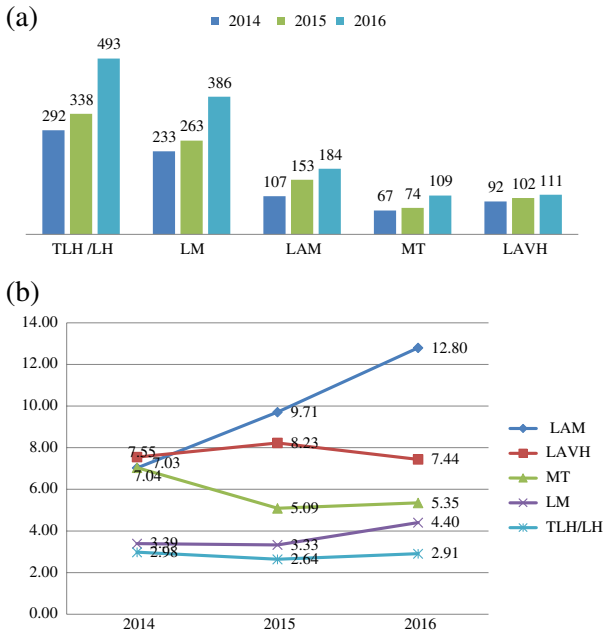

Figure 2 Annual (a) numbers and (b) incidence rates of major intraoperative complications occurred in laparoscopic surgery from 2014 to 2016.MT: Surgery for malignant tumor (containing lymph-adenectomy), TLH/LH: Total laparoscopic hysterectomy or laparoscopic hysterectomy, LAVH: Laparoscopic-assisted vaginal hysterectomy (LAVH), LAM: Laparoscopic-assisted myomectomy, LM: Laparoscopic myomectomy.

annual numbers and the incidence rates of major intraoperative complications in laparoscopic surgery from 2014 to 2016 were exhibited.

As the combination of indication for surgery and operative methods, the major frequent laparoscopic surgeries performed in 2016 were noted in the following order: (i) TLH/LH for uterine fibroid (11 289 cases), (ii) Cystectomy for ovarian tumor excluding chocolate cyst (9950 cases), (iii) Laparoscopic myomectomy (LM) for uterine fibroid (8701 cases) (data not shown). The number of cases with malignant diseases, that is, uterine endometrial or cervical cancer, and ovarian cancer, exhibited approximately 1.8-fold-increase (from 1898 to 3490 cases) within the past 3 years, although the rates of surgery performed for malignant diseases in 2016 was merely 5.2% in total 67 758 cases of laparoscopic surgery (Table 2a,b).

In terms of hysteroscopic surgery in Table 3 and Figure 1b, the majority of surgeries performed for 3 years were the resection of endometrial polyps (16 869 cases, 52.6% in total 32 052 cases) and submucosal uterine fibroids (12 182 cases, 38.0%). As the falloposcopic surgery in Table 4, the tuboplasty for tubal

Table 3 Classification of gynecologic endoscopic surgery performed in Japan – Hysteroscopic surgery

(a) Classification by indication for surgery			
Diagnosis	2014	2015	2016
Endometrial polyp	4397	5302	7091
Submucosal uterine fibroid	3576	3887	4733
Heavy menstrual bleeding	222	184	194
Asherman's syndrome (intrauterine adhesion)	111	83	147
Congenital uterine malformations	69	89	115
Others	267	409	1127
Total	8642	9954	13 407
(b) Classification by operative method			
Operation	2014	2015	2016
Resection of endometrial polyp	4375	5284	7210
Resection of uterine fibroid	3550	3885	4747
Microwave endometrial ablation (MEA)	286	242	224
Adhesiolysis in uterine cavity	111	91	142
Hysteroplasty	58	79	29
Others	259	425	1055
Total	8639	10 006	13 407

Table 4 Classification of gynecologic endoscopic surgery performed in Japan – Falloposcopic surgery

(a) Classification by indication for surgery			
Diagnosis	2014	2015	2016
Tubal obstruction	300	339	385
Functional infertility	207	4	2
Tubal stenosis	74	64	68
Hydrosalpinx or hemosalpinx	23	15	5
Others	2	0	6
Total	606	422	466
(b) Classification by operative method			
Operation	2014	2015	2016
Falloposcopic tuboplasty	242	298	330
Falloposcopic tuboplasty with laparoscopy	154	112	135
Others	211	1	1
Total	607	411	466

obstruction or stenosis was mainly performed (85.6% in total 1484 cases).

In Table 5, the intraoperative accidental occurrences in laparoscopic surgery were presented. In these types, the most frequent occurrence was technical problems with the apparatus. Almost all cases of CO_2-gas erroneous insufflation were resulted in subcutaneous emphysema. The majority of failure or

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Table 5 Accidental occurrences in laparoscopic surgery

Occurrences	2014	2015	2016
Technical problems with apparatus	47 (39.5%)	61 (42.1%)	68 (44.7%)
CO2-gas erroneous insufflation	39 (32.8%)	48 (33.1%)	38 (25.0%)
Failure or corruption of apparatus	23 (19.3%)	29 (20.0%)	22 (14.5%)
Remnant of apparatus or specimen	10 (8.4%)	6 (4.1%)	21 (13.8%)
Drug-induced accident	0	1 (0.7%)	3 (2.0%)
Total	119 (100%)	145 (100%)	152 (100%)

corruption of apparatus was the accidents involving in uterine manipulators and forceps. Four cases of the drug-induced accidents encountered in these 3 years were caused by the injection of vasopressin or epinephrine to uterus. All these occurrences were not severe, and could recover during the operations.

We summarized the number of cases, and major intra or postoperative complications caused by laparoscopic or hysteroscopic surgery (the top five frequent operative methods in this study), and minor operative methods were excluded in Tables 6–7 and 8. In Tables 6 and 7, the rates of total intra or postoperative complications caused by laparoscopic surgery in these 3 years were 2.35% or 1.22%. As we predicted, the rates of complications were higher in the surgery for malignant tumor (intra and postoperative: 5.76% and 3.92%) compared with other operation methods. With regard to intraoperative complications, high rates of complications were noticed in the surgery for malignant diseases, laparoscopic-assisted vaginal hysterectomy (LAVH) and laparoscopic-assisted myomectomy (LAM) (Table 6, Fig. 2a,b). In these three operations, the rates of incidences involving vascular injury (large-, abdominal wall- or other- blood vessels), urinary tract (ureter and bladder) and bowel injury were relatively high. Especially, in every year, the high incidence rates of massive bleeding in LAVH (6.36%) or LAM (9.43%) were found.

The total rates of intraoperative vascular, ureteral, bladder or bowel injury occurred in 3 years were 0.07%, 0.07%, 0.13% or 0.15% respectively (Table 6). The annual incidence rates of them were almost similar. In contrast, the rates of postoperative complications including ureter, bladder injury, intestinal complications such as ileus, perforation or herniation were 0.05%, 0.03% and 0.12%, respectively (Table 7). The incidence rates of intra or postoperative ureteral and bladder injury caused by TLH/LH, the most frequent operative method, in 3 years were similar, approximately 0.35%.

In Table 8 concerning the hysteroscopic surgery, the rates of total intra and postoperative complications were 0.78% (250 in 32 052 cases) for 3 years. In terms of uterine perforation, the incidence rate was 0.41%. Most frequent cause of uterine perforation (3.78%) was the surgery of adhesiolysis in uterine cavity for the treatment of Asherman's syndrome or uterine septum.

Clinical outcomes of cases which had operative complications were shown in Table 9 (laparoscopy: intraoperative), Table 10 (laparoscopy: postoperative) and Table 11 (hysteroscopy). In Table 9, the cases needed the blood transfusion, including the autologous blood transfusion which had preserved prior to the surgery, were increased in 2016. In Tables 10 and 11, the different proportion of the outcome-classification was not apparent. The severe cases needed the treatment in ICU (intensive care unit), or led to the death due to the complications were totally 83 for 3 years (Tables 9–10 and 11).

Discussion

The nationwide survey of the gynecologic endoscopic surgeries in Japan (JOE-D) has been conducted to assess and share the current status and information for the clinicians and patients. The number of endoscopic surgeries has continued to grow, while that of abdominal procedure was decreased. These data represent the real status of the complications of gynecologic endoscopic surgery, in the situation where also these surgeries are widely implemented throughout the whole nation. From the registration in 2018, the detailed items (i.e. disease name and operative method) regarding the robot-assisted surgery and the gynecologic malignant tumors will be added. From 2019, we will present the data for the gynecologic malignancies. The annual rates of complications by laparoscopic, hysteroscopic and falloposcopic surgeries were 3.1% (Table 1).

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Table 6 Classification of intraoperative complications in laparoscopic surgery. Major intraoperative complications in 3 years

Operation	Cases	Number of Complication	Massive bleeding	Vascular injury	Ureter injury	Bladder injury	Bowel injury	Others
Laparoscopic-assisted myomectomy (LAM)	4528	414 (9.14%)	427 (9.43%)	1 (0.02%)	0	4 (0.09%)	3 (0.07%)	8 (0.18%)
Laparoscopic-assisted vaginal hysterectomy (LAVH)	3.949	305 (7.72%)	251 (6.36%)	7 (0.18%)	7 (0.18%)	20 (0.51%)	5 (0.13%)	12 (0.41%)
Surgery for malignant tumor (containing lymph-adenectomy)	4443	256 (5.76%)	149 (3.35%)	41 (0.92%)	6 (0.14%)	11 (0.51%)	15 (0.13%)	30 (0.41%)
Laparoscopic myomectomy (LM)	23 516	882 (3.75%)	781 (3.32%)	6 (0.03%)	3 (0.01%)	8 (0.03%)	23 (0.10%)	57 (0.24%)
Total laparoscopic hysterectomy or laparoscopic hysterectomy (TLH or LH)	39 546	1123 (2.84%)	731 (1.85%)	32 (0.08%)	84 (0.21%)	113 (0.29%)	75 (0.19%)	91 (0.23%)
Total	172 919	4064 (2.35%)	2955 (1.71%)	119 (0.07%)	115 (0.07%)	219 (0.13%)	260 (0.15%)	398 (0.23%)

Table 7 Classification of postoperative complications in laparoscopic surgery. Major postoperative complications in 3 years

Operation	Cases	Number of Complication	Peritonitis	Wound Infection	Bleeding or hematoma	Vaginal cuff dehiscence	Intestinal complication	Ureter injury	Bladder injury	Others
Surgery for malignant tumor (containing lymph-adenectomy)	4443	174 (3.92%)	30 (0.68%)	20 (0.45%)	9 (0.20%)	16 (0.36%)	25 (0.56%)	8 (0.18%)	7 (0.16%)	37 (0.83%)
Total laparoscopic hysterectomy or laparoscopic hysterectomy (TLH or LH)	39 546	945 (2.39%)	214 (0.54%)	187 (0.47%)	91 (0.23%)	161 (0.41%)	48 (0.12%)	53 (0.13%)	29 (0.07%)	67 (0.17%)
Laparoscopic-assisted vaginal hysterectomy (LAVH)	3949	79 (2.0%)	17 (0.43%)	14 (0.35%)	13 (0.33%)	5 (0.13)	8 (0.2%)	5 (0.13%)	0	11 (0.28%)
Laparoscopic-assisted myomectomy (LAM)	4531	70 (1.54%)	12 (0.26%)	11 (0.24%)	22 (0.49%)	n.a.	9 (0.20%)	1 (0.02%)	0	4 (0.09%)
Laparoscopic myomectomy (LM)	23 536	182 (0.77%)	36 (0.15%)	43 (0.18%)	48 (0.2%)	n.a.	15 (0.06%)	2 (0.01%)	3 (0.01%)	19 (0.08%)
Total	172 919	2104 (1.22%)	415 (0.24%)	413 (0.24%)	304 (0.18%)	191 (0.10%)	203 (0.12%)	84 (0.05%)	45 (0.03%)	245 (0.14%)

n.a.: not applicable.

Table 8 Classification of complications in hysteroscopic surgery. Major intra and postoperative complications in 3 years

Operation	Cases	Number of complication	Intraoperative complication				Postoperative complication			
			Perforation	Water intoxication	Massive bleeding	Others	Bleeding	Infection	Adhesion	Others
Adhesion lysis in uterine cavity	344	15 (4.36%)	13 (3.78%)	0	0	0	0	0	1 (0.29%)	0
Uteroplasty	166	6 (3.6%)	5 (3.0%)	0	1 (0.6%)	0	1 (0.6%)	0	0	0
Microwave endometrial ablation (MEA)	752	12 (1.6%)	4 (0.53%)	0	0	0	0	6 (0.8%)	0	2 (0.27%)
Resection of uterine fibroid	12 182	121 (0.99%)	58 (0.48%)	22 (0.18%)	7 (0.06%)	8 (0.07%)	6 (0.05%)	2 (0.02%)	2 (0.02%)	13 (0.11%)
Resection of endometrial polyp	16 869	57 (0.34%)	34 (0.2%)	1 (0.01%)	2 (0.01%)	3 (0.02%)	0	1 (0.01%)	0	7 (0.04%)
Total	32 052	250 (0.78%)	132 (0.41%)	24 (0.07%)	19 (0.06%)	12 (0.04%)	9 (0.03%)	11 (0.03%)	3 (0.01%)	22 (0.07%)

Laparoscopy is now widely recognized as an indispensable tool in gynecologic surgery. Out of 172 919 laparoscopic surgeries performed from 2014 to 2016, the number of cases which had intra or postoperative complications was 6168 cases (3.57%), although the definition of massive bleeding as more than 500 mL would be strict. Among the gynecologic surgeries for pelvic organs, especially in TLH/LH, the urinary tract damage remains the major concern related to the laparoscopic surgery. An earlier national prospective survey in Finland was conducted in 1996, with a higher (1.1%) incidence of ureteral injury in LH.[1] Retrospective analyses have showed a decrease since then, reaching 0.3%.[2,3] In FINHYST study in Finland, the rates of ureteral or bladder injury in TLH/LH performed in 2006 was indicated as 0.3% or 1.0%.[4] An institute of Korea reported that the rates of ureteral or bladder injury as the postoperative complications in TLH from 2005 to 2014 were totally 0.4% or 0.8%, however, after 2010, no complication occurred by the improvement of surgical technique.[5] A single institute in Japan reported that the rates of ureteral and bladder injury was 0.32%, and 0.48%, respectively, in total 1253 TLH by using early ureteral identification technique.[6] Similar incidences (0.3–0.4%) occurred in large single-institute reports.[7,8] In the present data, the incidence rate of urinary tract injury in TLH/LH (ureteral: 0.25%, bladder: 0.36%) was almost similar to these previous studies. The JSGOE-license system requiring the approval of the training-facilities and the endoscopic surgeons may lead to this low incidence rate. This license system with proper training and education would contribute the surgeons to acquire the proficient surgical skill and allow for the safe procedures and the minimization of complications.

In Table 9 concerning the clinical outcomes of patients who had laparoscopic intraoperative complications, the proportion required the repair of laparoscopic or laparotomic surgery was gradually declined. The high rate (27.7%) of blood transfusion in 2016 was caused by the increase of cases that were needed for the autologous blood transfusion in LM or LAM (Table 6 and Fig. 2). It is beneficial for the patients to have damage repaired instantly without excessive re-operations. Nevertheless, it should be noted that all severe and harmful complication induced mortality, such as a major vascular injury (119 cases: 0.07% in Table 6) and bowel injury (260 cases: 0.15% in Table 6), occurred with laparoscopic surgery.

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Table 9 Clinical outcomes of patients who have had intraoperative complications in laparoscopic surgery

Outcome	2014	2015	2016
Follow-up at outpatients	445 (34.2%)	567 (36.0%)	567 (28.5%)
Blood transfusion	124 (9.5%)	148 (9.4%)	553 (27.7%)
Repair by intraopearative laparoscopic surgery	251 (19.3%)	274 (17.4%)	334 (16.8%)
Extended hospital stay	115 (8.8%)	144 (9.1%)	183 (9.2%)
Repair by intraoperative laparotomic surgery	154 (11.8%)	152 (9.7%)	153 (7.7%)
Prolonged treatment with antibiotics	36 (2.8%)	48 (3.0%)	35 (1.8%)
Re-operation	26 (2.0%)	41 (2.6%)	33 (1.7%)
Treatment In ICU	11 (0.8%)	13 (0.8%)	25 (1.3%)
Re-admission	2 (0.2%)	6 (0.4%)	9 (0.5%)
Death	1 (0.1%)	1 (0.1%)	3 (0.2%)
Others	136 (10.5%)	180 (11.5%)	96 (4.8%)
Total	1301	1574	1991

Table 10 Clinical outcomes of patients had postoperative complications in laparoscopic surgery

Outcome	2014	2015	2016
Follow-up at outpatients	235 (24.4%)	243 (25.1%)	241 (21.3%)
Prolonged treatment with antibiotics	196 (20.3%)	172 (17.8%)	239 (21.2%)
Extended hospital stay	183 (19.0%)	190 (19.7%)	205 (18.1%)
Re-operation	122 (12.6%)	134 (13.9%)	161 (14.2%)
Re-hospitalization	109 (11.3%)	115 (11.9%)	163 (14.4%)
Blood transfusion	28 (2.9%)	27 (2.8%)	52 (4.6%)
Treatment In ICU	6 (0.6%)	5 (0.5%)	13 (1.2%)
Death	0	0	0
Others	86 (8.9%)	80 (8.3%)	55 (4.9%)
Total	965	966	1130

Table 11 Clinical outcome of patients had complications in hysteroscopic surgery

Outcome	2014	2015	2016
Repair by intraoperative laparoscopic surgery	21 (28.1%)	30 (28.3%)	241 (20.5%)
Extension of hospital stay	15 (20.0%)	19 (17.9%)	24 (20.5%)
Follow-up at outpatients	9 (12.0%)	18 (17.0%)	19 (16.2%)
Prolonged treatment with antibiotics	7 (9.3%)	9 (8.5%)	10 (8.5%)
Repair by intraoperative laparotomic surgery	10 (13.3%)	5 (4.7%)	10 (8.5%)
Re-operation	5 (6.7%)	2 (1.9%)	6 (5.1%)
Blood transfusion	1 (1.3%)	5 (4.7%)	6 (5.1%)
Re-admission	1 (1.3%)	5 (4.7%)	6 (5.1%)
Repair by intraoperative hysteroscopic surgery	0	4 (3.8%)	2 (1.7%)
Treatment In ICU	1 (1.3%)	2 (1.9%)	2 (1.7%)
Death	0	0	0
Others	5 (6.7%)	7 (6.6%)	8 (6.8%)
Total	75	106	117

With the extended indications for gynecologic endoscopic surgeries, the surgical procedures have been constantly developed. The complications in endoscopic operations can be minimized with advanced training, experience and surgical technique. In addition, the improved surgical technique and the new endoscopic apparatus, such as the tissue-sealing device and the ultrasonic scalpel in laparoscopic

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operation might decrease the incidence rates of complication.

On the other hand, in hysteroscopic surgeries, there are the complications that relate to intraluminal endoscopic surgery that largely comprise perforation and injuries to surrounding structures and blood vessels, although hysteroscopic surgery is regarded as a safe and well-tolerated procedure with low complication rate. Uterine perforation is one of the most common complications of hysteroscopic surgery, with an incidence of 0.12–3.0%,[9,10] in this study, the rate of uterine perforation was 0.41% (Table 8). Importantly, uterine perforation is a potential cause of uterine rupture in pregnancy. There is also an increasing awareness of uncommon but problematic sequelae related to the use of uterine resectoscopes. Damage by electrosurgical electrodes may also lead to more serious bowel injuries. Better understanding of the mechanisms involved in these adverse events has provided the opportunity to perform hysteroscopic surgery in a manner that minimizes risk to the patient.

In conclusion, the gynecologic endoscopic surgeries have multiple advantages and appropriate technique. Prevention of the complications is feasible with precautionary measures and awareness of risk factors. A reduction of complications and need for re-operations would not only improve the prognosis for the patients, however, also have a great influence on the national public health economy. We hope these data will contribute to improve the daily clinical decision-making process and benefit the patients undergoing these procedures.

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Disclosure

None declared.

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