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"Freshman effect" in gynecologic surgery at a teaching hospital

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Abstract

Purpose The purpose of this study was to determine the existence of the freshman effect in patients who underwent gynecologic surgery at a teaching hospital by comparing surgical outcomes and morbidity rates between the first academic quarter and other quarters.

Methods All data were collected prospectively. Between January 2015 and March 2018, patients who underwent gynecologic surgeries during the first academic quarter (March, April, and May in Korea) were retrospectively compared with patients who underwent gynecologic surgeries during other academic quarters (June through February). The primary outcome measure was the incidence of operative complication. Secondary outcomes were the operative time, operative blood loss, and length of hospital stay.

Results Among 1241 patients who underwent gynecologic surgery during the study period of 39 months, 1136 patients were analyzed for this study and divided into groups according to the first academic quarter ($n=335$) and other academic quarters ($n=801$). The baseline characteristics were not different between the groups. No significant difference in operative complications was found between the first and other academic quarters (1.5% versus 3.0%; $P=0.143$). Moreover, there was no significant difference in operative time, operative blood loss, and length of hospital stay between the groups.

Conclusions This study did not demonstrate the existence of a "freshman effect", i.e., an increase in morbidity, at a Korean teaching hospital providing gynecologic surgical care. Patients undergoing gynecologic surgery can be reassured of their safety during the first academic quarter.

Keywords Freshman effect · July effect · Morbidity · Mortality · Gynecologic surgery

Introduction

The "freshman effect" or "July phenomenon" in the United States is a perceived increase in the risk of medical errors and surgical complications that occurs in association with the time of academic year at which medical school graduates begin residencies. A similar period in the United Kingdom is known as the killing season. Patients at teaching hospitals often worry about the involvement of inexperienced interns or residents in their care. Actually, many studies investigating the freshman effect have demonstrated an increase in medical errors and adverse outcomes at the beginning of the academic year, suggesting an association between this transition period and poorer patient care [1, 2]. However, a few studies in surgical patients did not find clear evidence for this effect [3, 4]. Furthermore, no study to date has evaluated the freshman effect for gynecologic surgery in Korea or other Asian countries.

Therefore, the purpose of this study was to determine the existence of a freshman effect in gynecologic surgery at a teaching hospital in Korea by comparing surgical outcomes and morbidity rates between the first academic quarter and other quarters.

Materials and methods

Patients

All data were collected prospectively (ClinicalTrials.gov Identifier: NCT02405936) and the study was approved by

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the Institutional Review Board of Kangbuk Samsung Hospital, Seoul, Republic of Korea. Between January 2015 and March 2018, patients who underwent gynecologic surgeries during the first academic quarter (March, April, and May in Korea) were retrospectively compared with patients who underwent gynecologic surgeries during the other academic quarters (June through February in Korea). Inclusion criteria were patients aged 18–80 years who underwent gynecologic surgery. All surgical procedures were performed by one surgeon (T. Song), who had performed more than 2000 gynecologic surgical procedures, to control the variability of surgical skills. Exclusion criteria were as follows: obstetrical surgeries such as cesarean section or cervical cerclage; non-gynecologic surgeries such as chemo-port insertion or ileostomy takedown; outpatient surgeries under local anesthesia; or cosmetic surgeries of the vulva or vagina. The study was conducted in compliance with Korean Good Clinical Practice and the Declaration of Helsinki.

Outcome measures

The primary outcome measure was the incidence of operative complications. An intraoperative complication was defined as a major vessel injury, bowel injury, urinary tract injury, or any other severe unplanned adverse events. A postoperative complication was defined as a grade III or higher complication occurring within three postoperative months according to the Clavien–Dindo classification [5]. A grade III complication was defined as any complication requiring surgical, endoscopic, or radiological intervention [5].

Secondary outcomes were operative time, operative blood loss, and length of hospital stay. The operative time was electronically recorded and was defined as the time from skin incision to skin closure. The detailed operative times required to perform each phase of an operation, including the skin incision time, the main procedure time, and the skin closure time, were separately measured only in patients who underwent laparoscopy. However, we did not measure detailed operative times in cases of open surgery. Operative blood loss was calculated by the anesthesiology unit as the difference between the total amount of suction and irrigation plus the difference between the total gauze weight before and after the surgery. Length of hospital stay was defined as the number of days from the operation to the date of discharge.

Statistical analysis

SPSS software 20.0 (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis. For continuous variables, data are presented as mean ± standard deviation (SD) or median [interquartile range (IQR)] after verifying the normal distribution of the data. For categorical variables, data are presented as frequency (percent). The baseline characteristics and study outcomes were compared between the groups with Student's t test or the Mann–Whitney U test for continuous variables, and the χ^2 test or Fisher's exact test for categorical variables, as appropriate. A P value < 0.05 was considered statistically significant.

Results

During the study period of 39 months, of 1241 patients who met the inclusion criteria, 105 were excluded from this study: 5 declined to participate, 29 were aged less than 18 or more than 80 years, and 71 underwent obstetric surgeries, non-gynecologic surgeries, outpatient surgeries under local anesthesia, or cosmetic surgeries of the vulva or vagina. Therefore, 1136 patients were analyzed for this study and divided into two groups according to the date of operation (Fig. 1): the first academic quarter ($n = 335$) and the other academic quarters ($n = 801$).

Table 1 shows the baseline characteristics of the two groups. The mean age and body mass index of the study patients were 42.7 ± 12.3 years and 23.6 ± 4.0 kg/m^2, respectively, with no significant differences between the groups. The other baseline characteristics were also similar: parity, comorbidity, history of abdominal surgery, preoperative hemoglobin, surgical approach, tumor pathology, and surgical procedure.

Surgical outcomes are summarized in Table 2. In a total of 1136 patients, there were no significant differences in the operative time between the groups. However, when each phase of operative time in 737 cases of laparoscopy was separately analyzed, the skin closure time in the first academic quarter was 13.4% longer than in the other academic quarters, and the difference was significant (13.5 ± 9.9 min versus 11.9 ± 7.0 min; $P = 0.009$). No significant differences were found in operative blood loss, change in hemoglobin (defined as the difference between preoperative and postoperative day 1 hemoglobin levels), transfusion, postoperative pain intensity (measured using a visual analog scale at 24 and 48 h after surgery), failure of intended laparoscopy (defined as use of additional ports or conversion to laparotomy), and length of hospital stay.

Operative complications, the primary outcome measure, are shown in Table 3. No significant difference in operative complications was found between the first and other academic quarters (1.5% versus 3.0%; $P = 0.143$). The first academic quarter experienced one intraoperative complication (bladder laceration that was managed by primary repair in laparoscopic staging surgery for endometrial cancer) and four postoperative complications (one case of umbilical wound problem; one case of distal ureteral injury; one case of vault dehiscence; and one case of readmission due to unexplained abdominal pain that

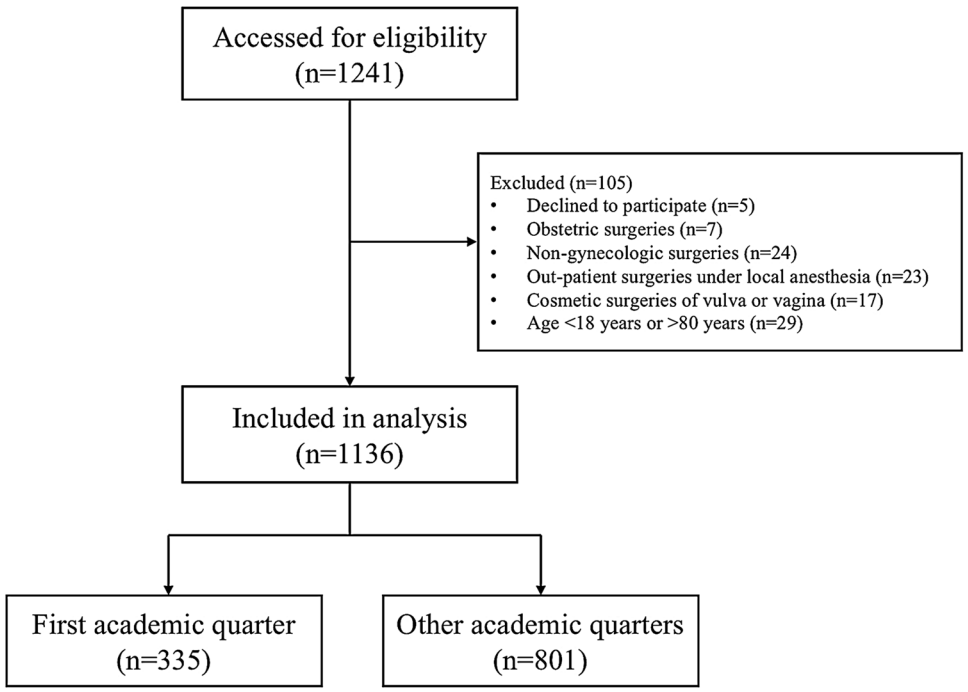

Fig. 1 Consort diagram for case selection

Table 1 Baseline characteristics ($n = 1136$)

	First academic quarter ($n = 335$)	Other academic quarters ($n = 801$)	*P*
Age (years)	43.4 ± 12.9	42.4 ± 12.0	0.155
Body mass index (kg/m^2)	23.6 ± 4.2	23.6 ± 4.0	0.763
Parity			0.776
Nulliparous	132 (39.4%)	308 (38.5%)	
Parous	203 (60.6%)	492 (61.5%)	
Comorbidity	61 (18.2%)	131 (16.4%)	0.447
History of abdominal surgery	100 (29.9%)	303 (38.0%)	0.010
Preoperative hemoglobin (mg/dL)	21.4 ± 1.7	12.5 ± 1.6	0.937
Surgical approach			0.829
Single-port laparoscopy	179 (53.4%)	438 (54.7%)	
Multi-port laparoscopy	35 (10.4%)	85 (10.6%)	
Open surgery	32 (9.6%)	63 (7.9%)	
Others[a]	89 (26.6%)	215 (26.8%)	
Tumor pathology			0.062
Benign disease	305 (91.0%)	698 (87.1%)	
Malignant disease	30 (9.0%)	103 (12.9%)	
Surgical procedure			0.695
Adnexal surgery	121 (36.1%)	292 (36.5%)	
Myomectomy	51 (15.2%)	105 (13.1%)	
Hysterectomy	74 (22.1%)	187 (23.3%)	
Conization	44 (13.1%)	92 (11.5%)	
Hysteroscopy or D&C	45 (13.4%)	125 (15.6%)	

Data are expressed as frequencies (percentages) or mean ± standard deviation, medians (interquartile range), as appropriate

[a]Others included conization, hysteroscopy, and dilatation and curettage (D&C)

Table 2 Surgical outcomes

	First academic quarter ($n=335$)	Other academic quarters ($n=801$)	*P*
Operative time for all surgeries ($n=1136$)	72.2 ± 71.5	71.5 ± 74.4	0.463
Operation time for laparoscopy ($n=737$)[a]	75.9 ± 38.0	73.2 ± 40.3	0.244
Skin incision time	4.3 ± 5.1	3.7 ± 3.5	0.321
Main procedure time	58.1 ± 33.5	57.6 ± 37.8	0.583
Skin closure time	13.5 ± 9.9	11.9 ± 7.0	0.009
Operative blood loss (mL) ($n=832$)[b]	46 (25, 113)	50 (24, 114)	0.616
Change in hemoglobin (g/dL)	1.6 ± 1.3	1.6 ± 1.3	0.439
Transfusion	19 (5.7%)	55 (6.9%)	0.457
Postoperative pain intensity			
At 24 h	3.6 ± 1.8	3.6 ± 1.9	0.795
At 48 h	2.9 ± 1.7	2.9 ± 1.7	0.959
Failure of intended laparoscopy (n = 737)[a]	8 (3.3%)	17 (2.9%)	0.784
Insertion to additional port	7	12	
Conversion to laparotomy	1	5	
Length of hospital stay (days)	2 (0, 2)	2 (1, 2)	0.241

[a]This analysis was performed only in patients who underwent laparoscopy

[b]This analysis was performed only in patients who underwent laparoscopy or open surgery

Table 3 Primary outcome measures

	First academic quarter ($n=335$)	Other academic quarters ($n=801$)	*P*
Operative complication	5 (1.5%)	24 (3.0%)	0.143
Intraoperative	1 (0.3%)	5 (0.6%)	0.677
Bladder injury	1	1	
Ureter injury	0	2	
Uterine perforation	0	2	
Postoperative[a]	4 (1.2%)	19 (2.4%)	0.252
Wound problem	1	8	
Reoperation due to bleeding	0	4	
Urinary tract injury	1	1	
Bowel perforation	0	2	
Vault dehiscence	1	2	
Others (readmission)	1	2	

[a]Postoperative complications were defined as grade III or higher occurring within three postoperative months according to the Clavien–Dindo classification

developed 20 days after the surgery). The other academic quarters experienced five intraoperative complications (two cases of ureteral injury; one case of bladder injury; and two cases of uterine perforation) and 19 postoperative complications (eight cases of wound problem; four cases of reoperation due to bleeding; one case of vesicouterine fistula; two cases of bowel perforation; two cases of vault dehiscence; and two cases of readmission due to fever or ileus).

Discussion

We performed this study to investigate the freshman effect in gynecologic surgery at a teaching hospital. We found no significant differences in operative complications between the first and other academic quarters. We also found that operative blood loss, total operative time, and length of hospital stay were also similar between the groups. To the best of our knowledge, this is the first study to examine the existence of the freshman effect for gynecologic surgeries in Asian countries. We believe that this study is very valuable to patients and healthcare providers because our findings disprove the myth of an increase in medical errors and adverse outcomes in the beginning of the academic year.

The main finding of this study was that a perceived increase in the risk of surgical complications during the early academic period was not demonstrated. Our finding was consistent with that of previous studies, including the first study for Asian countries about the freshman effect in surgery [6]. The first study by Malik et al. evaluated the freshman effect in total knee arthroplasty at a teaching hospital in Pakistan [6]. They reported that the surgeries performed during the first academic quarter (January–March in Pakistan) were not associated with changes in the length of hospital stay, operative time, hemoglobin, or postoperative complications. Hennessey et al. analyzed discharge data from the United State Nationwide Inpatient Sample for 48,263 patients who underwent surgery for head and neck cancer between 2005 and 2008 [7]. They also found insufficient evidence to support the existence of a "freshman effect" at teaching hospitals providing surgical care for

head and neck cancer. In contrast, the results of our study were not inconsistent with that of others [8]. Englesbe et al. studied 20,524 patients who underwent various surgical operations between 2001 and 2004 in the American College of Surgeons National Surgical Quality Improvement Program (ASC-NSQIP) database [9]. They found an 18% higher risk of postoperative morbidity and a 41% higher risk of mortality across all major surgeries during the first 2 months of the academic year (compared to those during the last 2 months) [8].

There are three interpretations for the absence of a freshman effect in our study. First, in the operating room, a large proportion of the surgery may be performed by the attending surgeon or senior resident due to the technical immaturity of newer residents during the first academic quarter [4, 10]. Second, on the ward, efficacious perioperative management and supervision by more senior-level residents may act to combat a new resident's lack of proficiency [4]. Third, senior residents must provide final confirmation of decisions during the early academic year, thereby limiting autonomy of the freshman [4, 8]. Our data suggest that despite turnover of new residents in a teaching hospital, appropriate supervision by a senior resident or faculty and well-organized hospital protocols prevent the potential for increased complications.

The present study demonstrates that the first academic quarter was associated with longer operative time of 1.6 min for skin closure. This finding was consistent with that of a previous study. Bakaeen et al. analyzed 70,616 cardiac surgical procedures performed between 1997 and 2007 [11]. The early period of the academic year was associated with longer operative times (295 ± 90 vs. 288 ± 90 min; $P < 0.05$). The longer operative time may reflect a decline in the efficiency of surgical care delivery due to the disruptive effect of resident changeover. However, from a practical view, we believe that the difference in skin closure time between the two periods was very small (< 2 min) and had no significant clinical implications, in spite of significance from a statistical perspective.

A recent systematic review of 39 studies evaluating the "freshman effect" was widely reported in the popular news and social media as evidence for the existence of this phenomenon [12]. The study concluded that "mortality and morbidity rates tend to increase" in early academic months; however, the researchers found that only 22% of reviewed studies assessed mortality as an outcome; 17% of studies that evaluated morbidity as an outcome showed evidence for a freshman effect. Furthermore, only one-third of the studies reviewed were rated as good or higher quality, and the researchers acknowledged that methodological limitations and between-study heterogeneity limited their conclusions. In spite of the relative lack of evidence for a "freshman effect," a majority of health care providers believe that the annual resident turnover results in worse outcomes and diminished patient care. However, considering that new resident trainees must fulfill the dual responsibilities of learning new clinical skills while actively providing clinical care, attending physicians should help new residents to be excellent senior residents with the goal of maintaining patient safety. Comparing the education goals of major teaching hospitals in Western and Asian countries [13–15], we found that Asian residency programs more emphasized the developing quality that enable educate and supervise junior resident.

This study had some limitations. First, our study only involved a single teaching hospital. Therefore, a multi-institution study with sample size calculation may be better able to discern any differences. Second, we did not separately measure the skin incision and closure times in cases of open surgery. Third, cost-effectiveness was not evaluated in the present study, although new residents may be more likely to order unnecessary laboratory tests, imaging studies, and other costly diagnostic tests. Finally, we were unable to determine the level of resident or attending physician involvement in our analyses. New residents may have been involved in preoperative, intraoperative, or postoperative care, or in all aspects of clinical care. Meanwhile, the strength of this study lies in its use of a prospective data collection. It also addresses the freshman effect in gynecologic surgery for the first time in an Asian country.

In conclusion, our findings suggest that gynecologic surgical care is as safe at the beginning of the academic cycle as it is later in the year, in terms of operative complication, blood loss, and length of hospital stay. This should reassure patients about the quality of surgery performed in the first academic quarter. Future studies are needed to verify potential seasonal effects of inexperienced health care providers on a national scale that can incorporate non-teaching hospitals as control groups.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest and nothing to disclose.

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