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Original Article

Decoding Factors Influencing Post-Operative Outcomes in Surgical Residents' Minor Surgeries

Jiraya Prompattanapakdee, MD
Chumpol Wongwanit, MD
Jirapat Tianrungroj, MD
Nachasa Khongchu, MS
Nutcha Yodrabum, MD

Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Abstract

Objective: Effective surgical residency training is essential for developing competent surgeons. The first year of training focuses on basic knowledge and fundamental surgical skills. Consequently, minor surgical procedures suit first-year surgical residents with minimal complexity and low complication rates. This pilot study aimed to evaluate the complications associated with surgical residency practice and examine the factors associated with these complications.

Materials and Methods: This study employed a single-center retrospective review method to evaluate the complications arising from surgical residents' minor operations and identify the factors associated with these complications. Data were collected at Siriraj Hospital over three consecutive years, from 2016 to 2018.

Results: During the study period, a total of 1,572 minor operations were performed by surgical residents. The overall complication rate was 4.3%, which included surgical site infections, wound dehiscence, hematoma or bleeding, seroma, and superficial skin necrosis. Among the surgical site infection cases, an operative time exceeding 30 minutes (OR 13.3, ***p***-value = 0.00) and lesion size larger than two centimeters (OR 5.24, ***p***-value = 0.01) were significant influencing factors for complications. Conversely, residents' background characteristics and the presence of a 'July effect' did not significantly impact surgical outcomes.

Conclusion: The rate of complications associated with minor operations performed by residents at Siriraj Hospital was comparable to the findings from other studies. The most common complications were wound dehiscence and surgical site infections. Operative time and lesion size were significant factors affecting complications. The results of this study can contribute to enhancing surgical residency training.

Keywords: Minor surgery, Complication, Surgical resident, Training

Introduction

Siriraj Hospital is one of Thailand's largest tertiary hospitals and medical training centers. Our mission includes providing medical services and promoting the well-being of Thais. Moreover, our responsibility extends to the development of qualified physicians. Striking a balance between providing standard patient care and delivering a high-quality training program is always a significant concern. An effective surgical residency program is key for developing qualified surgeons.

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Corresponding author: Nutcha Yodrabum MD, Division of Plastic and Reconstructive Surgery, Department of Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand; Email: n.yodrabum@gmail.com; Tel*ephone: +66 2 419 8002, Fax: +66 2 412 8109*

Beginning from the first academic year, residents gain essential knowledge and develop fundamental surgical skills to enhance their proficiency. Minor surgical procedures are particularly well-suited for first-year surgical residents due to their lower complexity, limited time requirements, and minimal complication rates. These factors contribute to increasing residents' autonomy in performing operations.[1]

On average, complications associated with minor procedures have been reported at a rate ranging from 3% - 6%. While there have been no reports of mortality complications, it is still essential to consider the potential impact of any complications on patients' quality of life. Common complications include surgical site infections, wound dehiscence, and bleeding.[1,2] Several significant factors influence these complications, such as operative time, lesion size, and location.[2,3] Additionally, resident-related factors can affect surgical outcomes. For instance, previous studies have demonstrated that differences in the training year or level of institutional training can impact surgical outcomes.[4-7] Interestingly, a 'July effect' has even been suggested as a potential cause of complications. Indeed, a systematic review of studies published between 1989 and 2010 revealed that the mortality rate during this period was higher than during the rest of the year.[8] However, a multi-institutional study of plastic surgeries published in 2018 provided assurance that there was no statistical difference in complications based on the time of year.[9]

Ensuring patient safety is the most crucial consideration when determining the suitability of surgical procedures for first-year residents. Procedures involving larger lesions or those with potential complications present elevated risks for less experienced residents. Consequently, meticulous oversight and selective assignment of cases based on complexity are essential measures to maintain patient safety while facilitating residents' learning experiences in the operating room.

Our study aimed to evaluate the complications that arise during surgical residency practice and the factors associated with these complications. This research's practical benefit would be minimizing complications by addressing the related factors. Further, the results will serve as a guide for enhancing the surgical residency training curriculum at Siriraj Hospital.

Materials and Methods

Ethical consideration

This retrospective study was approved by the Institutional Review Board (SiRB) of Siriraj Hospital under protocol number 038/2564. The study encompassed 1,572 minor surgical operations conducted at the minor surgery clinic, Department of Surgery, Siriraj Hospital, Mahidol University, from July 1st, 2016, to June 30th, 2018.

Clinical setting

First-year surgical and third-year plastic surgery residents manage the minor surgery clinic during their general surgery rotation. A supervisor is present to oversee complicated cases and ensure patient safety. Although there are no dedicated workshops or practice sessions specifically for the residents in the clinic, the medical school curriculum includes these training opportunities. It is also assumed that residents have gained sufficient practice and experience during their internships.

Common procedures performed at this clinic include the excision of soft tissue masses, incision and drainage, debridement, cauterization, and nail extraction.

When patients visit the clinic, their care begins with measuring their vital signs. Subsequently, the resident conducts the patient history-taking and physical examination and discusses procedural planning with the attending staff. Patients might be requested to undergo further investigations, such as radiography, if necessary. Generally, all infectious cases undergo the operation during the same visit. However, procedures for soft tissue masses may be postponed or re-preparated to optimize the outcomes and minimize complications.

Most procedures are performed by the resident alone, and they are responsible for all the treatment steps, including providing information to the patient and obtaining consent, patient positioning, anesthesia administration, performing the procedure, providing wound care instructions or specific management guidance, and scheduling the next visit. Attending staff are readily available for emergencies, especially when the resident encounters critical situations and needs assistance.

Data collection

The patient's demographic data encompassed age, gender, body mass index (BMI), and underlying diseases. Operative data consisted of pre- and post-operative diagnoses, details of the procedure, lesion size and location, pre-operative skin preparation, anesthesia drug amounts, cauterization, wound dressing, operative time, estimated blood loss, and post-operative antibiotic use (if required). The post-operative section covered dressing frequency, follow-up time, duration of follow-up, complications, and the management of complications.

The complications considered in this study included surgical site infections, bleeding and hematomas, seromas, wound dehiscence, and superficial skin infections. Resident-related factors included the graduation institution, pre-training experience, academic year, division of residency program, and the operative period within the academic year.

Statistical analysis

In this study, descriptive statistical analysis was conducted using IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY, USA). Patient demographic data, operation characteristics, and postoperative complications are presented as frequencies and percentages. Factors affecting postoperative complications were assessed using a paired *t*-test and are presented herein as the mean and standard deviation (SD), with statistical significance defined as a *p*-value less than 0.05. For the subgroup analysis assessing factors influencing post-operative complications, we conducted Chi-square tests and calculated odds ratios to evaluate the relationships.

Results

During the inclusion period, 1,572 minor operations were performed at the minor surgery clinic. The patients' demographic data are presented in Table 1. Their ages ranged from 1 to 97, with a mean age of 50.3 ± 19.6 years old (IQR [35–65]). The average BMI was 24.2 ± 4.6. Common comorbidities among these patients included hypertension and diabetes mellitus. The duration of follow-up averaged 11.3 ± 11.6 days, with an average of 2.1 ± 2.8 visits.

Table 1 Demographic data

Age (years)	50.3 ± 19.6
Sex	
Male	695 (44.2)
Female	877 (55.8)
BMI (kg/m^2)	24.2 ± 4.6
Underlying disease	
Hypertension	471 (30.0)
DM	231 (14.7)
Heart disease	74 (4.7)
Renal disease	51 (3.2)
Peripheral arterial disease	13 (0.8)
Lymphatic disease	12 (0.8)
Duration of follow-up (days)	11.3 ± 11.6
Follow-up (visits)	2.1 ± 2.8

Data presented as the mean ± S.D., number (%)

Common diagnoses in this clinic included benign masses, sebaceous cysts, and abscesses, which accounted for 21.5%, 15.2%, and 10.6% of all cases, respectively. Sebaceous cysts were the most frequently diagnosed conditions dealt with by first-year residents, constituting 18.6% of their 985 procedures. In contrast, benign masses were the most common diagnosis in the third-year group, accounting for 42.9% of their 587 procedures. Regarding the types of operations performed, excisions accounted for 61.5%, incision and drainage for 16.2%, and nail extractions for 7.4%, as shown in Table 2.

Table 2 Diagnosis

	Resident year 1 Cases (%)	Resident year 3 Cases (%)	All Cases (%)
Total	**985 (62.7)**	**587 (37.3)**	**1,572**
Diagnosis			
Sebaceous cyst	183 (18.6)	56 (9.6)	239 (15.2)
Abscess	141 (14.3)	26 (4.4)	167 (10.6)
Infected sebaceous cyst	120 (12.2)	18 (3.1)	138 (8.8)
Paronychia/ ingrowing nail	111 (11.3)	7 (1.2)	118 (7.5)
Lipoma	104 (10.6)	31 (5.3)	135 (8.6)
Benign mass	87 (8.8)	252 (42.9)	339 (21.5)
Corns & callus	85 (8.6)	3 (0.5)	88 (5.6)
Skin tag	52 (5.3)	32 (5.6)	84 (5.3)
Wart	34 (3.5)	13 (2.2)	47 (3.0)
Delayed suture wound	26 (2.6)	11 (1.2)	37 (2.4)
Infected wound	20 (2.0)	11 (1.2)	31 (2.0)
Lymphadenopathy	10 (1.0)	3 (0.5)	13 (0.8)
Ganglion cyst	5 (0.5)	7 (1.2)	12 (0.8)
Keloid	3 (0.3)	53 (9.1)	56 (3.6)
Malignancy	2 (0.2)	62 (10.6)	64 (4.1)
Other	2 (0.2)	2 (0.3)	4 (0.2)
Operation			
Excision	557 (56.55)	410 (69.85)	967 (61.5)
Incision	9 (0.91)	92 (15.67)	101 (6.4)
I&D	217 (22.03)	37 (6.30)	254 (16.2)
Debridement	16 (1.62)	7 (1.19)	23 (1.5)
Suture wound	36 (3.65)	15 (2.56)	51 (3.2)
Cauterization	39 (3.96)	20 (3.41)	59 (3.8)
Nail extraction	111 (11.27)	6 (1.02)	117 (7.4)

Data presented as number (%)

During the inclusion period, a total of 68 complications were recorded in the clinic, accounting for 4.3% of the total operations. These complications included wound dehiscence (1.7%), surgical site infection (1.5%), hematoma or bleeding (0.3%), and superficial skin necrosis (0.3%). Factors related to the complications were categorized by diagnosis, operation type, and location, as shown in Table 3.

Regarding the diagnoses, sebaceous cysts appeared to be the most significant risk factor for the complications, with six cases associated with infection and five cases related to wound dehiscence. In terms of the operation type, excisions were the most critical risk factor, with 20 operations linked to wound dehiscence, 16 to infection, and 5 to wound hematoma or bleeding. As for the location, the face and posterior chest wall were the primary factors contributing to infections.

Table 3 Complications

	Complications								
	Total	Infection	Hematoma/ Bleeding	Seroma	Dehiscence	Superficial necrosis	Other	More than one	*p*-value
Total (% of total operations)	68 (4.3)	23 (1.5)	5 (0.3)	2 (0.1)	26 (1.7)	5 (0.3)	6 (0.4)	1 (0.1)	
Diagnosis (% of each diagnosis)									
Sebaceous cyst	14 (5.85)	6 (2.51)	1 (0.42)	1 (0.42)	5 (2.10)	-	1 (0.42)	-	0.00
Abscess	2 (1.20)	2 (1.20)	-	-	-	-	-	-	
Infected sebaceous cyst	6 (4.35)	3 (2.17)	1 (0.72)	-	2 (1.19)	-	-	-	
Lipoma	6 (4.44)	2 (1.48)	3 (2.22)	-	-	-	-	1 (0.74)	
Benign mass	13 (3.83)	4 (1.17)	-	-	7 (2.06)	-	2 (0.59)	-	
Skin tag	2 (2.38)	1 (1.19)	-	-	1 (1.19)	-	-	-	
Wart	5 (10.64)	1 (2.12)	-	-	3 (6.38)	-	1 (2.12)	-	
Delayed suture wound	7 (18.92)	2 (5.40)	-	-	4 (10.81)	-	1 (2.70)	-	
Infected wound	1 (3.26)	1 (3.22)	-	-	-	-	-	-	
Ganglion cyst	3 (25.00)	1 (8.33)	-	-	1 (8.33)	-	1 (8.33)	-	
Keloid	7 (12.50)	-	-	-	2 (3.57)	5 (8.9)	-	-	
Malignancy	1 (1.56)	-	-	-	1 (1.56)	-	-	-	
Other	1 (25.00)	-	-	1 (25.00)	-	-	-	-	
Operation (% of each operation)									0.83
Excision	53 (5.48)	16 (1.65)	5 (0.52)	1 (0.10)	20 (2.07)	5 (0.52)	5 (0.52)	1 (0.10)	
Incision	2 (1.98)	1 (0.99)	-	-	1 (0.99)	-	-	-	
I&D	4 (1.57)	2 (0.78)	-	1 (0.39)	1 (0.39)	-	-	-	
Suture wound	9 (17.64)	4 (7.84)	-	-	4 (7.84)	-	1 (1.96)	-	
Location (% of each location)									0.00
Scalp	3 (6.52)	-	1 (2.17)	-	2 (4.35)	-	-	-	
Face	14 (4.29)	2 (0.66)	-	1 (0.33)	5 (1.65)	3 (0.99)	3 (0.99)	-	
Neck	2 (2.47)	-	1 (1.23)	-	-	-	-	1 (1.23)	
Anterior chest wall	2 (2.82)	1 (1.41)	-	1 (1.41)	-	-	-	-	
Posterior chest wall	12 (7.59)	7 (4.43)	-	-	3 (1.90)	1 (0.63)	1 (0.63)	-	
Abdomen	2 (5.26)	-	1 (2.63)	-	1 (2.63)	-	-	-	
Lower back	7 (7.14)	3 (3.06)	1 (1.02)	-	3 (3.06)	-	-	-	
Buttock	6 (6.45)	2 (2.15)	1 (1.08)	-	3 (3.26)	-	-	-	
Arm and forearm	2 (1.77)	1 (0.88)	-	-	-	-	1 (0.88)	-	
Hand and wrist	2 (2.67)	-	-	-	2 (2.67)	-	-	-	
Leg	8 (6.35)	4 (3.17)	-	-	4 (3.17)	-	-	-	
Foot and ankle	8 (2.89)	3 (1.09)	-	-	3 (1.09)	2 (0.72)	-	-	

Data presented in number (%)

In our subgroup analysis focusing on specific risk factors, infectious complications were found to be strongly associated with several factors, including an operative time of more than 30 minutes, a lesion size exceeding 2 cm, and the absence of intra-operative wound irrigation. These factors exhibited odds ratios of 13.3, 5.2, and 8.9, respectively. In the group of wound dehiscence complications, an operative time exceeding 30 minutes, lesion size larger than 2 cm, and the use of either one or two layers of suture were not statistically significant factors. However, in the hematoma and bleeding group, a lesion size exceeding 2 cm was found to be a substantial risk factor, with an odds ratio of 10.6 (Table 4).

Table 4 Subgroup analysis

Risk factor	OR	95% CI	*p*-value
Infection			
Operation time > 30 min	13.30	3.03 - 58.46	0.00
Size more than 2 cm	5.24	1.88 - 14.57	0.01
No wound irrigation	8.90	3.13 - 25.31	0.01
Dehiscence			
Operation time > 30 min	0.70	0.27 - 1.85	0.47
Size more than 2 cm	0.22	0.03 - 1.70	0.14
Suture one layer	0.83	0.80 - 0.86	0.14
Suture both layers	0.74	0.70 - 0.79	0.34
Hematoma / Bleeding			
Operation time > 30 min	4.03	0.67 - 24.02	0.13
Size more than 2 cm	10.61	1.18 - 95.23	0.02
Adrenaline within Xylocaine	0.85	0.83 - 0.87	1.00
Cauterization	3.47	0.58 - 20.83	0.17
Compression dressing	4.76	0.53 - 43.14	0.23

Data presented as OR, CI

The total number of residents included in this study was 123, with 88.7% being first-year surgical residents and 11.4% third-year plastic surgical residents. The average complications per resident per case each year were 0.04 ± 0.11 and 0.08 ± 0.17, respectively, for the two resident groups. Among these residents, 42.7% had graduated from the Faculty of Medicine, Siriraj Hospital, while 52.9% had graduated from other medical schools. The mean complications per doctor per case in each graduation school were 0.05 ± 0.11 and 0.04 ± 0.13, respectively (Table 5). In terms of the academic quarter, 35.9% of complications occurred during the first academic quarter, while 64% occurred during the rest of the academic year, with a *p*-value of 0.56 (Table 6).

Table 5 Resident factors

	Person (%)	Complications (times/person/case)	*p*-value
Residency year			0.14
First-year	109 (88.62)	0.04 ± 0.11	
Third year	14 (11.38)	0.08 ± 0.17	
Medical school			0.28
Siriraj	58 (47.15)	0.05 ± 0.11	
Other medical school	65 (52.85)	0.04 ± 0.13	
Internship			0.39
General intern	92 (74.80)	0.06 ± 0.14	
Surgery internship	31 (25.20)	0.02 ± 0.42	
Division			0.27
General surgery	51 (41.5)	0.05 ± 0.15	
Neurosurgery	10 (8.1)	0.02 ± 0.05	
Cardiothoracic surgery	11 (8.9)	0.04 ± 0.05	
Pediatric surgery	15 (12.2)	0.04 ± 0.06	
Urosurgery	7 (5.7)	0.01 ± 0.03	
Orthopedic	4 (3.3)	0.08 ± 0.17	
Plastic surgery (First year)	11 (9.9)	0.07 ± 0.07	
Plastic surgery (Third year)	14 (11.4)	0.08 ± 0.17	

Data presented as the mean ± S.D., number (%)

Table 6 Resident factors with July effect

Academic quarter	Cases	Complications	OR	95% CI	*p*-value
First academic quarter					
(1 July 2016 - 30 Sep 2016)	255 (31.7)	14 (35.9)	0.82	0.42 - 1.60	0.56
Other academic quarters					
(1 Oct 2016 - 30 June 2017)	550 (68.3)	25 (64.1)	0.82	0.42 - 1.60	0.56
Total	**805**	**39**			

Data presented as the mean ± S.D., number (%)

Discussion

In worldwide surgical training programs, minor surgical procedures are a fundamental requirement for resident surgeons. They are performed in clinics that are colloquially known as "lumps and bumps clinics".[10,11] The excision of skin and soft tissue lesions is an operation that all Thai surgical residents have to successfully perform within their first year of training according to the Thai Board of Surgery curriculum. As part of the surgical training at our hospital, these procedures are the responsibility of first-year surgical residents.[12] because such minor surgical operations are not considered major complicated, require minimal time, and have the risk of only minor complications. Moreover, they can improve surgical skills and operative autonomy, which benefits junior surgical residents.[1]

In line with the general characteristics of the clinic, there were no definite follow-up times for minor surgical cases.

During the study period at the OR minor clinic in our hospital, the average duration of follow-up was 11.3 ± 11.6 days with 2.1 ± 2.8 mean follow-up visits. Due to the nature of this clinic, which primarily performs uncomplicated procedures, such as superficial lesion excisions or incisions and drainage, the duration of follow-up in this clinic was shorter than in the other post-operative clinic. Moreover, the middle half of the patient age group ranged from 35 to 65 years old, which is an age group that can independently take care of themselves post-operatively. In comparison, a retrospective review of 1,572 operations in Canada reported 68 days of follow-up time in a pediatric population because of concerns about scarring and pediatric well-being.[13]

Most common soft tissue tumors are benign. Compared to malignancies, the report from the USA confirmed a ratio of 150 cases of benign masses per one malignant mass.[14] In our study, we found 64 cases to be malignant and 726 to be benign masses. Due to our hospital's status as a tertiary care center, the number of malignant masses might be higher than that in the general population, especially in the field of plastic specialization. Interestingly, the first-year residents handled only two cases of malignant masses. This finding requires consideration due to the responsibility of the graduate surgeons in Thailand, who may encounter both benign and malignant masses.

Surgical residents perform various operations. According to a study at Massachusetts General Hospital by Wojcik BM et al. (2016), the most common operation was excision, accounting for 78.2% of the total 110 operations performed by the surgical residents at the hospital. Following that, incision and drainage accounted for 10.0%.[1] Similarly, in our study, the first and second most common operations were excision, incision, and drainage, representing 61.5% and 16.2% of all procedures, respectively.

The complications we identified in these operations were neither fatal, leading to systemic infections, nor necessitated further major surgery. Overall, the complications in this study accounted for 4.3% of cases, which was slightly higher than the findings in the Massachusetts study. That study reported a complication rate from minor surgeries performed by surgical residents as 3.6%,[1] encompassing surgical site infections (SSIs), wound dehiscence, hematoma or bleeding, seroma, and superficial necrosis.

The US Centers for Disease Control and Prevention defined SSIs as an infectious process that occurs only at the skin and subcutaneous tissue of the incision site within 30 days after a procedure. Further, this infectious process must meet at least one of the following conditions: purulent discharge from the superficial incision, isolation of organisms from a fluid or tissue culture, surgical site tenderness, swelling, heat, redness, or a diagnosis of SSI by the surgeon.[14] To consider, we typically diagnose this condition based on clinical presentation and rarely send specimens for culture or organism isolation. Our study's rate of infectious complications was 1.5% out of 1,572 operations. Similarly, the approximate percentage of infectious complications for skin and superficial soft tissue surgery in other studies ranged from 0.6% - 4.0%.[15-17]

In the excision group, an operative time exceeding 30 minutes was found to be associated with SSI. A systematic review of the relationship between SSI and operative time concluded that a prolonged operative time increased the likelihood of SSI complications across a wide range of procedures, with an average of 30 minutes longer operative time observed in patients with SSI compared to the non-SSI group.[3] Other significant risk factors related to infectious complications included the size of the lesion and wound irrigation.

Wound dehiscence refers to the separation of previously approximated wound edges, which occurs due to a failure in the proper wound-healing process.[18] Several factors contribute to appropriate wound closure, including the wound type, location, underlying diseases, closure materials, and surgical techniques.[19] The significant risk factors for wound dehiscence in a wide range of surgical procedures include obesity, diabetes mellitus, a history of smoking, age over 65 years old, wound infection, and inadequate surgical closure.[18] Areas of the body with high tension, such as the back, chest, and deltoid, have an increased likelihood of wound dehiscence, as noted by Campbell et al.[20] In a study conducted by Amici et al., an operative time of more than 24 minutes was identified as a significant risk factor for hemorrhagic complications in dermatosurgical procedures[2] However, in our findings, an operative time exceeding 30 minutes, lesions larger than 2 cm, and the use of either one or two layers of sutures were not statistically significant factors.

Hemorrhagic complications are among the significant post-operative issues, and they have the potential to lead to other complications, such as surgical site infection, wound dehiscence, or skin necrosis.

Previous studies have indicated that factors such as age, location, defect size, and the use of anticoagulant agents were associated with postoperative bleeding, with an average hemorrhagic complication rate ranging from 1.6% - 7.1%.[21-23] In contrast, our study revealed that only 0.3% of cases were counted as post-operative bleeding, and none of these cases required operative management. We found that a defect size exceeding 2 cm was a significant risk factor. However, operative time, the presence of adrenaline in a lidocaine injection, cauterization, and the use of compression dressing were not statistically significant risk factors. This contradicts previous data that suggested that adrenaline in a lidocaine injection, cauterization, and compression dressing were effective techniques for preventing hemorrhagic complications.[24] This discrepancy may be due to the increased awareness among surgeons who already employ these techniques to prevent post-operative bleeding. It is important to note that one limitation of our study was the low number of bleeding complications, which could have contributed to the insignificant result.

Siriraj Hospital is one of Thailand's largest tertiary referral hospitals and the biggest surgical training center. Consequently, novice surgical residents are recruited for each training year from various medical centers across all regions of Thailand. Concerns have arisen regarding whether medical students graduating from tertiary hospitals would perform better than those from regional hospitals. However, the average complication rates among graduates from Siriraj Medical Center and other medical centers showed no statistically significant differences. This finding aligns with a study conducted in Australia, which demonstrated that the academic performance of medical students, regardless of whether they graduated from a tertiary center or other institution, did not differ.[6] The career path for surgeons in Thailand typically begins with six years as a medical student, followed by at least one year as an internist, and finally, four years as a surgical resident. During the internship period, individuals may assume various roles, including that of a general practitioner or surgical intern. Regarding internist experience, no statistically significant differences were observed in terms of complication rates between general practitioners and surgical interns.

The residency training program at our hospital comprises six divisions: General Surgery, Neurosurgery, Cardiothoracic Surgery, Pediatric Surgery, Urology, and Plastic Surgery. All first-year surgical residents are assigned to the minor operation clinic to enhance their autonomy and surgical skills. Additionally, first-year residents from the orthopedic department participate in this clinic. This study's results confirmed no significant difference in average complication rates among residents from the different divisions.

The 'July effect' concept is commonly mentioned as a factor related to the academic year changeover. A systematic review of studies published between 1989 and 2010 indeed demonstrated that the mortality rate during this period was higher than during the rest of the year.[8] Interestingly, no 'July effect' was observed during the rotation of Siriraj surgical residents. Complications that occurred during the first quarter were comparable to those in other quarters. This observation may have resulted from the relatively low complexity of procedures, and most of the procedures were performed during the medical student to internship periods. Consequently, surgical staff should remain consistently attentive to complications in minor operations throughout the surgical training year without any specific period of heightened concern.

Because senior residents who were in the plastic surgery program performed the procedures for the intricate cases, the results showed no statistically significant difference between the first-year and third-year surgical residents in this study who performed the minor procedures.

This research has some limitations to note. The completeness of the medical records was a significant concern, as all records were handwritten, and some data might have been missing. Therefore, the reported complications could potentially be lower than the actual number of complications. Additionally, a portion of the patients did not reach the intended follow-up periods, possibly due to difficulties in accessing a tertiary hospital. Consequently, it is essential to consider these limitations when interpreting the results.

Conclusion

The complications associated with minor operations performed by residents at Siriraj Hospital were similar to those in previous studies. Several factors influenced these complications, particularly an operative time exceeding 30 minutes and lesion sizes larger than 2 centimeters. However, our results indicated there was no 'July effect' throughout the academic quarters. Ultimately, the findings

of this study should be considered as a guide for improving the surgical residency training curriculum at Siriraj Hospital.

Conflicts of Interest

There is nothing to declare.

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