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SURGICAL SITE INFECTIONS DURING THE COVID-19 ERA: A RETROSPECTIVE, MULTICENTER ANALYSIS

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Highlights

- Multicenter analysis evaluating perioperative COVID-19 precautions impact on SSIs.
- Perioperative COVID-19 precautions did not significantly reduce the risk of SSIs.
- Further study is needed to evaluate modifiable environmental factors effect on SSIs.

ABSTRACT

Background: Surgical site infections (SSIs) are an undesired perioperative outcome. Recent studies have shown increases in hospital acquired infections during the coronavirus disease 2019 (COVID-19) pandemic. The objective of this study was to evaluate postoperative SSIs in the COVID-19-era compared to a historical cohort at a large, multicenter, academic institution.

Material and methods: A retrospective review of all patients who underwent National Health and Safety Network (NHSN) inpatient surgical procedures between January 1, 2018 and December 31, 2020. Patients from the COVID-19-era (March-

December 2020) were compared and matched 1:1 with historical controls (2018/2019) utilizing the standardized infection ratio (SIR) to detect difference.

Results/Discussion: During the study period, 29,904 patients underwent NHSN procedures at our institution. When patients from the matched cohort (2018/2019) were compared to the COVID-19-era cohort (2020), a decreased risk of SSI was observed following colorectal surgery (RR =0.94, 95% CI [0.65, 1.37], p=0.76), hysterectomy (RR=0.88, 95% CI [0.39, 1.99], p=0.75), and knee prothesis surgery (RR =0.95, 95% CI [0.52, 1.74], p=0.88), though not statistically significant. An increased risk of SSI was observed following hip prosthesis surgery (RR 1.09, 95% CI [0.68, 1.75], p=0.72), though not statistically significant.

Conclusions: The risk of SSI in patients who underwent NHSN inpatient surgical procedures in 2020 with perioperative COVID-19 precautions was not significantly different when compared to matched controls at our large, multicenter, academic institution.

Keywords: Surgical site infections, SARS-CoV-2, COVID-19, healthcare-associated infections.

INTRODUCTION

Healthcare associated infections (HAIs) are one of the most undesired adverse outcomes associated with perioperative surgical care. Surgical site infections (SSIs), the most frequent form of HAIs, are associated with significant morbidity, mortality, and patient dissatisfaction.[1] Largely considered preventable, SSIs pose significant financial burden on the healthcare system with an annual estimated cost of $3.5-10 billion in the United States alone.[2] Multiple risk factors have been identified for the development of SSIs following surgical procedures including facility related risk factors (inadequate operating room (OR) ventilation, increased OR traffic, insufficient sterilization of equipment) and intraoperative risk factors (improper aseptic technique, hand hygiene, and gloving).[1] Improved basic preventative measures by all perioperative providers, such as proper hand hygiene and improved environmental cleaning, have been suggested to reduce HAIs and SSIs.[3,4]

The coronavirus disease 2019 (COVID-19) pandemic has significantly altered the delivery of healthcare across the world. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus of COVID-19 is transmissible by respiratory droplets, contaminated hands, and environmental surfaces.[5-7] In response, healthcare facilities worldwide implemented additional preventative hygiene measures to limit possible transmission to patients and providers.

Initiatives at our institution, similar to other facilities, included continuous perioperative surgical mask wearing, emphasized hand hygiene, use of personal protective equipment (PPE: fitted N95 masks and/or respirators, face shields, gowns, gloves), social distancing, and enhanced environmental disinfection of perioperative areas to protect providers, patients, and employees.[5,6,8] These initiatives, often labeled as Perioperative COVID-19 Precautions, have resulted in a heightened awareness regarding perioperative infection prevention and basic hygienic behaviors.

The anesthesia provider is essential in the fight to reduce perioperative HAIs due to their frequent contact with the patient's airway, mucosa, skin, and bloodstream. Prior studies have shown that interventions such as hand hygiene monitoring, improved environmental cleaning, patient decontamination, and vascular care all reduce the risk of HAIs.[3,8] Preliminary, small, single-center studies have shown mixed results regarding the impact of COVID-19 infection protocols on the rate of SSIs compared to historical cohorts.[9-13] The objective of this study was to evaluate the risk of postoperative SSIs in the COVID-19-era compared to a historical cohort at a large, multicenter, academic institution for inpatient colorectal, hysterectomy, hip prosthesis, and knee prosthesis surgeries.

METHODS

This study was approved by the institutional review board (IRB) at the Mayo Clinic and the requirement for written informed consent was waived for all patients who had previously granted permission to use their medical records for observational research (consistent with Minnesota Statute 144.295). This manuscript adheres to the applicable STROBE guidelines. The study cohort was identified through the Mayo Clinic Infection Prevention and Control (IPAC) database, an institutional database that records and reports SSI rates quarterly. The IPAC database contains a current list of SSIs for National Health and Safety Network (NHSN) inpatient procedures including colorectal surgery, abdominal hysterectomy, knee prosthesis, and hip prosthesis procedures. Patients who underwent the above NHSN surgical procedures and developed SSIs at reporting Mayo Clinic centers between January 1, 2018 and December 31, 2020 were identified and included in the study cohort. Reporting centers where SSI data for NHSN procedures was analyzed included Mayo Clinic sites in Phoenix, Arizona; Jacksonville, Florida; Rochester, Minnesota and Mayo Clinic Health Systems sites in Eau Claire, Wisconsin; La Crosse, Wisconsin; Mankato, Minnesota and Red Wing, Minnesota.

Universal perioperative COVID-19-precautions were implemented at our multicenter institution in March 2020 and included enhanced hand hygiene efforts, limiting operating room and general hospital traffic, healthcare provider and patient masking including the use of appropriate personal protective equipment

(PPE) during aerosol generating procedures, and social distancing. All patients presenting for perioperative care were required to have a COVID-19 polymerase chain reaction (PCR) test within 48 hours of scheduled surgery. If positive for COVID-19 infection and the surgery was an elective procedure, the procedure was delayed at least 20 days. If a patient tested positive for COVID-19 infection or COVID-19 testing was unknown but the case was considered urgent/emergent, then appropriate COVID-19 operating room precautions were instituted. These included “modified droplet precautions” (masks, eye protection, gowns, and gloves) for routine care with the addition of a respirator (N95 or equivalent, e.g., powered air-purifying respirator) for aerosol-generating procedures (AGPs) throughout the perioperative period; procedures were performed in a negative pressure operating room with only required personnel present, a high efficiency particulate air (HEPA) viral filter was placed on the breathing circuit, a plastic drape covered the patient during emergence, and the patient was transported with a facemask to recover in a negative pressure isolation room. Only patients who underwent surgical procedures between March 1st and December 31, 2020 were included in the year 2020 or COVID-19-era patient cohort.

Demographic and perioperative data including age, American society of Anesthesiologists (ASA) physical status classification, body mass index, history of diabetes, wound classification, surgery type, risk adjustment,[14] procedure duration, description of SSI, surgical closure technique, time from procedure to SSI, signs and symptoms of infection, laboratory evidence of infection, radiographic evidence of infection, presence of abscess, presence of sinus tract, and mortality were collected and reviewed.

Mayo Clinic uses the NHSN surveillance definition for SSIs, which includes a 30-day surveillance period for hysterectomy and colorectal surgery and a 90-day surveillance period for hip prosthesis and knee prosthesis surgery. Healthcare acquired infections, including SSIs, are reported quarterly to NHSN, providing us with the risk adjusted standardized infection ratio (SIR) for each surgical procedure. The SIR is calculated by dividing the number of observed infections by the number of predicted infections. The SIR is calculated by NSHN only if the number of predicted HAIs is ≥ 1. An SIR >1.0 reveals more HAIs were observed than predicted, while an SIR <1.0 indicates fewer HAIs were observed than predicted. A ratio of 0 signifies that no SSIs were reported during the respective study period.[15] We elected to use the 2015 baseline all SSI SIR model based on inpatient procedures, categorized as superficial, deep, and organ space SSIs identified on admission, readmission, and post-discharge surveillance. Superficial and deep incisional SSIs are limited to primary incisional SSIs only. Cases that meet the NHSN criteria for "Present At Time of Surgery" (PATOS), are excluded from both the numerator and denominator for SSI SIR calculation.

Statistical Analysis

Demographic and perioperative data were descriptively summarized using mean ± SD or median for continuous variables and frequency percentages for categorical variables. Patient and procedural characteristics were compared by procedure year for all surgeries and within each surgery type. Kruskal-Wallis testing was used for continuous variables and Chi-squared testing for categorical variables. Patients with surgeries completed in the year 2020 were then matched 1:1 based on age (±6 years), gender, and procedure type with patients who underwent similar surgical procedures in the year 2018 or 2019, to eliminate bias. A greedy algorithm was used to produce the most optimal matches. The NHSN provided SIR data was generated for each group (year 2020 and matched years 2018/2019). The SIR was also produced for each of the three years studied: 2018, 2019 and 2020. SIRs for year 2020 were compared against year 2018, 2019 and the matched groups (years 2018/2019). The SIRs were compared using the NHSN SAS macro *%binom* presented as relative ratios. Two-tailed tests were utilized with statistically significance inferred with a p-value $\leq$0.05. All statistical analysis were performed using SAS version 9.4 (SAS Institute Inc.).

RESULTS

During the study period, 29,904 patients underwent colorectal, hysterectomy, hip, and knee prosthesis procedures at our multicenter institution. Patient demographic and perioperative data are displayed in Table 1. Surgical site infections (SSIs) were identified in 258 patients following 2,231 colorectal surgeries, 46 patients following 1,192 hysterectomies, 132 patients following 3,414 hip prosthesis procedures, and in 103 patients following 4,036 knee prosthesis procedures (Table 1). Demographic and perioperative data for patients who developed SSIs following colorectal surgery, hysterectomy, hip prosthesis surgery, and knee prosthesis surgery are displayed in Supplemental Table 1. A significant difference in the rate of emergency procedures by year was observed amongst the entire patient cohort (2.0% in 2018, 2.9 % in 2019, and 3.7% in 2020, $p<0.0001$) [Table 1] but no difference was observed when comparing the rate of emergency procedures by specific procedure type (Supplemental Table 1). A significant difference in the type of SSI (deep incisional primary vs. organ-space infection vs. superficial incisional) was observed in patients who underwent hip prosthesis surgery ($p=0.04$), but no difference was observed for the remaining surgical procedures (Supplemental Table 1). Following 1:1 patient matching, demographic and perioperative data were compared amongst 112 colorectal surgery patients, 24 hysterectomy patients, 70 hip prosthesis surgery patients, and 44 knee prosthesis surgery patients (Supplemental Table 2). In hip prosthesis surgery patients, a significant difference in the type of SSI (deep incisional primary vs. organ-space infection vs. superficial incisional; p=0.03) was observed between matched groups but no other significant differences were observed between groups (Supplemental Table 2).

A relative ratio (RR) comparing the SIR from the years 2018/2020 and 2019/2020 is outlined in Table 2. In patients that underwent colorectal surgery, a significant decrease in the risk of SSI was observed when comparing 2018 vs. 2020 (RR=0.58, 95% CI [0.42, 0.79], p<0.001) and 2019 vs. 2020 (RR 0.71, 95% CI [0.50, 0.98], p=0.04) [Table 2]. A non-significant, decreased risk of SSI was also observed following hysterectomy in 2019 vs. 2020 (RR=0.91, 95% CI [0.43, 1.86], p=0.81), hip prosthesis surgery in 2019 vs. 2020 (RR 0.96, 95% CI [0.62, 1.46], p=0.85), knee prosthesis surgery in 2018 vs. 2020 (RR=0.82, 95% CI [0.48, 1.38], p=0.47), and knee prosthesis surgery in 2019 vs. 2020 (RR=0.84, 95% CI [0.50, 1.41], p=0.53) [Table 2]. A non-significant increase in the risk of SSI was observed when comparing 2018 vs. 2020 following hysterectomy (RR=1.30, 95% CI [0.59, 2.85], p=0.51) and hip prosthesis surgery (RR=1.30, 95% CI [0.82, 2.05], p=0.27) [Table 2].

When patients from the matched cohort (2018/2019) were compared to the COVID-19-era cohort (2020), a decreased risk of SSI was observed following colorectal surgery (RR =0.94, 95% CI [0.65, 1.37], p=0.76), hysterectomy (RR=0.88, 95% CI [0.39, 1.99], p=0.75), and knee prothesis surgery (RR =0.95, 95% CI [0.52, 1.74], p=0.88) but failed to meet statistical significance (Table 3). An increased risk of SSI was observed following hip prosthesis surgery (RR 1.09, 95% CI [0.68, 1.75], p=0.72) [Table 3].

DISCUSSION

The COVID-19 pandemic has significantly altered the delivery of healthcare across the world including implementation of infection prevention protocols in the perioperative environment. Surgical site infections, one of the most common complications following surgical procedures, result in increased morbidity and mortality, sepsis, readmission, and extended postoperative hospital stay with negative economic impact on the healthcare system.[16,17] The main findings of this study show that the risk of SSI in patients who underwent NHSN inpatient surgical procedures in 2020 with perioperative COVID-19 precautions was not significantly different when compared to matched controls from 2018 and 2019 at our large, multicenter, academic institution.

Since the onset of the pandemic in March 2020, implementation of Perioperative COVID-19 Precautions, including strict hand hygiene, gloving, use of PPE, distancing, and environmental disinfection have become standard practice.[6,8] Heightened awareness of perioperative viral transmission and increased adherence to Perioperative COVID-19 Precautions carried optimism that perioperative SSIs would be further reduced as a result. Retrospective, single-centered studies from Italy, the United Kingdom, Germany, and Greece reported statistically significant reductions in SSIs following general surgery, cardiac surgery, neurosurgery, and colorectal surgery, respectively.[9-11,18] These findings are significant given that many of the surgical procedures performed following the COVID-19 shutdown were urgent/emergent in nature, conferring higher risk, while minor, elective procedures at low-risk of SSI were less commonly performed. A retrospective, propensity score matched study from India evaluated the risk of SSI following elective major oncologic surgery and reported that "increased compliance with hand hygiene, near-universal mask usage, and social distancing during the COVID-19 pandemic possibly led to 23% decreased odds of SSI in major oncologic resections." Subsequent retrospective studies from Switzerland, China, and the United States failed to show significant reductions in SSIs in the COVID-19-era following orthopedic and oculofacial plastic surgery.[12,13,19]

In the current study, a significant decrease in the risk of SSI was observed following colorectal surgery when comparing 2018 vs. 2020 and 2019 vs. 2020 (Table 2). When COVID-19-era patients who underwent colorectal surgery were compared to matched controls, a decreased risk of SSI was observed, but failed to meet statistical significance (RR=0.94, 95% CI [0.65, 1.37], p=0.76) [Table 3]. No statistically significant difference in the risk of SSI was identified in patients who underwent hysterectomy, hip prosthesis, and knee prosthesis surgery in the COVID-19-era cohort when compared to matched controls who underwent similar procedures prior to the pandemic (Table 3). Important to the analysis of the findings herein and a major strength of the current study is an understanding of institutional surveillance and reporting of SSIs. We elected to review surgical procedures that Mayo Clinic IPAC performs routine SSI surveillance, defined by NHSN, across our multicenter institution. This database contains a current list of SSIs, including the SIR, provided to us by NHSN, which is an ideal risk adjusted and standardized SSI metric. To reduce the risk of confounding variables, we performed matching with a historical patient cohort which underwent similar procedures at our institution (Supplemental Table 2, Tables 2 and 3). We think this approach, utilizing SIR to define SSI and matched analysis, offers the most comprehensive review of SSIs during the COVID-19-era available in the literature.

Our results may be congruent with the findings of Unterfrauner et al, that medical centers and surgical procedures with low rates of SSIs pre-COVID-19 may not benefit from additional infection prevention measures of perioperative COVID-19 precautions to the extent seen in centers and surgical procedures with historically higher rates of SSIs.[13] While the aforementioned small, retrospective, single-centered studies provided hope that SSIs may be reduced early in the pandemic,[9-11,18] larger subsequent studies, including the findings herein, fail to demonstrate significant differences. Although counterintuitive, we observed no robust or statistically significant changes in SSI despite unprecedented changes in surgical workflow and PPE use. We speculate that in centers with low rates of SSIs, modifiable environmental factors may offer minimal potential to further reduce SSI in the future. The data presented here may yield more subtle conclusions when combined in future meta-analysis with other large observational reports.

The findings of the current study come at a time of unparalleled challenges and strain to individual providers and the entire health care system imposed by the pandemic. Concern for a decline in health care safety has been raised[20] given recent studies that show increases in HAIs during the pandemic, including: catheter-associated urinary tract infections, central-line associated blood stream infections, and methicillin-resistant Staphylococcus aureus bacteremia.[21,22] The authors agree with Fleisher et al.[20] that a renewed emphasis on rewarding a culture of safety that actively strives to support providers and promote resiliency and quality is necessary to achieve the level of care our patients deserve.

To evaluate compliance and promote a culture of infection prevention, perioperative hand hygiene compliance has been monitored for many years at our institution. A trained observer assesses the operating room environment and records compliance with hand hygiene performance. The rate of hand hygiene compliance is reported monthly, with results communicated to providers. The frequency and documentation of hand hygiene compliance has not been standardized at all centers in our institution. Furthermore, compliance with additional COVID-19 precautions at our institution was expected but not strictly monitored during the study period.

Limitations

This study has limitations inherent to a large, retrospective cohort analysis including the potential for missing patient data and charting inaccuracies. Given that many centers within our institution are tertiary referral centers, patients often receive perioperative care at our institution and may receive postoperative followup elsewhere. Despite 29,904 patients included in the study cohort, the low incidence of SSIs made statistical analysis of the outcome of interest difficult due to limited statistical power. Furthermore, the results of this study should be interpreted in the context of the pre-described NHSN surgical procedures, the postoperative surveillance routinely performed by the Mayo Clinic IPAC to detect SSIs, and how the SSIs are reported. Thus, these findings may not be reproducible across other surgical procedures or other medical centers. Differences in the incidence of SSIs may be observed when alternative definitions, surveillance, and reporting of SSIs exist. Moreover, perioperative “COVID precautions” intended to protect healthcare workers from infection, were not specifically designed to reduce SSI. Furthermore, differences in relative risk of SSI observed in the data may reflect limited statistical power secondary to the low incidence of SSI in the study population.

Conclusions

Surgical site infections pose significant burden to patients, perioperative providers, and the entire healthcare system. The main findings of this study show that the risk of SSI in patients who underwent NHSN inpatient surgical procedures in 2020 with perioperative COVID-19 precautions was not significantly different when compared to matched controls from 2018 and 2019 at our large, multicenter, academic institution.

Financial Disclosures

None.

Declaration of Competing Interest

None.

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Table 1: Demographic and Perioperative Data.

	Procedure Year				
	2018 (N=10873)	2019 (N=11494)	2020 (N=7537)	Total (N=29904)	P-value
Age					0.8648[1]
Mean (SD)	64.7 (13.52)	64.6 (13.32)	64.6 (13.69)	64.6 (13.49)	
Median	66.0	66.0	66.0	66.0	
Range	18.0, 103.0	18.0, 103.0	18.0, 103.0	18.0, 103.0	
ASA Classification, n (%)					<.0001[2]
1	292 (2.7%)	351 (3.1%)	167 (2.2%)	810 (2.7%)	
2	5314 (48.9%)	5693 (49.5%)	3555 (47.2%)	14562 (48.7%)	
3	4927 (45.3%)	5035 (43.8%)	3520 (46.7%)	13482 (45.1%)	
4	320	396	278	994	

	(2.9%)	(3.4%)	(3.7%)	(3.3%)	
5	20 (0.2%)	19 (0.2%)	17 (0.2%)	56 (0.2%)	
Emergency Procedure, n (%)					<.0001[2]
No	10651 (98.0%)	11160 (97.1%)	7256 (96.3%)	29067 (97.2%)	
Yes	222 (2.0%)	334 (2.9%)	281 (3.7%)	837 (2.8%)	
BMI (kg/m^2)					<.0001[1]
Mean (SD)	30.5 (6.88)	30.8 (6.92)	30.1 (6.93)	30.5 (6.91)	
Median	29.8	30.0	29.4	29.8	
Range	12.6, 59.3	13.0, 59.5	14.4, 59.8	12.6, 59.8	
Diabetes Mellitus, n (%)					<.0001[2]
No	10112 (93.0%)	11205 (97.5%)	7255 (96.3%)	28572 (95.5%)	

Yes	761 (7.0%)	289 (2.5%)	282 (3.7%)	1332 (4.5%)	
Wound Class, n (%)					<.0001[2]
Clean	7341 (67.5%)	7882 (68.6%)	4929 (65.4%)	20152 (67.4%)	
Clean-contaminated	2801 (25.8%)	2684 (23.4%)	1732 (23.0%)	7217 (24.1%)	
Contaminated	316 (2.9%)	480 (4.2%)	485 (6.4%)	1281 (4.3%)	
Dirty	415 (3.8%)	448 (3.9%)	391 (5.2%)	1254 (4.2%)	
Risk Adjustment Factors,* n (%)					<.0001[2]
0	3449 (32.1%)	3778 (33.3%)	2236 (30.1%)	9463 (32.1%)	
1	4855 (45.2%)	5021 (44.3%)	3256 (43.8%)	13132 (44.5%)	
2	2231 (20.8%)	2245 (19.8%)	1655 (22.3%)	6131 (20.8%)	

3	198 (1.8%)	297 (2.6%)	286 (3.8%)	781 (2.6%)	
Missing	140	153	104	397	
Type of HPRO/KPRO procedure, n (%)					<.0001[2]
Hemi	790 (10.6%)	851 (10.6%)	673 (13.4%)	2314 (11.3%)	
Total	6660 (89.4%)	7158 (89.4%)	4364 (86.6%)	18182 (88.7%)	
Missing	3423	3485	2500	9408	
Type of Hemi HPRO/KPRO, n (%)					0.9595[2]
Partial Primary	412 (52.2%)	442 (51.9%)	353 (52.5%)	1207 (52.2%)	
Partial Revision	376 (47.6%)	406 (47.7%)	319 (47.4%)	1101 (47.6%)	
Total Revision	2 (0.3%)	3 (0.4%)	1 (0.1%)	6 (0.3%)	
Missing	10083	10643	6864	27590	

Type of Total HPRO/KPRO, n (%)					<.0001[2]
Partial Revision	36 (0.5%)	11 (0.2%)	0 (0.0%)	47 (0.3%)	
Total Primary	6097 (91.5%)	6490 (90.7%)	3963 (90.8%)	16550 (91.0%)	
Total Revision	527 (7.9%)	657 (9.2%)	401 (9.2%)	1585 (8.7%)	
Missing	4213	4336	3173	11722	
Surgical Site Infections					
Colorectal	107	94	57	258	
Hysterectomy	14	20	12	46	
HPRO	39	57	36	132	
KPRO	39	42	22	103	

[1]Chi-Square p-value; [2]Kruskal-Wallis p-value.

*: Am J Infect Control. 2009 Dec;37(10):783-805.

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; HPRO, hip prosthesis and related operations; KPRO, knee prosthesis and related operations, N/n, number; SD, standard deviation

Table 2: Standardized Infection Ratio Comparison of 2018, 2019, and COVID-era group (2020) by Procedure Type.

	2018 vs. 2020		
Surgery	*Ratio**	*95% CI*	P-value
Colorectal Surgery	0.576	(0.415, 0.794)	0.0007
Hysterectomy	1.302	(0.588, 2.846)	0.5055
Hip Prosthesis and Related Operations	1.297	(0.818, 2.052)	0.2660
Knee Prosthesis and Related Operations	0.824	(0.481, 1.382)	0.4719
	2019 vs. 2020		
Surgery	*Ratio**	*95% CI*	P-value
Colorectal Surgery	0.706	(0.504, 0.980)	0.0375
Hysterectomy	0.910	(0.431, 1.855)	0.8081
Hip Prosthesis and Related Operations	0.959	(0.624, 1.456	0.8504
Knee Prosthesis and Related Operations	0.844	(0.496, 1.406)	0.5270

*Relative ratio comparing the Standardized Infection Ratio (SIR) between the control groups (2018 or 2019) and COVID-era group (2020).

Table 3: Standardized Infection Ratio Comparison of Matched Group (2018/2019) vs. COVID-era Group (2020) by Procedure Type.

	Matched 2018/2019 vs. 2020		
Surgery	*Ratio*[*]	*95% CI*	P-value
Colorectal Surgery	0.943	(0.650, 1.369)	0.7579
Hysterectomy	0.875	(0.386, 1.986)	0.7465
Hip Prosthesis and Related Operations	1.090	(0.680, 1.748)	0.7189
Knee Prosthesis and Related Operations	0.954	(0.524, 1.736)	0.8771

[*]Relative ratio comparing the Standardized Infection Ratio (SIR) between the control group (2018/2019) and COVID-era group (2020).