



Surgical Team Compliance with the Surgical Safety Checklist in the Central Operating Theater: A Cross-Sectional Study

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Article Information	ABSTRACT
Received : 25 May 2026 Revised : 09 July 2026 Accepted : 09 July 2026	Surgical procedures are high-risk interventions that require consistent implementation of the SSC to reduce preventable adverse events. However, differences in workflow and clinical urgency between elective and emergency procedures may influence surgical team compliance with SSC implementation. This study aimed to analyze the relationship between the type of surgical procedure and surgical team compliance with the SSC in the COT of a maternal and child hospital. A non-experimental observational study with a cross-sectional design was conducted involving 65 surgical procedures selected through accidental sampling from a population of 148 procedures. Data were collected through direct observation of SSC implementation during the sign-in, time-out, and sign-out phases and analyzed using the chi-square test. Most observed procedures were elective surgeries (55.4%). SSC compliance was achieved in 52.3% of procedures during the Sign-in phase, 67.7% during the time-out phase, and 72.3% during the sign-out phase. A statistically significant association was identified between the type of surgical procedure and SSC compliance ($p=0.006$). these findings support the need to strengthen SSC implementation through regular compliance audits, continuous surgical team training, and reinforcement of patient safety culture. Because of the cross-sectional design, the findings indicate an association rather than a causal relationship.
Keywords: Surgical Safety Checklist, Surgical Team Compliance, Elective Surgery, Emergency Surgery, Patient Safety.	

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Introduction

Healthcare facilities provide a wide range of health services, including surgical care delivered through the Central Operating Theater (COT). Surgical procedures, whether elective or emergency, are invasive interventions performed to save lives, prevent disease progression, alleviate disability, and improve patients' quality of life (Muhammad et al., 2026). Despite their therapeutic benefits, surgical procedures remain among the most complex healthcare interventions because they involve multidisciplinary teamwork, rapid clinical decision-making, and coordinated communication throughout the perioperative process (Ghanmi et al., 2024). Consequently, failures in teamwork or deviations from established safety practices may contribute to preventable adverse events, including wrong-site surgery, procedural errors, postoperative complications, and patient harm (Moreal et al., 2026)(Budijono et al., 2024; Faridasari et al., 2026; Namotemo et al., 2020; Nugroho et al., 2025; Suswita, 2019). Therefore, improving patient safety in the operating room requires not only technical competence but also consistent adherence to standardized safety practices that support effective teamwork and communication during surgical care (Levesque et al., 2024; Puspita et al., 2024).

Recent international evidence indicates that adverse events remain a major patient safety concern in surgical care despite continuous improvements in perioperative practice. A multicenter cohort study conducted in 11 hospitals in the United States reported that adverse events occurred in 38.0% of surgical admissions, with 15.9% classified as major adverse events. Furthermore, 59.5% of all identified adverse events were considered potentially preventable, highlighting substantial opportunities to improve patient safety throughout the perioperative pathway (Duclos et al., 2024). These findings demonstrate that preventable adverse events continue to represent a persistent challenge in surgical services and emphasize the need for comprehensive safety strategies involving all healthcare professionals. Therefore, patient safety has become a fundamental indicator of healthcare quality in the Central Operating Theater (COT), requiring systematic implementation of evidence-based safety practices, continuous monitoring, and quality improvement initiatives to minimize preventable harm during surgical care.

Surgical procedures are associated with inherent clinical risks; therefore, patient safety must be integrated throughout the entire perioperative pathway, from preoperative assessment to postoperative care (Martinez-Nicolas et al., 2024; Webster et al., 2023). The complexity of surgical care requires coordinated multidisciplinary teamwork, standardized clinical processes,

and continuous efforts to prevent avoidable patient harm (Webster et al., 2023; WHO, 2024). To standardize safe surgical practices, the World Health Organization (WHO) introduced the Surgical Safety Checklist (SSC), which consists of three sequential phases: Sign-in, Time-out, and Sign-out. The SSC was developed to strengthen communication, improve teamwork, and promote safer surgical care through standardized perioperative verification processes (WHO, 2024). Recent evidence indicates that implementation of the Surgical Safety Checklist contributes to improving adherence to perioperative safety processes, strengthening communication among surgical team members, and supporting safer surgical care. However, the effectiveness of the checklist depends largely on the quality and consistency of its implementation across different healthcare settings (Pilkington et al., 2023). Nevertheless, despite the widespread dissemination of international SSC guidelines, adherence remains inconsistent across healthcare settings. Recent studies suggest that standardized protocols alone are insufficient to ensure sustained compliance because SSC implementation is also influenced by organizational culture, leadership commitment, staff engagement, communication, education, and continuous monitoring of clinical practice (Habtie et al., 2025; Paterson et al., 2024). Therefore, the effectiveness of the SSC depends not only on the availability of standardized protocols but also on their consistent implementation and integration into routine surgical practice across different healthcare settings.

Previous international studies have consistently demonstrated that implementation of the Surgical Safety Checklist (SSC) is associated with improvements in perioperative safety processes, communication among surgical team members, and overall quality of surgical care. Recent evidence also indicates that higher levels of SSC adherence are associated with better compliance with recommended perioperative safety practices and more effective multidisciplinary teamwork (Armstrong et al., 2022). Despite these benefits, preventable adverse events continue to occur in surgical care, indicating that consistent implementation of patient safety interventions remains an ongoing global challenge (DW, 2023). Evidence from different healthcare settings further suggests that compliance with the SSC remains variable, with incomplete implementation frequently observed across the Sign-in, Time-out, and Sign-out phases (Habtie et al., 2025). Although previous studies have confirmed the importance of SSC implementation, most have focused on overall compliance, implementation barriers, patient safety culture, or clinical outcomes. Limited evidence has specifically examined whether

SSC compliance differs according to the type of surgical procedure, particularly between elective and emergency surgery, despite the substantial differences in clinical urgency, workflow, and decision-making processes associated with these procedures, especially within maternal and child healthcare settings.

Despite the growing body of evidence supporting the effectiveness of the Surgical Safety Checklist (SSC), several important knowledge gaps remain. Most previous studies have examined SSC implementation in relation to patient safety outcomes, patient satisfaction, or overall compliance, whereas limited evidence has specifically compared SSC compliance between elective and emergency surgical procedures, particularly within maternal and child hospitals in Indonesia. This evidence gap is important because obstetric and gynecological surgical services involve distinctive clinical characteristics, including time-sensitive decision-making, multidisciplinary coordination, and strict adherence to perioperative patient safety protocols. To address this gap, the present study examined the relationship between surgical procedure type (elective and emergency) and surgical team compliance with SSC implementation through direct observation in the Central Operating Theater of a maternal and child hospital in Yogyakarta. The findings are expected to provide evidence for developing targeted strategies to improve SSC compliance according to surgical procedure type, thereby supporting patient safety policies and quality improvement initiatives in Indonesian hospitals. Accordingly, this study aimed to analyze the relationship between the type of surgical procedure (elective and emergency) and surgical team compliance with the SSC in the Central Operating Theater of a maternal and child hospital in Yogyakarta.

Method

This study employed a non-experimental observational design using a cross-sectional approach to examine the relationship between the risk factor (surgical procedure implementation) and its effect (compliance with the Surgical Safety Checklist [SSC]) during the Sign-in, Time-out, and Sign-Out phases. The study population consisted of all surgical procedures performed at a maternal and child hospital in Yogyakarta, totaling 148 procedures carried out by medical personnel, including surgeons, anesthesiologists, surgical nurses, and anesthesia nurses. The sample was selected using an accidental sampling technique, resulting in 65 procedures comprising both elective and emergency surgeries. The study was conducted in the Central Operating Theater (COT) of a maternal and child hospital in Yogyakarta from

December 2016 to January 2017. During the study, two observation forms were used. The first was a surgical procedure checklist used to collect data on surgical procedures, while the second was an SSC checklist used to assess the compliance of the medical team with SSC implementation. The researchers directly observed the medical team while completing the Surgical Patient Safety Checklist for both elective and emergency surgical patients throughout the data collection process. The collected data were tabulated to facilitate statistical analysis. This process included coding, data entry, data cleaning, data presentation, and data analysis. Data analysis was conducted in two stages. First, univariate analysis was performed to describe respondent characteristics, including sex, age, educational level, type of surgery, and occupation. Second, bivariate analysis was conducted using the Chi-square test to determine the relationship between surgical procedures and team compliance with the SSC. Throughout the study, the researchers adhered to research ethics by maintaining the confidentiality of all respondent identification information.

Research Results

This study was conducted in the Central Operating Theater (COT) of a maternal and child hospital in Yogyakarta, which was equipped with two operating rooms and two recovery beds. The hospital employed 30 medical personnel, consisting of anesthesiologists, surgeons, anesthesia nurses, and surgical nurses. The volume of surgical procedures at this hospital was relatively high, with an average of 150 surgeries performed each month. The medical personnel observed in this study were predominantly male, accounting for 24 individuals (80%). Most participants were between 41 and 50 years of age, totaling 17 individuals (56.7%). Regarding educational attainment, 14 participants (46.7%) held a master's degree, while 9 participants (30%) had between 11 and 15 years of work experience. During surgical procedures, the medical personnel were organized into four teams, each consisting of seven members. Each team included a surgeon, an anesthesiologist, assistants, a scrub nurse (instrumentator), an anesthesia nurse, and a circulating nurse. The remaining personnel served as reserve staff when needed.

The surgical procedure began with the handover of the patient between the ward nurse and the anesthesia nurse, followed by a comprehensive patient assessment, including verification of the patient's identity and medical status, laboratory results, and other relevant examinations. Subsequently, the anesthesiologist and anesthesia nurse performed the Sign-in phase, which was followed by the induction of general anesthesia (GA) and positioning the patient on the

operating table. The surgical team then marked the operative site and covered the area with sterile drapes. Before the surgical incision was made, the surgeon and surgical nurse conducted the Time-out phase. Upon completion of the procedure, the anesthesiologist, anesthesia nurse, and surgeon performed the Sign-Out phase before wound closure or before the patient was transferred out of the operating room. Based on the 65 surgical procedures included in this study, surgeries performed in the Central Operating Theater (COT) of a maternal and child hospital in Yogyakarta were classified into two categories according to their nature: elective and emergency (cito) procedures. The distribution of these procedures is presented in Table 1, while the types of surgical procedures are shown in Table 2.

Table 1. Types of Surgical Procedures at COT RSKIA Yogyakarta Based on Their Nature

Type of surgical procedure	F	(%)
Emergency	29	44.6
Elective	36	55.4
Total	65	100.0

Table 2. Types of Surgical Procedures at COT RSKIA Yogyakarta

Surgical action	F	(%)
App	2	3.1
Cystotom	1	1.5
Lupussco	1	1.5
Mioma	2	3.1
Caesarean section	55	84.6
Sircumsi	1	1.5
TAH	3	4.6
Total	65	100.0

The bivariate analysis of medical team compliance with the Surgical Safety Checklist (SSC) at each phase, from Sign-in to Sign-Out, is presented sequentially in Tables 3–5.

Table 3. Compliance with the Surgical Team in the “Sign-in” Phase in the COT Room at RSKIA Yogyakarta

Types of surgical procedures	Obedient		Not obey		p-value
	F	(%)	F	(%)	
Elective	10	15.4	26	40	0.195
emergency	13	20	16	24.6	
Total	23	35.4	42	64.6	

Table 4. Compliance with the Surgical Team in the “Time-out” Phase in the COT Room at RSKIA Yogyakarta

Types of surgical procedures	Obedient		Not obey		p-value
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	F	(%)	F	(%)	
Elective	30	46.2	6	9.2	0.004
Emergency	14	21.5	15	23.1	
Total	44	67.7	21	32.3	

Table 5. Compliance with the Surgical Team in the “Sign-out” Phase in the COT Room at RSKIA Yogyakarta

Types of surgical procedures	Obedient		Not obey		p-value
	F	(%)	F	(%)	
Elective	31	47.7	5	7.7	0.011
Emergency	16	24.6	13	20	
Total	47	72.3	18	27.7	

Table 6. Cross Tabulation of the Association of Surgical Procedures on Medical Team Compliance with SSC at COT RSKIA Yogyakarta

Types of surgical procedures	Surgical action				Chi square
	Obedient		Not obey		
	F	%	F	%	P value
Elective	15	23,1	21	32,3	0,006
Emergency	3	4,6	26	40	
Total	18	27,7	47	70,3	

Discussion

This study aimed to examine the relationship between the type of surgical procedure and surgical team compliance with the Surgical Safety Checklist (SSC) in the Central Operating Theater of a maternal and child hospital. The findings demonstrated that SSC compliance differed according to both the checklist phase and the type of surgical procedure. Although no statistically significant association was observed during the Sign-in phase ($p = 0.195$), significant associations were identified during the Time-out ($p = 0.004$) and Sign-out ($p = 0.011$) phases. Overall, elective procedures demonstrated significantly higher SSC compliance than emergency procedures ($p = 0.006$). These findings indicate that adherence to the SSC may vary according to the clinical context in which surgical care is delivered rather than being uniformly implemented across all surgical procedures.

The absence of a significant association during the Sign-in phase suggests that the initial safety verification process was implemented relatively consistently in both elective and emergency procedures. Because this phase includes routine activities such as patient identification, confirmation of the surgical site, verification of informed consent, and anesthesia safety checks, these procedures may have become standardized components of perioperative practice regardless of surgical urgency. Nevertheless, the proportion of incomplete compliance

observed in both groups indicates that opportunities for improvement remain. Therefore, the absence of statistical significance should not be interpreted as evidence of optimal compliance but rather as an indication that similar implementation challenges may exist across both types of procedures. This finding is consistent with previous studies reporting that successful SSC implementation depends on effective multidisciplinary communication, teamwork, organizational support, and a strong patient safety culture rather than the availability of the checklist alone (Armstrong et al., 2022; Dhamanti et al., 2025b; Gul et al., 2022).

In contrast, significant associations identified during the Time-out and Sign-out phases indicate that compliance with these SSC components differed according to the type of surgical procedure. Compared with the Sign-in phase, both Time-out and Sign-out require active multidisciplinary communication, confirmation of critical clinical information, instrument and specimen verification, and agreement regarding postoperative management before completion of the procedure. Although this study did not investigate the factors underlying incomplete compliance, the findings suggest that implementation of these communication-intensive phases may vary between elective and emergency procedures. Accordingly, these results should be interpreted as demonstrating an association between procedure type and SSC compliance rather than indicating that emergency surgery itself causes lower compliance. Recent international evidence suggests that successful implementation of the Surgical Safety Checklist depends not only on the availability of standardized guidelines but also on effective multidisciplinary communication, teamwork, organizational and leadership support, continuous education, regular audit and feedback, and the integration of patient safety practices into routine surgical workflows (Armstrong et al., 2022; Dhamanti et al., 2025a; Etheridge et al., 2024; Lim et al., 2023).

The overall finding that elective procedures demonstrated higher SSC compliance than emergency procedures contributes additional evidence to the existing literature on perioperative patient safety. Previous studies have primarily examined overall SSC compliance or determinants such as knowledge, workload, communication, leadership, and patient safety culture, whereas fewer studies have specifically compared SSC implementation according to the type of surgical procedure. By directly comparing elective and emergency surgeries using observational assessment across the three phases of the SSC, this study extends current evidence by demonstrating that compliance may differ according to the surgical context. Although the

present study was conducted in a single maternal and child hospital, the findings suggest that evaluating SSC implementation according to procedure type may provide additional insights beyond overall compliance rates alone.

From a practical perspective, these findings indicate that strategies to strengthen SSC implementation should focus particularly on maintaining compliance during the Time-out and Sign-out phases, where significant differences between procedure types were observed. Hospitals may benefit from implementing regular SSC compliance audits, providing structured feedback to surgical teams, conducting periodic refresher training, and strengthening multidisciplinary communication as part of patient safety improvement programmes (Lim et al., 2023). International evidence suggests that these implementation strategies facilitate sustained SSC compliance, strengthen teamwork and patient safety culture, and may contribute to reducing preventable adverse events during surgical care. In addition, reinforcing patient safety culture through organizational commitment and continuous monitoring may further improve adherence to standardized perioperative safety practices.

Several limitations should be considered when interpreting these findings. First, the cross-sectional design allows identification of associations but does not establish causal relationships between the type of surgical procedure and SSC compliance. Second, this study was conducted in a single maternal and child hospital with accidental sampling, which may limit the generalizability of the findings to other healthcare settings. Third, although direct observation enabled assessment of actual SSC implementation, this study did not evaluate organizational and behavioral factors that may influence compliance, such as workload, communication quality, leadership support, or patient safety culture. Future multicenter studies involving larger sample sizes and prospective designs are therefore needed to clarify the mechanisms underlying variations in SSC compliance between elective and emergency procedures. Further research should also examine whether improvements in SSC compliance are associated with postoperative outcomes, including surgical complications, surgical site infections, and patient mortality.

Conclusion

This study involved 65 surgical procedures, consisting of 36 elective surgeries and 29 emergency surgeries. Of the total procedures observed, the majority of surgical teams complied with the implementation of the Surgical Safety Checklist (SSC) during the Sign-in, Time-out,

and Sign-Out phases. However, during the Sign-Out phase, several team members did not comply with the instrument-counting component of the SSC. In the Sign-in phase, the analysis yielded a significance value of $p = 0.195$, indicating that there was no significant correlation between the type of surgical procedure and surgical team compliance with SSC implementation during this phase. In contrast, the Time-out and Sign-Out phases showed significant associations between the type of surgical procedure and surgical team compliance with SSC implementation, with significance values of $p = 0.004$ and $p = 0.011$, respectively. Furthermore, the cross-tabulation analysis demonstrated a significant association between the implementation of surgical procedures and surgical team compliance with the SSC in the Central Operating Theater (COT) of the maternal and child hospital in Yogyakarta ($p = 0.006$). Future studies should consider using a larger sample size and including multiple hospitals across Indonesia to improve the generalizability of the findings.

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