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Assessment of Adherence to the Use of the World Health Organization Surgical Safety Checklist Among Medical Staff in Ain Shams University Hospital, Egypt

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ABSTRACT

Introduction: Surgical services are considered one of the main and most important, fundamental health-care services provided in any health-care system. Annually, approximately 310 million operations are performed worldwide. The World Health Organization checklist is aimed at detecting potential safety hazards, improving communication among surgical staff, and decreasing the incidence of drug and surgical site errors. We aim to assess the degree of adherence of medical staff to the safety checklist and to study the effect of supervision on adherence.
Methods: This study was conducted in the Department of Surgery, Ain shams University Hospital, between January 2017 and December 2018, and included all the patients who underwent either elective or emergency general surgical operations in the selected unit at Ain Shams University Hospital. The baseline pre-intervention phase of the study was conducted then the checklist was implemented for 4 months without supervision followed by another 4 months with supervision.
Results: We observed that the incidence of postoperative morbidities (21.40%) before implementation significantly decreased after implementation without (11.2%) and with supervision (4.7%). A significant improvement in adherence was observed in the three groups in terms of the number of patients with missed items in the checklist (10.9%) after implementation without (5.2%) and with supervision (7 patients, 1.6%).
Conclusion: Our results indicated that the implementation of the surgical safety checklist was associated with improved postoperative results and decreased postoperative morbidities linked to the surgery. Further research with a larger sample is needed to investigate the association between the checklist implementation and its effect on patient mortality and survival.
Key words: surgical safety checklist, surgical services, effect of supervision on adherence

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BACKGROUND

Surgical services are considered one of the main and most important,

fundamental health-care services provided in any health-care system. Annually, approximately 280 to 310 million major surgical operations are performed worldwide, which means that >1 of every 25 living human beings will undergo a major surgical operation annually (1). Such a number is large and reflects the importance and significant outcomes of surgical operations on public health.

Surgical operations are associated with different outcomes such as increased risk of mortality and morbidity. Estimations of morbidity and mortality rates vary between different countries and types of surgical operations (2-4). Many published papers estimated that 75 million patients per year develop postoperative complications worldwide, which will eventually lead to >2 million deaths per year (5,6). Many previously published studies in the United Kingdom estimated that one of every six patients who underwent surgical operations had postoperative complications, half of which were avoidable medical mistakes. This costs the united kingdom approximately £1 billion every year (7-9). The numbers are more likely to be much higher in the developed country.

Most iatrogenic surgical adverse events and complications can be attributed to surgical site infections, drug errors such as drug allergies, anatomical site errors, surgical equipment malfunctioning, and retained surgical foreign bodies such as sponges (10).

Checklists can be used worldwide to standardize the quality of medical services provided to patients. The World Health Organization (WHO) has created the "Safe surgery save lives" program, which is aimed at increasing the quality of surgical care provided worldwide. The WHO surgical safety checklist is now considered one of the most used surgical checklists in >4000 hospitals worldwide (11). The WHO checklist is aimed at detecting potential safety hazards, improving communication among surgical staff, and decrease the incidence of drug and surgical site errors (12).

Despite the numerous possible benefits of using the WHO checklist, many factors can contribute to its implementation, such as limited low-income settings, confusion about the aim and purpose of the checklist, and rejection by the surgical staff to use it (13-16).

To achieve successful implementation of the WHO Surgical safety checklist, all health-care providers included in the health system must adhere to the checklist, starting from the hospital manager; this can be achieved by creating a multidisciplinary environment, organizing training groups, and providing constructive feedback in the health-care system (17).

To our knowledge, Egypt is still lagging in the issue of surgical safety practice. Thus, in this study, we aimed to assess the adherence of medical staff to the surgical safety checklist and the effects of supervision on the implementation and patient outcomes, which is justified by the high global incidence of potentially preventable adverse events during surgery. In this study, we aimed to assess the degree of adherence of medical staff to the safety checklist and to examine the effect of supervision on adherence.

METHODS

This pre-intervention/post-intervention study conducted in a surgical unit in the Department of Surgery, Ain Shams University Hospital, between January 2017 and December 2018, and included all patients who underwent either elective or emergency general surgical operations in the selected unit at Ain Shams University Hospital. The final number of patients included was 408 patients.

The baseline pre-intervention phase of the study was conducted between January 2017 and May 2017 to assess the secondary postoperative outcomes before implementing the surgical safety checklist.

In the first week of May 2017, all surgical operation teams had a 1-week training program on the safety checklist. Thereafter, the checklist was implemented for 4 months without supervision, followed by another 4 months with supervision. A circulating nurse was designated as the checklist coordinator after undergoing adequate training. Later, she was responsible for filling out the checklist, which was then integrated with the patient's medical files. The coordinator nurse was in charge of checking the sign-in, timeout, and sign-out phases by interviewing the anesthetists and surgeon or/and operating nurses. Adherence was assessed every month by reviewing the checklist completeness. Patient outcomes were measured and compared with those in the pre-implementation phase.

Statistical analyses

The statistical analyses were performed using SPSS 23.0.A univariate analysis was performed to generate descriptive statistics for the defendant variables (adherence and patient outcomes) as continuous variables presented as mean ± SD. Descriptive statistics was used for the demographic variables such as age, weight, and body mass index. A bivariate analysis was conducted to examine the association between the checklist completeness and type, surgery duration and time, surgeon experience, and checklist

Table 1 - Patients' demographics

		Total	Pre-implementation	Post-implementation	With supervision	Test value	p Value	Significance
		N= 408	n = 147	n = 134	n = 127			
Age (years)	Mean± SD	38.38 ± 12.66	39.35 ± 12.31	36.95 ±13.63	38.76 ±11.96	1.346•	0.261	NS
	Range	3 – 71	15 – 71	3 – 68	16 – 65			
Sex	Female	256 (62.70%)	102 (69.4%)	84 (62.7%)	70 (55.1%)	5.935*	0.051	NS
	Male	152 (37.30%)	45 (30.6%)	50 (37.3%)	57 (44.9%)			

p>0.05, non-significant (NS); p<0.05, significant (S); p< 0.01, highly significant (HS).
*Chi-square test; •One-way analysis of variance

fatigue using the chi-square test. To assess the relationship between adherence and patient outcome, patient outcomes before and after implementation, and adherence before and after supervision were evaluated.

The confidence interval was set at 95%, and the acceptable margin of error was set at 5%. Thus, the following p values were considered: >0.05, non-significant (NS); <0.05, significant (S); and <0.01, highly significant.

RESULTS

A total of 408 patients were included in the study. The mean age of the patients was 38.38 ± 12.66. Of the patients, 62.70% were women, and the rest were men. The patients' characteristics are described in *table 1*. The different diagnoses and types of operation for the whole sample are shown in the *supplementary table (*)* and *supplementary table (**)*.

Of the patients, 348 (85.30%) underwent elective surgery, while the other 60 (14.70%) underwent emergency surgery, with a median surgery duration of 1.96 ± 0.84 hours. Of the total surgeries, 407 were performed under general anesthesia, and only 1 operation was performed under spinal anesthesia (*figs. 1*, *2)*. The total number of mortalities was 6 (2.20%), with only 25 cases (6.10%) of reported missed items in the checklist (*table 2*).

When comparing the postoperative complications among the three phases of the study, we found a significant decrease in the incidence of postoperative morbidities, in which postoperative morbidities

Supplementary Table(*) - Types of operations performed in the sample

		No.	%
Operation	Excision of fibroadenoma	51	12.50%
	Appendectomy	15	3.70%
	MRM	82	20.10%
	Hernia repair with mesh	50	12.30%
	Lap Chol	64	15.70%
	Lap Sleeve	39	9.60%
	Exploration	17	4.20%
	Total thyroidectomy	30	7.40%
	Open chole	2	0.50%
	Conservative breast surgery	18	4.40%
	Above-knee amputation	8	2.00%
	Below-knee amputation	6	1.50%
	Abscess drainage	2	0.50%
	Hemicolectomy	7	1.70%
	Others	17	4.20%

Supplementary Table(**) - Diagnoses of the sample

		No.	%
Diagnosis	CCC	66	16.20%
	Fibroadenoma	33	8.10%
	Appendicitis	10	2.50%
	Breast cancer	98	24.00%
	Toxic goiter	20	4.90%
	Diabetic foot	19	4.70%
	Inguinal hernia	4	1.00%
	Intestinal obstruction	5	1.20%
	PUH	22	5.40%
	Morbid obesity	39	9.60%
	Cancer colon	9	2.20%
	Perforated viscus	4	1.00%
	Strangulated hernia	2	0.50%
	OIH	23	5.60%
	Appendicitis	7	1.70%
	Perforated du	1	0.20%
	Post trauma ulcer	1	0.20%
	Multinodular goiter	10	2.50%
	Splenomegaly	2	0.50%
	Stap abdomen	1	0.20%
	Post colostomy	1	0.20%
	Wrong injection	1	0.20%
	Breast mass	23	5.60%
	Perforated sigmoid mass	1	0.20%
	Breast abscess	1	0.20%
	Adhesive IO	1	0.20%
	Apelvic abscess	1	0.20%
	Rupture spleen	1	0.20%
	Multinodular goiter	1	0.20%
	Anterior abdominal wall abscess	1	0.20%

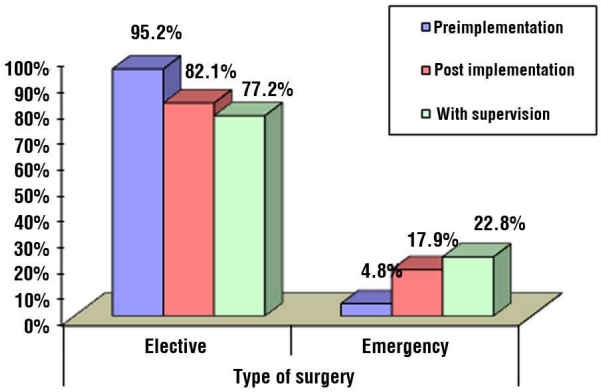

Figure 1 - Types of surgery

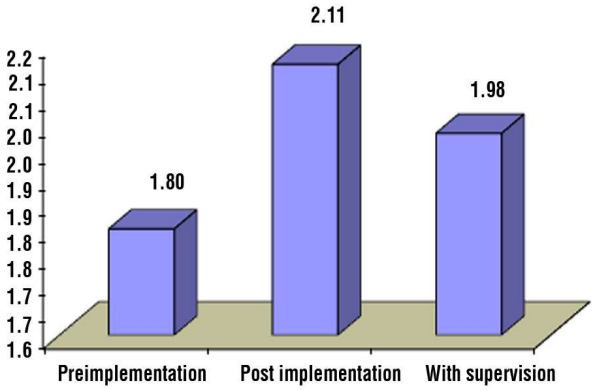

Figure 2 - Surgery durations

Table 2 - Morbidity, mortality, and missed items between the three groups

		Pre-implementation		Post-implementation		With supervision		Test value*	P value	Significance
		No.	%	No.	%	No.	%			
Morbidity	No	115	78.2%	119	88.8%	121	95.3%	19.518	0.003	HS
	ICU	15	10.2%	7	5.2%	2	1.6%			
	SI	15	10.2%	8	6.0%	3	2.4%			
	Both	2	1.4%	0	0.0%	1	.8%			
Mortality	No	142	96.6%	132	98.5%	125	98.4%	1.524	0.467	NS
	Yes	5	3.4%	2	1.5%	2	1.6%			
Missed item	No	131	89.1%	127	94.8%	125	98.4%	16.536	0.035	S
	Equipment failure	7	4.8%	6	4.5%	2	1.6%			
	Wrong patient	3	2.0%	1	.7%	0	0.0%			
	Wrong site	3	2.0%	0	0.0%	0	0.0%			
	SI	3	2.0%	0	0.0%	0	0.0%			

occurred in 32 patients (21.40%) before implementation and in 15 patients (11.2%) after implementation without supervision and in 4 patients (4.7%) before implementation with supervision (p=0.003; *fig. 3*).

A significant improvement in adherence was also observed in the three groups in terms of having the number of patients with missed items in the checklist, with 16 patients (10.9%) before implementation and 7 patients (5.2%) after implementation without supervision and 2 patients (1.6%) after implementation with supervision (p=0.035; *fig. 4*). No significant difference in mortality rate was found among the three groups (*table 2*).

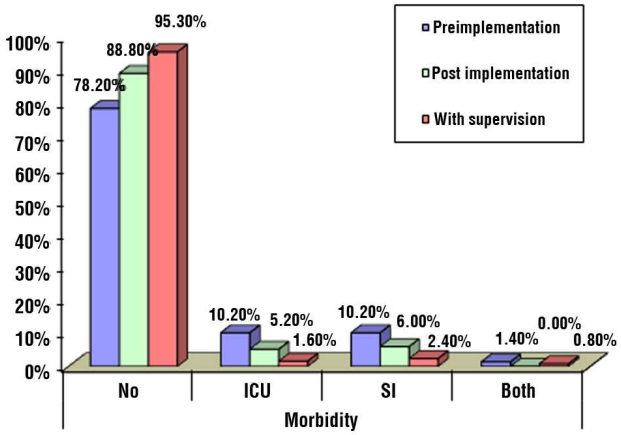

Figure 3 - Morbidities between the three groups

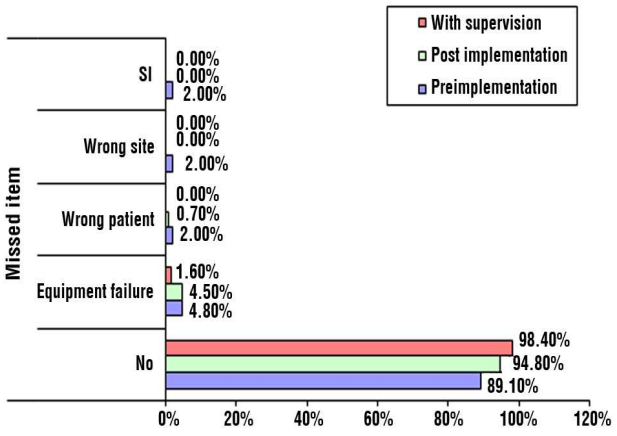

Figure 4 - Missed items between the three groups

Table 3 - Type of anesthesia and surgeon experience between the three groups

		Pre-implementation		Post-implementation		With supervision		Test value*	P value	Significance
		No.	%	No.	%	No.	%			
Type of anesthesia	General	146	99.3%	134	100.0%	127	100.0%	1.780	0.411	NS
	Spinal/ Epidural	1	0.7%	0	0.0%	0	0.0%			
Surgeon experience	Junior	54	36.7%	51	38.1%	71	55.9%	12.306	0.002	HS
	Senior	93	63.3%	83	61.9%	56	44.1%			

Regarding surgeon experience, a significant increase in the experience of junior surgeons was observed after the implementation of the checklist, with an increase in the number of junior surgeons conducting surgical operations under the supervision of less senior surgeons (p = 0.002; *table 3* and *fig. 5*).

DISCUSSION

In this study, we found statistically significant decreases in the incidence rates of postoperative morbidities and missed items in the checklist with the progression of the study into the second and third phases. The WHO safety checklist implementation with supervision was associated with the lowest incidence rates of morbidities and missed items, followed by that without supervision.

The superior survival results associated with the implementation of the surgical safety checklist are attributable to the direct influence on surgery and the surgeon, such as marking the right surgical site. Another aspect of the surgical checklist is increasing the communication and teamwork between surgical staff to create a better environment during the operation.

Such findings may lead to the assumption that the implementation of the WHO safety checklist is associated with better health-care services, which leads to decreased postoperative mortalities and morbidities. Many previously published studies have associated the implementation of the surgical safety checklist with improved mortality and morbidity outcomes. In 2014, a European multicentric study reported that the implementation of a safety checklist was associated with 19% lower risk of postoperative hospital mortality (18). Another study conducted in South America reported a 27% decrease in postoperative mortality after implementing the surgical safety checklist (19). Middle- or low-income countries have less reported evidence of the advantages of implementing a surgical safety checkbox in the routine workup in surgery departments (20).

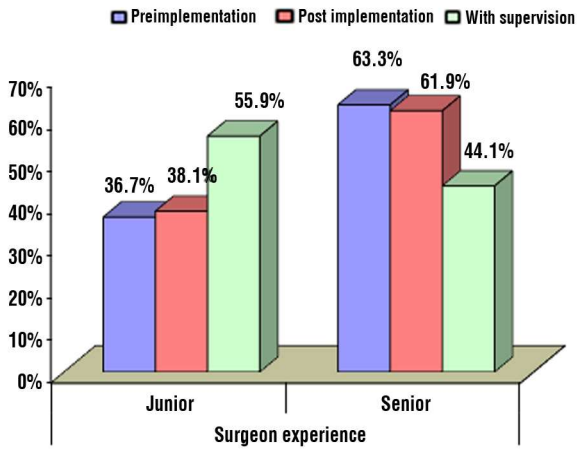

Figure 5 - Surgeon experience between the three groups

In contrast to our findings, those of one of the largest multicentric studies to evaluate the effect of implementing a surgical safety checklist in Canada reported no beneficial gains associated with the implementation of the checklist after comparing the data of >200,000 patients (21). Such results may be attributed to the excellent, high-quality health-care system in Canada, where everyone is covered by health insurance, which may cause fewer comorbidities that lead to less postoperative complications and mortality.

In a previously published meta-analysis conducted in multiple low- and middle-income countries, the implementation of the safety checklist was associated with lower postoperative mortality, even with the significantly lower use frequency of the safety checklist in the lower-income countries (22). This indicates the positive effect of implementing a checklist on surgical outcomes and highlights the importance of spreading the use of the checklist in less developed countries. In such countries, the importance of the checklist may not be brought to the attention of health-care providers; thus, more governmental and academic efforts must be made to generalize the use of a safe surgical checklist in the routine workup of patients undergoing surgery.

In our study, >85% of the surgical operations performed were elective surgeries. This may indicate that the implementation of a checklist may be neglected in the workup for emergency surgeries, with

less time allocated for the preparation of patients, and the importance of the time asset in such settings. The Global Surg study focused more on emergency laparotomy operations and reported that the checklist can be used in the setting of emergency surgery, and the implementation of the checklist was associated with superior results regarding the morbidity and mortality of patients (22).

Many studies have linked the incidence of postoperative complications to the incidence of postoperative mortality and an increased period of hospitalization (23,24). The use of the safety checklist is aimed at reducing the incidence of possibly preventable surgical errors, thus reducing the incidence of postoperative complications associated with increased hospitality time and mortality. By contrast, a previous study reported the implementation of the checklist to be associated with increased postoperative complications; this can be explained by the fact that in a safer, well-controlled, and supervised environment, the chance of early detection of any postoperative complication is increased and will lead to less mortality and shorter hospitalization time, and reduced incidence of readmission after discharge.

In our study, we reported no significant association between postoperative mortality and the implementation of the surgical safety checklist. In contrast to our findings, most findings of the previous papers associated the implementation of the checklist with reduced postoperative mortality. One explanation of our result can be our relatively small sample size and different operations performed with different risks of complications and mortality. As the increased number of easy, low-risk operations may lower the incidence of pre-implementation mortality, the difference between the pre- and post-implementation mortality rates may decrease.

In our study, the implementation of the checklist was associated with more involvement of junior surgeons and decreased involvement of senior surgeons, who were only supervising and ensuring that the junior surgeons adhered to the checklist. The incidence of missed items was lowest in the third phase of our study, when the junior surgeons were under the supervision of the senior surgeons.

Some of the weak points of this study are the relatively small number of patients included in the final analysis, the fact that the study was conducted in only one surgical unit in Ain Shams University Hospital. Thus, it would be difficult to generalize the outcomes of this study.

CONCLUSION

In this study, our results indicated that the implementation of the surgical safety checklist was associated with better postoperative results and decreased postoperative morbidity linked to the surgery. Further research is needed with a larger sample to investigate the association between checklist implementation and its effect on patient mortality and survival.

Conflicts of Interest and Source of Funding

This work was funded by the National Institute of Health, Fogarty International Center, USA, through grant No. 2D43TW007296. Authors declare no conflict of interest.

Authors declare no conflict of interest.

Ethics approval

- The Institutional Review Board (IRB) of Ain Shams University, Cairo, Egypt.
  Date: 5-3-2017Reference: IRB 00006379
- The Institutional Review Board (IRB) of University of Maryland, Baltimore, USA
  Date: Reference: HP-00062968

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