Clinical Science

Improving postoperative handover: a prospective observational study

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Abstract

BACKGROUND: The information provided during the postoperative handover influences the delivery of care of patients in the postoperative recovery unit through their care on the ward. There is a need for a structured and systematic approach to postoperative handover. The aim of this study was to improve postoperative handover through the implementation of a new handover protocol, which involved a handover proforma and standardization of the handover process.

METHODS: This prospective pre-post intervention study demonstrated the improvement in postoperative handover through standardization. There was a significant reduction in information omissions and task errors and improvement in communication and teamwork with the new handover protocol.

RESULTS: There was a significant reduction in overall information omissions from 9 to 3 (P < .001) omissions per handover and task errors from 2.8 to .8 (P < .001) with the new handover protocol. Teamwork and nurses’ satisfaction score significantly improved from a median of 3 to 4 (P < .001) and median of 4 to 5 (P < .001). Duration of handover decreased from a median of 8 to 7 minutes (P < .376).

CONCLUSIONS: The study demonstrates that standardization of postoperative handover improved communication and teamwork and reduced information omissions and task errors. There was an improvement in the quality of the handover after the introduction of the new handover protocol, which was easy and simple to use.

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Handover—the transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to another person or professional group on a temporary or permanent basis.1

Good quality handover is central to the effective delivery of health care.2 The primary intention of any patient handover is the accurate transfer of information about a patient’s state and care plan to ensure the safety and continuity of patient care.3 It is an interactive communication allowing the opportunity for questioning between the giver and receiver of patient information. Handover is also one of the most frequent4 and influential moments of the patient’s journey through hospital as it plays a central role in determining the future management plan of the patient. Missing or fragmented information may lead to delay in medical diagnosis, wrong treatment, life-threatening adverse events, patient complaints, increased health care expenditure, increased length of stay,5 and potentially result in increased morbidity and mortality.1

From a review of sentinel events and root cause analyses, handovers have been identified as the source of significant medical error and adverse patient outcomes. They account for 20% of malpractice claims in the United States.6 A joint commission reported “communication failures” to be the root cause in 70% of sentinel events,7 of which at least half were due to communication breakdowns during handovers. In a recent study of handovers from the operating theater to the intensive care unit, communication errors were present in 100% of handovers.8 Although the level of detail of information exchanged during handovers varies according to each individual case, the lack of a supporting framework or predetermined format results in inconsistent and variable quality handovers.9

The surgical patient is more vulnerable to handover errors than patients in other clinical specialties because of the high number of transitions in care that occur throughout the preoperative, intraoperative, and postoperative phases of care. It is only logical to assume that the greater the number of transitions, the greater the need for handovers during the transitions and thus the greater the likelihood of information being distorted or lost across the phases of care.10 A standardized approach to handover would probably help minimize errors.

Postoperative handover is one such critical phase in the care of surgical patients. Fourteen percent of 419 adverse events in the recovery room were reported to be due to communication failures during the handover process.11 Another descriptive study highlighted that 14% of anesthesiists failed to transfer essential verbal information during the handover. In addition, only one-third of anesthesiists attained a maximum score for the quality of verbal information.12 In a previous study, we showed that postoperative handover is characterized by a high number of information omissions and that distractions during the handover compromise the transfer of information.13

Studies have been done to improve handover in the intensive care unit,14 however, no attempt has been made to improve the quality of handover from the theater to the postanesthesia care unit (PACU). The aim of this study was to develop a simple, easily trainable, new handover protocol to improve the quality of handover of patients undergoing major general surgical operations.

Methods

This was a prospective pre–post intervention study with direct observation of handover conducted in the PACU of an acute teaching hospital in London. A total of 90 handovers were evaluated by a trained researcher, 50 before and 40 after the introduction of a new handover protocol. Handovers of patients who had undergone major vascular (n = 41) and major gastrointestinal (n = 49) surgical procedures were observed. Operative patients included 55 males and 35 females, with a median age of 64 (interquartile range [IQR] 52.7 to 74.0).

Procedure

A trained researcher observed the handovers using an assessment tool to evaluate the quality of the handover before and after the implementation of the new handover protocol. The assessment tool has been described elsewhere.15 Twenty percent of the handovers were observed by a 2nd observer to assess for interrater reliability. The outcome measures were as follows:15

- Information omissions: Omissions were documented when the information was not transferred verbally. Information items were categorized as patient-specific information, anesthesia information, and surgical information.
- Tasks errors: Errors were classed when patient-specific tasks and equipment tasks were not completed appropriately. For example, if monitors and alarms were not set up before the verbal handover, this was classed as an error.
- Teamwork: This was assessed using the behavioral postoperative component of the Observational Teamwork Assessment Tool for Surgery.16 It consists of 5 domains: Leadership, Communication, Coordination, Cooperation, and Situational Awareness, which were rated on a 7-point Likert scale (0 to 7).
- Nurse satisfaction: Recovery nurses rated their overall satisfaction with the handover on a 5-point Likert scale (1 to 5).
- Duration: Measured from the time the patient and operating theater team enters the PACU until theater staff leave the PACU.

Development of a new handover protocol

The new handover protocol consisted of a postoperative handover proforma and standardization of the handover process:
1. **Proforma:** The development of the proforma has been described elsewhere. Appendix 1 demonstrates the new postoperative handover proforma.

2. **Standardization of the handover process was achieved by:**
   - **Surgeon input:** The surgeon participated in the handover in order to transfer the patient's surgical information.
   - **Task sequence:** Equipment and patient-specific tasks were completed first followed by information transfer from the anesthetist and then the surgeon.
   - **Distractions:** No information was handed over until tasks were completed. Verbal handover of information occurred in a sterile environment with limited interruptions and distractions.

**Statistical analysis**

Statistical methods included the Mann-Whitney U test for continuous variables, chi-squared test for categorical variables, and Spearman rank correlation to assess relationships using the Statistical Package for Social Sciences version 16.0 software (SPSS, Chicago, IL).

**Results**

**Interrater reliability**

The interrater reliability calculated by Spearman correlation was found to be significant ($\rho = .964$, $P < .001$).

**Information omissions**

After the new handover protocol, there was a significant reduction in the number of information omissions per handover, from 9 to 3 ($P < .001$) (Fig. 1). The largest reduction in information omissions per handover was observed for surgical information, which decreased from 4.2 to .8 ($P < .001$). Information omissions per handover of both patient-specific information 2.6 to 1.3 ($P < .001$) and anesthetic information fell from 3.4 to 1.5 ($P < .001$).

**Task errors**

The overall number of task errors per handover reduced significantly from 2.8 to .8 task errors per handover ($P < .001$).
(Fig. 2). The number of patient-specific task errors reduced significantly from .3 to .06 errors per handover ($P < .05$). Finally, there was a significant reduction in the number of equipment task errors from 2.5 to .7 errors per handover ($P < .001$).

**Teamwork**

Teamwork (all 5 components) improved significantly, with an overall improvement of median teamwork score from 3 to 4 ($P < .001$) (Fig. 3).

**Nurse satisfaction**

The overall nurses’ satisfaction improved significantly after the new handover, from a median of 4 to 5 ($P < .001$, Mann-Whitney test). After the new handover protocol, 58% of the handovers were awarded a score of 5 of 5 by the recovery nurse compared with only 8% before the new protocol.

**Duration**

Duration of the postoperative handover reduced from a median of 8 (IQR 5 to 12) to 7 (IQR 5 to 9) minutes after the new handover protocol, however, the reduction was not significant ($P = .376$, Mann-Whitney).

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**Correlations**

Spearman rank correlation identified a significant correlation between the number of information omissions and number of task errors per handover before and after the
handover protocol (ρ = .548, P < .001). Thus, information omissions were more likely compounded by the task errors (ie, information omissions is directly proportional to the task errors). The communication component of the teamwork score was negatively correlated with the number of task errors (ρ = −.625, P < .001), demonstrating that poor communication during the handover is associated with more task errors.

The 2-tailed Spearman rank correlation demonstrated a negative correlation between the number of information omissions and teamwork score (ρ = −.663, P < .001), thereby highlighting the importance of teamwork as a vital component in good quality handover information transfer.

**Comments**

The new handover protocol produced a marked improvement in the quality of handover. Information omissions and task errors were significantly reduced and there was considerable improvement in teamwork and nurse satisfaction scores. In fact, improvements were found across almost the entire process following its introduction. The structured approach to the transfer of information from operating theater staff to recovery staff and coordination of tasks performed contributed to the improved teamwork score. Although there was no significant reduction in the duration after the new protocol, the nurses were more satisfied with the overall handover.

The protocol focused on the surgeon’s participation in the handover process, communication, task sequence, and leadership. Most significant is the finding that team members working in a hectic and high-pressure clinical environment can successfully implement a change in their handover practice. Several factors contributed to the success of the new handover protocol implementation in the study. The surgical, anesthetic, and recovery team included a consistent group of people who were supportive of research. The surgeon’s commitment was particularly critical for the successful implementation, which can be seen by the largest improvement in surgical information omissions. Consistent with quality improvement initiatives that involve health care professions, we engaged in a continuous process with the participants, receiving and providing continuous feedback. The feedback of theater and recovery staff both before and during the development of proforma provided critical insight into the implementation process. Engagement with the professionals may also have conferred a sense of ownership to participants, which is essential to the success of quality improvement initiatives that seek to change the behavior.

Before the intervention, the handover process was negatively affected by the lack of surgical information provided, distractions during the handover, and lack of a formalized structure. The new protocol ensured the presence of at least 1 member of the surgical team and adequate transfer of all the information, especially surgical information, in a standardized format. Furthermore, the correlation between information omissions and teamwork emphasized the value of teamwork in achieving the lowest rate of errors.

Avoidance of any variability in the delivery of postoperative handover through standardization of process, implementation of postoperative handover proforma and task sequence, involvement of the “captain of ship” (ie, surgeon), excellent teamwork, and camaraderie, performed in exactly the same manner every time were the key principles of the successful outcome. These led to changes in critical clinical processes, which eventually led to changes in outcomes, as discussed below. We did not focus on outcomes; therefore, this parameter was not measured. Moreover, adverse outcome measures were precluded by low rates requiring large sample sizes. However, we believe that changes in these clinical processes (ie, information omissions, task errors, and teamwork) will impact the clinical and nonclinical outcomes.

Our results echo the findings of poor quality handover from theater to the PACU. Our study also demonstrated that 48% of anesthetic information was not transferred. In the study conducted by Anwari, nurses awarded the highest marks to almost half the anesthetists, however, this figure increased from 7% to 60% after the introduction of the new protocol. Very few studies have attempted to improve postoperative handover. A noteworthy exception is a study by Catchpole et al, which used Formula-1 concepts to improve the handover process in the pediatric intensive care unit. They demonstrated a significant reduction in information omissions and technical errors after standardizing their handover process.

As evident in other high-reliability industries, standardization of the handover has been effective through teamwork, communication techniques, flattening of hierarchy, mutual respect within and across disciplines, and situational awareness, which are key components of a culture of safety. Furthermore, improving coordination of care through a structured communication process is particularly important in environments in which interruptions and multitasking are common, such as the PACU setting. This coordination of care helps to create a “shared mental model” of a patient’s status and the expected clinical course. As a result, any digression from the anticipated postoperative course is more promptly identified.

There was evidence that clinically significant steps in the information transfer process were missed, which at the very least eroded safety margins. The potential of adverse events occurring during the patient’s care became evident in the preintervention phase. Two patients did not receive deep vein thrombosis prophylaxis on their 1st postoperative day because of information omission during the handover process. Introduction of the proforma was effective in ensuring that pertinent information was not overlooked during the handover. Additionally, the proforma served as a reminder to the surgeon to write instructions regarding deep
vene thrombosis prophylaxis on the drug chart on 4 occasions, which otherwise would not have been written and potentially not administered to the patient, affecting the patient’s safety. Formalizing and producing a more standardized handover was accomplished, and the study can be seen as a step in meeting the joint commission’s National Patient Safety Goals for a standardized approach to handoff communication.19

There were several limitations to this study. In any observational study, the question of authenticity of data is of central concern. In addition to mechanisms employed to minimize the observer or Hawthorne effect,20 the observer recorded evidence of this possible effect in the field notes. Furthermore, informal interviews with randomly selected participants following each observation period contributed to our sense of the data’s representativeness. Working group members commented on whether data seemed representative or not; on no occasion did experts question these data. Moreover, the validity of data was also confirmed by significant interrater reliability. Another limitation was the small sample size and the fact that the study was conducted on a single site; each institution has its own barriers to changing culture, therefore, the results may not be broadly generalized. This study also suffers from the traditional biases of a pre–post test design, specifically that we were unable to control for all potential confounding influences. However, a randomized controlled trial of this intervention within 1 institution would be impossible due to the risk of contamination between study groups and feasibility issues. Despite these limitations, we believe that implementation of the new handover protocol indeed standardizes and facilitates communication among health care providers in the PACU. This study did not set out to determine if this new handover protocol improved patient outcomes. Nevertheless, it is important that the likelihood of multiple errors with individual patients was reduced, as the avoidance of compounding errors is a fundamentally important component of safety.21 and has been shown in other studies to affect outcome.22

A further limitation is that while the proforma is effective to ensure that the necessary information is handed over; it does not ensure that the information is understood by the receiving nurse. In this study, the improved nurses’ satisfaction for the overall handover could indicate that their level of understanding of the information communicated during the handover improved. We also observed that the researcher had to facilitate the process by asking the anesthetist and a member of the surgical team to use the proforma for the handover on 4 occasions. This and the high level of engagement with the clinical team during the study highlights the fact that the successful implementation of the protocol was influenced to a large extent by the motivation of the clinical team and that there was a certain amount of selection bias in this study. As the protocol is more widely implemented, we will have to be aware of the need for a strategy for engagement with clinical teams. This also raises the question of sustainability of the protocol when someone is not present to drive the use of the protocol.

Conclusions

Despite any potential failings, implementation of the new handover protocol significantly improved the quality of the postoperative handover through enhanced information transfer, teamwork, and reduced task errors. In most health care settings, the handover in the PACU is the conduit to information downstream when patients are transferred to their final recovery facility. By improving postoperative handover in the PACU, we can ensure that information transferred downstream is made more accurate, comprehensive, and robust. This could potentially ensure a heightened state of vigilance for postoperating complications, improve postoperative care by ensuring that key processes are undertaken, and thus potentially improve postoperative outcomes. We are now undertaking research to evaluate the impact of improved handover on postoperative care and outcomes.

References

# Appendix 1

## Postoperative handover proforma

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<th>Surgical</th>
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<td>☑ Intraoperative surgical course &amp; any complications</td>
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<td>☑ Intraoperative course &amp; any complications</td>
<td>☑ Blood loss</td>
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<tr>
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<td>☑ Anticipated postop problems: bleeding, pain, airway</td>
<td>☑ Antibiotic plan</td>
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<td>☑ Drugs to be restarted</td>
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BP = blood pressure; DVT = deep vein thrombosis; IV = intravenous; NG = nasogastric; UO = urinary output.