

Implementation of a postoperative handoff protocol

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Background: Standardised handoff protocols have become necessary patient safety tools in the perioperative venue. In this study, the authors took a validated standardised perioperative handoff protocol and implemented it into their institution to improve the perioperative handoff communications from the cardiac operating theatres to the ICU.

Methods: This was a prospective, unblinded cross-sectional study. During a 6-week pre-intervention phase, 30 perioperative handoffs were observed and data were collected. Then a new structured hand-off protocol was implemented for one month, which focused on training all participating healthcare providers. This was followed by a post-intervention audit consisting of 30 operating room theatre-to-ICU handoffs using the same methodology as the pre-intervention period.

Results: Overall attendance significantly increased from 20 to 86.7%. The percentage of parallel conversations decreased from 100% pre-intervention to 60% post-intervention ($p < 0.0001$). The mean number of interruptions of the anaesthesiology handoff report decreased from 3.37 to 0.77 ($p < 0.0001$) and of the surgery report from 1.84 to 0.27 ($p < 0.0001$). Information-sharing scores improved among all handoff attendees with the Overall Information Sharing Score (OISS) increasing from 51.47 to 88.24% ($p < 0.0001$).

Conclusions: The implementation of a perioperative handoff protocol resulted in a drastic improvement in attendance, decrease in the number of interruptions, and improved information sharing. Future research should focus on patient-specific outcomes.

Keywords: handoffs, handover, ICU handoff, patient safety, perioperative handoff

Introduction

Handoffs have been defined as the transfer of responsibility and patient-specific information from one group of caregivers to another to ensure the continuity and safety of patient care.^{1–3} Postoperative handoffs are a specific type of handoff that represent a critical step in the management of surgical patients. Surgical patients' postoperative management is complex and adequate knowledge of intraoperative events is critical to managing their ICU stay. Communication between the senders of the handoff report (anaesthesiologists, surgeons and theatre nursing staff) and receivers of the report (ICU physicians and ICU nursing staff) is often poor.⁴ The unstructured presentation of information, noisy ICU environment, and discussion between healthcare workers from different disciplines and at different levels of training add to the burden of communication.^{1,5} On arrival at the ICU, patients may be clinically unstable and require urgent intervention, yet time to review the medical record prior to these critical interventions is limited. The postoperative handoff serves as an important source of information, ensuring coordinated management by multiple disciplines.⁶

Despite its importance, the practice of a structured postoperative handoff protocol in our region's hospitals is non-existent. The practice of transferring patients without the attendance of a surgeon, and handing patients over to the ICU team with little clinical discussion, is commonplace. The authors set about studying the current nature of postoperative handoffs in the cardiac surgical ICU at a tertiary-level hospital. A validated handoff protocol was implemented and the handoff process re-evaluated. The hypothesis was that the implementation of a validated

structured handoff protocol would improve the quality of the handoff with regards to attendance, information sharing, and healthcare provider satisfaction. The successful implementation of a structured handoff protocol would validate such a tool for broader implementation in our health care environment.

Methods

A prospective, unblinded study with pre- and post-intervention design was performed at a large provincial South African tertiary hospital from August 2012 to March 2013. Institutional ethical review gave permission for the attendance of an independent observer to observe and record handoffs during this period. This observational study consisted of 30 pre- and 30 post-interventional evaluations and audio recording of cardiac theatre to ICU handoffs.

Evaluation focused on the handoff duration, technical aspects of the handoff, and information sharing between healthcare providers. An unblinded observer who was not a member of the clinical team captured a description of the ICU environment and post handoff events. Healthcare providers completed a post-handoff satisfaction survey and an overall handoff score was calculated. Only elective cardiac surgery cases were included with handoffs occurring between 7:00 am and 7:00 pm. Following the pre-intervention audit, a validated structured handoff protocol was implemented.^{1,7} This protocol was developed at a large tertiary institution in the United States and was implemented after minor additions (e.g. changed the order of the handoff protocol; limited nurse checklist to six items; added an element to the surgical checklist to comment on the pacemaker) were made to satisfy institutional requirements. The

Table 1: Handoff sequence of events

Step	Action
1	Theatre staff to phone ICU 30 min prior to arrival to prepare the ICU bed
2	Upon arrival the patient is connected to the ICU ventilator and monitor with no verbal communication of handoff information during this time
3	Once the patient is stable and all monitoring in place all team members introduce themselves
4	The anaesthesiologist does a handoff following the 20 points on the handoff checklist and takes questions from the ICU team
5	The surgeon and then the theatre scrub sister do their respective handoff following the six points included in the handoff checklist
6	The ICU team formally ends the handoff report once all questions have been clarified

Table 2: Postoperative handoff data points monitored

No.	Data points observed
1	Whether ICU was phoned prior to patient arrival
2	Time from arrival of patient to start of handoff report
3	Time from start to completion of handoff report
4	Description of ICU environment
5	Healthcare providers attending the handoff report and reasons for their absence
6	Equipment problems during handoff and description thereof
7	Information shared during handoff report
8	Number of interruptions, parallel conversations and questions during the handoff report

protocol focused on ensuring attendance of senders and receivers of the handoff report. Practical aspects regarding communication during the arrival and stabilisation of patients in the ICU, as well as during the handoff report, aimed to minimise interruptions and parallel conversations. A checklist containing essential information to be communicated during the handoff was installed above each ICU bed. Receivers of the handoff report were encouraged to ask questions at the end of the handoff and to formally end the handoff once all patient-specific information was clarified. Table 1 explains the handoff sequence of events that the protocol recommends.

ANAESTHESIA	SURGICAL
<ol style="list-style-type: none"> Past medical Hx Past surgical Hx Allergies Baseline vital Tx Baseline labs Procedures e.g. epidural/spinal Invasive lines e.g. CVP/A-line IV access, size & location Fluid totals Blood loss Paralytic status Narcotic totals Antibiotics Last act Bypass yes/no Bypass time Aortic X-clamp time Ventilation strategy Pacemaker setting Anticipatory guidance 	<ol style="list-style-type: none"> Chief surgical problem Surgery performed Surgical complications Drains/tubes & positions Pacing required Anticipatory guidance
	THEATRE STAFF
	<ol style="list-style-type: none"> Procedure Skin closure & integrity Theatre time Drains Adverse theatre events Anticipatory guidance

Figure 1: Structured handoff checklist

The new structured handoff protocol was implemented over a one-month period via focused training of all participating healthcare providers. Training was conducted through presentations, booklets, and visual aids in the cardiac theatre and ICU. Following the implementation of the handoff protocol, a four-week period of guided intervention was completed. This consisted of healthcare providers familiar with the handoff protocol observing and guiding the use of the protocol in ICU. This was followed by a post-intervention audit consisting of 30 theatre-to-ICU handoffs using the same methodology as for the pre-intervention period. The independent observer monitored data points during the postoperative handoff (see Table 2).

Senders of the handoff report were expected to communicate certain information regarding the patient and procedure that were deemed essential for a thorough handoff report, starting with the anaesthesiology checklist. Each sender of the handoff report was expected to end with a comment regarding anticipatory guidance for the ICU team. Once the ICU team clarified any questions from the anaesthesiologist, the surgeon (and then the theatre nursing staff) proceeded to report on the six points included in their checklist. The theatre nursing staff checklist was based on current nursing council guidelines implemented in our institution (Figure 1).

An information sharing score (ISS) was calculated for each discipline's handoff report and the handoff as a whole. The ISS for each discipline was calculated with the following formula: (number of categories verbally reported by each discipline/number of categories that should be reported for that discipline) x 100. An Overall Information Sharing Score was calculated using the following formula: (number of categories verbally reported by all disciplines/number of categories for all disciplines) x 100. During the handoff report the independent observer counted the number of interruptions, parallel conversations, and questions from the ICU team. The audibility of the report was recorded as being audible always, mostly, or sometimes. Two hours after the handoff report, the observer contacted the unit to capture data regarding any phone calls made to senders of the handoff report to clarify information. He also enquired regarding any unintended interruptions or complications with intravenous (iv) lines, additional procedures required or return to the operating theatre (OT), requirements for re-intubation or cardiopulmonary resuscitation (CPR), and whether the routine medications were prescribed correctly.

Upon completion of the handoff report all members of the handoff team were asked to complete a post-handoff survey. This consisted of nine statements and a five-point Likert scale with the options strongly disagree, disagree, neutral, agree, and strongly agree. Since some handoff providers felt that certain questions did not pertain to them, a sixth option 'not applicable' was included (see Table 3).

Due to the fact that patient outcome was not measured, an overall handoff score was calculated which contained subjective and objective handoff elements that reflected the efficiency, efficacy, safety and order of the handoff (see Table 4). Staff satisfaction with the handoff was the last element counted in the overall handoff score.

Data capturing was done with EpiData® software ("The EpiData Association", Odense, Denmark) and analysis performed with Stata MP® (StataCorp LP, College Station, TX, USA). Kruskal–Wallis

Table 3: Post-handoff survey questions

No.	Questions
1	I was satisfied with the OR to ICU handoff for this patient
2	The report given by the surgery provider was satisfactory
3	The report given by the anaesthesiology provider was satisfactory
4	I could hear all of the report
5	I received information about potential problems that could arise in this patient
6	I received information about things I need to follow up
7	The physical act of transferring monitors and equipment went smoothly
8	It was clear when the handoff started and ended
9	I received guidance on what to do if certain problems arise

Table 4: Overall handoff score questions

No.	Questions
1	Was ICU phoned prior to handoff?
2	Was all equipment functioning well in transit?
3	Were all providers present at the bedside?
4	Did the handoff take < 15 min?
5	Was anaesthesia ISS more than 80%?
6	Was surgical ISS more than 80%?
7	Was nursing ISS more than 80%?
8	Was the overall ISS more than 70%?
9	Was the total amount of questions at end of handoff less than 5?
10	Were less than two phone calls made to senders in 2 h post-handoff?
11	Were there no interruptions during handoffs?
12	Were there no parallel conversations during handoffs?
13	Was overall satisfaction for Q1 on handoff survey > 80%?

Note: ISS = information sharing score.

and Mann–Whitney tests were used to determine whether or not the median values of valued variables differed, and they were used in place of the ANOVA or t-test methods because the distributions of the continuous valued variables were non-normal.

Results

The implementation of the handoff process resulted in decreased parallel conversations, increased audibility of the report, and an increase in the number of attendees present during the handoff (Table 5). Anaesthesiologists, theatre nursing staff, and ICU staff were present at all pre- and post-intervention handoffs. The surgical team was not present 5 times (out of 30), and there was one instance of the ICU physician being absent. Moreover, it was noteworthy that the number of interruptions and questions asked by the ICU team decreased (Table 6).

There was no significant association between protocol implementation and equipment malfunction as observed by the independent observer (Table 7). Equipment problems related mostly to the malfunctioning of arterial lines, infusion pumps, and ventilator breathing circuits and were unrelated to the handoff process. That being said, the anaesthesiologists did report a decrease in the number of equipment problems that reached statistical significance (see Table 7). Theatre staff were very compliant with informing the ICU of their arrival during 90%

Table 5: Key indicators of improved communication

Factor	Pre-intervention	Post-intervention	p
Parallel conversations	100%	60%	< 0.0001
Report could be heard	53.3%	96.7%	< 0.0001
Overall attendance	20%	86.7%	< 0.001

Table 6: Mean interruptions and questions asked during handoffs

Interruptions/questions	Pre-intervention	Post-intervention	p
Anaesthesiology report	3.37	0.77	< 0.0001
Surgery report	1.84	0.27	< 0.0001
Nursing report	0.79	0.2	< 0.01
Total amount of questions from ICU team	5.7	1.83	< 0.0001

of pre- and post-intervention handoffs ($p = 1.0$). Although the mean time between arrival at the ICU and the start of the handoff report increased, the duration of the post-intervention handoff shortened (see Table 7). There was no significant difference in distractions between the different cohorts of handoffs. Most distractions seem to emanate from ringing telephones and in handoffs that occurred during visiting hours.

There was no statistically significant association between the handoff implementation and data points collected during the first two hours post-handoff. Only one patient required an emergency sternotomy for pericardial tamponade. All prescription charts were filled in correctly.

The Information Sharing Scores increased for clinical services and overall (Table 8). The Likert scores for the nine statements showed a statistically significant improved score for the option ‘strongly agree’ by members of the theatre and ICU nursing staff. However, this reached statistical significance only for the scrub technician’s response to Q8 (see Table 3) ($p = 0.038$). The only two questions that did not reach statistical significance for improvement in the ICU nursing staff responses were for Q1 (see Table 3) ($p = 0.096$) and for Q7 (see Table 3) ($p = 0.273$). The anaesthesiologist reported an improved response to the option ‘strongly agree’ to statements 4, 5, 6, 8 and 9. Only statement 8 did not reach significance ($p = 0.155$). Neither the anaesthesiologist, ICU physician, nor surgeon reported an improved response for option ‘strongly agree’ to Q1 (see Table 3). However, this only reached statistical significance for the surgical team ($p = 0.024$). The overall handoff score as calculated from a total of 13 (see Table 4) improved from a mean of 3.47 to 8.27 ($p < 0.0001$).

Discussion

Ours is another handoff study which demonstrates that using a handoff protocol improves communication and teamwork.^{8–14} This was shown first by the improvement in provider attendance at handoffs. Attendance of providers at the handoff is essential in order for teamwork to occur: a team does not exist unless its members are present. Furthermore, attendance establishes the context for the sharing of relevant patient data amongst providers. Although this study did not quantify the reasons for

Table 7: Equipment malfunction and time intervals

Factor	Pre-intervention	Post-intervention	<i>p</i>
Equipment malfunction	36.7%	26.7%	0.405
Anaesthesia reported equipment problems	34%	12.8%	0.038
Arrival to start of the handoff	3.37	7.4 min	< 0.0001
Duration of the handoff	10.97	8.03 min	< 0.0001

Table 8: Summary of information sharing scores (ISS)

Score	Pre-intervention	Post-intervention	<i>p</i> -value
	Mean ± SD	Mean ± SD	
AISS*	49.5% ± 13.73	89.67% ± 11.89	< 0.0001
SISS†	54.76% ± 31.85	90% ± 25.49	< 0.0001
NISS‡	46.19% ± 15.32	70% ± 19.26	< 0.0001
OISS§	50.39% ± 11.48	85.98% ± 10.89	< 0.0001

*AISS: anaesthetic information sharing score.

†SISS: surgical information sharing score.

‡NISS: nursing information sharing score.

§OISS: overall information sharing score.

surgical team absence, it appears that the writing of operation notes or surgical preparation for the next case placed the biggest burden on surgeons' ability to attend handoffs. Second, we demonstrated that parallel conversations and interruptions decreased with use of the handoff protocol. We believe that the protocol creates an improved environment for information exchange and dialogue. This leads to better team-based decision-making processes and empowers the ICU staff through the dissemination of anticipatory guidance by theatre providers. Third, the improved ISS for each discipline demonstrates improved communication. ISS is partly dependent on the use of checklists; however, the use of checklists should not add to the administrative burden of healthcare workers and should not be seen as an easy fix in response to the complex nature of handoffs. Simply giving structure to information does not necessarily make information useful or relevant.⁶ Lastly, we found that there were fewer questions asked in the structured handoff cohort, which we believe reflects improved communications. We believe the decreased number of questions asked in our study reflected the improved overall information sharing that occurred with the structured handoff, which thereby eliminated the need for provider follow-up queries. The asking of fewer questions may also have resulted in the decreased handoff time that we found in our study. Spearman correlation tests showed an association between OISS and the number of questions ($p < 0.0001$) as well as handoff time ($p = 0.0034$). The decrease in the amount of questions corresponds with the improved audibility of the handoff report (Mann-Whitney test $p = 0.0027$).

Other studies have also shown that the use of a standardised handoff template provides the best scenario for optimal information sharing.^{1,5,15,16} We also observed that the standardisation overcame the lack of communication skills displayed by many healthcare workers.¹⁶ It prompts verbal communication and feeds into the collective information push model promoted by Abraham *et al.*¹⁷ Senders of the handoff

report know what important patient-specific information to communicate to the receivers of the report. In an information pull model, the receivers of the report have to extract information from the handoff process and this can lead to loss of information.¹⁷

While we have demonstrated much success with use of the handoff protocol, there were also barriers to its implementation. One such barrier was that, prior to this study, the anaesthesia and surgical teams were never required, asked, or expected to attend a handoff. Non-attendance was, in fact, a common accepted practice in the local culture. Moreover, the providers never spoke as a team about a patient's management. Changing this behaviour required a major institutional paradigm shift. This daunting task was left to the handoff implementation team and, as you can imagine, there was push-back to the change. Another significant barrier was the sceptical viewpoint held by many clinicians as to whether a structured handoff process could really improve communication or, more importantly, could result in improved patient care. It was therefore also necessary that the study implementation team overcome and eliminate such scepticism through educational efforts. Lastly, the handoff protocol incorporated checklists, which have been proven to be beneficial in the handoff process; however, they can serve as a barrier to communication if they are designed incorrectly. For instance, lengthy checklists may negatively influence their own function, since there is a tendency to perform other tasks while reading the checklist in an effort to expedite the handoff.⁶

There were also many lessons learned during this study. First, it is important to ensure and validate that each and every team member understands his/her importance in the process. A valued team member quickly becomes the flag-bearer for the intervention. Second, the intervention must be perceived as not impinging upon the rapid time management and turnover of the theatre. If time spent during a handoff is perceived as wasted time, providers will quickly abandon the process. Third, a quintessential lesson learned while assisting other institutions in implementing their handoff protocol is the need for upper management support (e.g. division chiefs, chief of staff, president, and so forth). This is due to the major cultural paradigm shift that must be made. Management support provides a means to deal with the cultural resistance that will ensue during use of the new handoff process; such support manifests itself first vocally and then, if warranted, through interventions for those still unwilling to comply. Lastly, sustainability is the means of ensuring that a process continues to be used correctly over time. A few studies have shown that erosion of proper use of the handoff occurs with time^{18,19} while a recent sustainability study of a postoperative handoff study showed positive results.²⁰ Based on the existing literature and our own experience conducting handoff research, which includes assisting institutions to implement their own handoff protocols, we know that continual assessment and re-education on the handoff protocol is essential in preventing such long-term erosion and misuse from occurring.

Our study has several limitations. First, this study was performed in the cardiac theatres of a tertiary-level hospital with around 40 elective cardiac admissions per month. The results may therefore not be applicable to other kinds of hospitals, types of ICU, or high-acuity environments. Second, the study was not designed to show a difference in terms of hard outcomes such as morbidity, mortality, or length of ICU stay. Third, in theory, the Hawthorne effect may have played a role in influencing handoff providers' participation in the study. This was, however, limited by the observer's nonparticipation in the handoff. The observer did not interact with

the handoff providers and did not have any clinical authority over them. Fourth, the unblinded observer knew the intervention had occurred, which may have biased him in the recording of the observation data. Finally, the same handoff observation sheets and surveys were used for all cases in this study. They were based on similar assessment tools in studies with the same design using the same handoff protocol.¹ There is, however, no agreed standard for such instruments.

The goal for future research is to focus on integrating patient-specific outcome measures.⁴ The measures may include analysing reduction in hospital stay, reduction in the number of returns to the ORs, reduction in the length of stay in the ICU, and so forth. Future studies may also explore the entire perioperative journey of a patient and look at handoffs that occur ward-to-theatre, between anaesthetists, and also from ICU-to-ward.³ As patients travel along the healthcare pathway from admission to theatre and beyond, the content of communication often disintegrates and the recollection of treatment can become increasingly fragmented. Informed healthcare professionals may recognise this phenomenon for the hazard that it is and institute adequate interventions to prevent it from occurring.

This study confirms that the implementation of a structured handoff protocol improves the quality of the information exchange. However, the best mode of information exchange and method to measure patient outcome is yet to be determined. A standardised handoff protocol that combines verbal communication with a written template may offer the best solution to communication failures during transfer of patient care.^{21,22} We believe that our findings demonstrate and emphasise the importance of a structured handoff process regardless of the country wherein the handoff occurs.

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