Original Article

The Effect of Standard Patient Handover Intervention on Improving the Quality of Transfer from the Operating Room to the Intensive Care Units

Zohreh Nematollahzadeh[1], Simin Jahani[1], Saeed Ghanbari[2], Neda Sayadi[1]

[1]Nursing Care Research Center in Chronic Diseases, [2]School of Public Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

ORCID:
Zohreh Nematollahzadeh: 0000-0002-0896-4459
Simin Jahani: 0000-0002-4407-6993
Saeed Ghanbari: 0000-0002-8696-8447
Neda Sayadi: 0000-0002-8537-3185

Abstract

Background: Handover from the operating room (OR) to the intensive care unit (ICU) is a complicated process that may endanger patients' lives. **Objectives:** The present study determined the effect of a standard patient handover protocol on the quality of transfer from the cardiac OR to the cardiac ICU. **Methods:** A quasi-experimental study was conducted in 2020 at an adult cardiac surgery center in Ahvaz city, Iran. Sixty-two handover cases were assessed before ($n = 31$) and after ($n = 31$) a training intervention on the nursing staff in the OR and ICU. The training intervention covered the process of standard handover. A checklist was used to evaluate the quality of care through the process of handover. The checklist consisted of three subscales. The independent samples *t*, Fisher's exact or chi-square tests were used to analyze the data. **Results:** The mean score of the technical errors was 10.61 ± 1.20 before the intervention and changed to 12.61 ± 0.80 after the intervention ($P < 0.001$). The mean score of ignoring information was 10.21 ± 1.78 before the intervention and changed to 14.00 ± 1.92 following the intervention ($P < 0.001$). **Conclusion:** Implementation of a standard handover protocol for post-cardiac surgery patients can decrease the intermission and improve the quality of care during patient handover.

Keywords: *Intensive care unit, operating room, patient handover*

Introduction

In 1999, the Institute of Medicine estimated that approximately 44,000–98,000 deaths occur annually in the United States (US) hospitals due to errors related to patient safety. The improper patient transfer has been identified as one of the main causes of medical malpractice. A healthcare provider cannot be present 24 h a day, 7 days a week. Therefore, the caring staff may inevitably be changed, and the process of patient handover may occur several times during patients' hospital stay.[1] The terms "patient transfer" and "patient handover" are usually used interchangeably and refer to the process of transfer of care from one person or care provider to another person or team. This process includes the transfer of information, responsibility, and authority.[1-3] The patient handover process should provide accurate and up-to-date information about the patient's current clinical condition, care plan, recent changes in the patient's clinical condition, and predictable changes. Effective and efficient patient handover allows the healthcare teams to provide safe and effective patient care without disrupting the continuity of care.[4-6] Transfer of patients from operating room (OR) to the intensive care unit (ICU) is a high-risk procedure both due to the patient's unstable physical condition and for the multiple handovers that occur between the healthcare providers (i.e., between anesthesiologists, surgeons, operating room nurses, intensive care staff, etc.).[7] Evidence shows that many adverse events occur during the patient transfer from the OR to the ICU due to improper patient handover. Failure to transmit information about events that

Address for correspondence: Dr. Neda Sayadi, Department of Medical and Surgical Nursing, School of Nursing and Midwifery, Nursing Care Research Center in Chronic Diseases, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
E-mail: sayadi_neda@yahoo.com

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occurred during surgery can lead to inadequate monitoring, medication errors, and other adverse events.[8] However, staff training on care transfer can improve the process of handover and prevent transfer-related adverse effects.[9] Checklists are emerging as a reliable way to standardize communication during the transfer of care. Studies have shown that technical errors and verbal omissions are significantly reduced after the implementation of patient transfer protocols.[10,11] Confirming the significant effects of handoff tools used in US hospitals, a systematic review suggested that experimental studies should be conducted to evaluate and improve the existing care transfer tools.[6] However, few studies have been conducted in this area. A study reviewed the standards of patient safety during the handover from ICUs to general wards.[12] Two studies assessed the process of patient handover in emergency trauma situations[13] and post-anesthesia care units.[14] A study also examined the effect of a checklist on the quality of patient handover from the OR to the ICU.[15] Another study also implemented an electronic checklist to improve the patient handover from the ward to the OR.[16] Nonetheless, the published studies are limited to specific clinical settings[15,16] or focussed on the process of handover during the shift change.[2] Abraham *et al.*[6] also have criticized some studies due to the limited sample size. Furthermore, only one study in Canada examined the effect of a standardized handover on the process of patient transfer from a cardiac OR to ICU. Also, the latter study reported beneficial effects on decreasing the disruptions and improving the patient care; however, due to the study limitations such as small sample size, the authors recommended that further studies be performed with larger sample sizes and in other areas of the world.[8]

Objectives

This study aimed to determine the effect of a standard patient handover protocol on the quality of transfer of intubated adults from the cardiac OR to the cardiac ICU.

Methods

Study design and participants

This study is an interventional study that was performed over a 6-month period from May to November 2020 in Golestan Hospital of Ahvaz city, Iran. The sample size was calculated based on the findings of an earlier study, in which the percent of handovers with interruptions was 66% and changed to 13% after the intervention.[8] Then, considering an α of 0.05 and a power of 90%, and P_1 and P_2 of 13% and 66%, respectively, the sample size in each study phase was estimated at 31.

The eligibility criteria were consent to participate in the study and being ready to be transferred to the ICU based on the diagnosis of a specialist physician. Patient death before transfer and being transferred to non-ICU wards were selected as the exclusion criteria. The patients entered the study via a consecutive sampling. Because the handover was performed by the same staff and it was not possible to blind the study, first the control group ($n = 31$) and then the intervention group ($n = 31$) were recruited. In other words, a non-random allocation was used.

Data collection instruments

The data collection tool consisted of three parts. The first part included questions on demographic and occupational information of nurses as well as demographic and medical information of patients. The second part was a checklist containing 11 questions on the patient's condition during the surgery including patient details, infection precautions, procedure details, comorbidities, intraoperative events (such as intubation, ventilation, monitoring, catheters, bypass separation), post-operative condition, OR nursing report/pump expert report, needing rapid estuation, and anticipated events (such as a need for being transplanted, valve dysfunctions, tamponade, homeostasis problems, stroke, arrhythmias, vascular paralysis). This part was completed by the anesthesiologist.[8] The third part included a checklist designed by Chenault *et al.* to assess the quality-of-care transfer. This checklist has three subscales, namely, technical errors, information ignorance, and observed errors. The technical errors subscale contains 13 items addressing the lack or defect in functions that occur during the handover of patients from the cardiac OR to the cardiac ICU. The information ignorance subscale contains 14 items examining the complete and accurate exchange of patient data during the handover. The observed error subscale does not have any specific items. In this way, the observer records specific errors that occur during the transfer but are not mentioned in the previous two subscales. These errors should not normally occur by cardiac operating room staff and are the result of significant negligence in the process of patient care. This part was completed by the researcher. Examples of such errors include incorrect connecting of pipes, use of incorrect fluids, providing incorrect patient information, failure to monitor end-tidal carbon dioxide ($ETCO_2$), incorrect labeling of liquids containing drugs, etc. The checklist was completed by the researcher, and all items were scored either 1 ("No") or 0 ("Yes"). The overall score of the checklist can range from 0 to 27.[17] For validity and reliability assessment, first, the checklists were translated from English to Persian and then back-translated into English. The translation process was performed by two people independently. Then, for content validity assessment, the instruments were provided to 10 nursing faculty

members, including an anesthesiologist and cardiologists at Ahvaz Jundishapur University of Medical Sciences, to be assessed for relevance, clarity, and fluency of items. After implementing the suggestions and confirming the content validity, the reliability of the second part of the instrument (i.e., intraoperative and post-operative events) was calculated through inter-rater assessment. To this end, two independent raters completed this instrument in 10 cases, and then the Kappa agreement coefficient was calculated at 0.7. The researcher also implemented the Chenault checklist in 100 transfer cases, and then the reliability coefficient was calculated through the Kuder–Richardson formula of 0.819 and 0.855 for the technical errors and information ignorance subscales, respectively.

Intervention

First, the researcher assessed the quality of handover in 31 patients with inclusion criteria who were recruited consecutively in the control group. The handovers in the control group were done routinely without any intervention. After the sample size was completed in the control group, the researcher trained the nursing staff [i.e., all nurses, nurse assistants, and nurse anesthetists who usually take part in the handover of patients between OR and ICU ($n = 31$)] in the standard process of handover, based on the handover checklist items. The patient delivery and receiving staff were trained to be fully present and establish face-to-face communication during handover and prevent any possible interruptions during patient transfer. They were urged not to allow some minor actions such as adjusting the infusion pumps, moving pipes and tubes, or other less important issues to diminish their focus on the handover process. The deliverers were also trained to take the time to answer potential recipients' questions about the patient and what happened to them in the OR and the recovery room. The content of the training sessions was prepared through a literature review[8,10,11,18,19] and was approved by four ICU nurses and an anesthesiologist. All deliverer and recipient staff were also trained to communicate with each other before the operation, agree on how to perform the handover in accordance with the standard, and clarify the process. They also were trained on how to fill out the patient transfer checklist during the operation, during the handover and transfer, and on how to use it as a patient handover protocol. After the intervention phase, a nurse anesthetist completed the checklist for the next 31 handovers/transfers, with the constant supervision of the researcher. The researcher also evaluated and recorded the process of patient handover/transfer using Chenault *et al.*'s checklist.[17]

Ethical consideration

This study was conducted according to the last version of the Helsinki Declaration. The study protocol was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1399.226) and was registered at the Iranian Registry of Clinical Trials with the registration number IRCT20200922048807N1. The study aims and procedures were explained to all of the participants and they all signed a written informed consent before entering the study.

Data analysis

We used the SPSS software version 16 to analyze the data. Descriptive statistics (i.e., mean, median, standard deviation, minimum, maximum, frequency, and percentage) were used to describe the characteristics of the study groups. The Shapiro–Wilk test was used to examine the normality of the quantitative variables. Then, Fisher's exact or chi-square tests were used to compare the categorical variable between the two groups. Also, the independent samples *t*-test was used to compare the mean of the quantitative variables between the two groups. The level of significance was selected at less than 0.05.

Results

In this study, we trained 31 staff participating in the process of handover and transfer, and then we evaluated a total of 62 handover and transfer cases, 31 before and 31 after the staff training. The mean age of the staff who participated in this study was 33.18 ± 8.65 years; most of them (64.51%) were females, 71% had a work experience of more than 5 years, and 93.5% had a bachelor's degree in nursing [Table 1]. Table 2 compares the demographic characteristics of the patients in the control and intervention groups and shows that the two groups were homogeneous in terms of their mean age ($P = 0.092$), gender ($P = 0.58$), education level ($P = 0.26$), and marital status ($P = 0.23$). No case was observed in the area of observational errors. However, the mean score of technical errors was 10.61±1.20 before the intervention and subsequently increased to 12.61±0.80. The observed change was statistically significant when the independent samples *t*-test was performed ($P < 0.001$). Furthermore, the mean score of information ignorance was 10.22±1.78 before the intervention and subsequently increased to 14.00±1.92, and the observed change was significant in the *t*-test ($P < 0.001$). Table 3 presents the details of changes in the technical errors' subscales. Although most items have been improved after the intervention, only changes in the "availability of file on the patient's bed" and "readiness of the chest tubes" were statistically

Table 1: Demographic and occupational characteristics of nurses

Variable		*N*	%
Gender			
	Female	20	64.5
	Male	11	35.5
Age (years)			
	< 30	7	22.6
	30–35	17	54.8
	36–40	3	9.7
	40 <	4	12.9
Work experience (years)			
	5 <	22	71
	< 5	9	29
Education level (degree)			
	Bachelor	29	93.5
	Masters	2	6.5

significant in the chi-square test (P<0.001). Table 4 also presents the details of changes in the information ignorance subscale. According to the chi-square test and at a significance level less than 0.001, changes were statistically significant in the items related to mentioning the "patient weight," "bypass duration," "issues related to bypass separation," "size of the endotracheal tube," and the "results of echocardiographic examinations."

Discussion

In the present study, the mean score of technical errors during handovers was significantly different before and after the intervention. In other words, the frequency of technical errors has significantly reduced after the intervention and using the standard handover protocol. However, the observed differences were mainly related to the two items of "availability of file on the patient's bed" and "readiness of the chest tubes." The insignificant changes in other items might be attributed to the fact that these items are routinely performed by the health providers. The findings of this study are consistent with the results of Dusse *et al.*,[11] which showed that the use of a standard protocol for patient handover significantly reduces the number of technical errors in the transfer of infants from the OR to the ICU. Considering the disastrous effects of a defective handover, and the importance of information transmission, Petrovic *et al.*[1] developed and used a standard transfer of care protocol for transferring the patients from the OR to the post-anesthesia ward, and the results showed a reduction in technical errors. Similar results have also been reported in other studies that studied the effects of using standard multidisciplinary handover protocols in improving the process of transfer between OR and ICUs.[10,20,21] Our intervention also resulted in an improvement in the domain of information ignorance. In fact, the intervention significantly decreased the frequency of ignorance of reporting the "patient weight," "bypass duration," "issues related to bypass separation," "size of the endotracheal tube," and "the results of echocardiographic examinations." Current patient handover methods are mostly informal and unstructured, and the surgical team is not involved. Therefore, it is common to ignore vital information, especially surgical information such as the length of surgery and prescribed blood products,[11,21] which may result in serious complications.[17,22] Joy *et al.*[10] and Craig *et al.*[23] have shown that on average 36–40% of clinical information about the patient is overlooked during a non-standard handover. They also concluded that the development and implementation of standard handover checklists would reduce information ignorance during the patient transfer by 50–66%.[10,23] Consistent findings have also been reported by Beigmoradi *et al.*,[24] Halterman *et al.*,[25] and Gleicher *et al.*,[8] who examined

Table 2: Comparison of demographic information (gender, marital status, education, and age) of patients in the intervention and control groups

Variable	Control, (*n*: 31)	Intervention, (*n*: 31)	*P*[a]
Gender			0.58
Female	11 (35.5)	8 (25.8)	
Male	20 (65.5)	23 (74.2)	
Education level			0.26
Illiterate	24 (80.6)	22 (70.9)	
Diploma	4 (12.9)	6 (19.4)	
Associate degree	3 (6.5)	1 (3.2)	
Bachelor	0	2 (6.45)	
Marital status			0.24
Single	3 (9.7)	0	
Married	28 (90.3)	31 (100)	
Age, years (mean±SD)	54.77±14.34	59.87±8.27	0.092[b]

[a]Chi-square, [b]*t*-test

Table 3: Comparison of technical errors subscales in the intervention and control groups

Item	Control (n = 31) n (%)	Intervention (n = 31) n (%)	P-value
Up-to-date patient information			0.99
Yes	31 (100)	31 (100)	
No	0	0	
Availability of file on the patient's bed			< 0.001
Yes	1 (3.2)	25 (80.6)	
No	30 (96.8)	6 (19.4)	
Provide airway opening equipment			0.238
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Ventilator ready in ICU			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Preparation of serum			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Preparation of intravenous infusions			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Readiness of the chest tubes			< 0.001
Yes	0	25 (80.6)	
No	31 (100)	6 (19.4)	
Additional infusion pump ready			0.99
Yes	31 (100)	31 (100)	
No	0	0	
Suction readiness			0.492
Yes	29 (93.5)	31 (100)	
No	2 (6.5)	0	
Promptitude in giving oral information			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Transfer of care			0.492
Yes	29 (93.5)	31 (100)	
No	2 (6.5)	0	
Observance of sterility			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Discussion of care plan between deliverer and recipient			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	

the effects of standard handover protocols in the process of patient transfer. Several standard patient handover checklists are available that, if implemented, can improve the care transfer process, decrease technical errors and ignorance of information, enhance communication between healthcare providers, and improve the quality of care during patient handover and transfer.[8,17] Our study had limitations that should be considered when using the results. These limitations include small sample size, the inclusion of only one medical center, and non-random and non-blind sampling, which may increase the risk of bias and affect the generalizability of the findings. Therefore, replication of multicenter studies with larger sample sizes and more rigorous methods is suggested.

Table 4: Comparison of subscales of ignoring information in intervention and control groups

Item mentioning	Before the intervention (*n*=31), *n* (%)	After the intervention (*n*=31), *n* (%)	*P*-value
The patient's name			0.492
Yes	29 (93.5)	31 (100)	
No	2 (6.5)	0	
Patient's age			0.238
Yes	28 (90.3)	31 (100)	
No	3 (9.7)	0	
Patient's weight			< 0.001
Yes	6 (19.4)	31 (100)	
No	25 (80.6)	0	
Pre-operative medical diagnosis			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Type of the surgery			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Bypass duration			< 0.001
Yes	16 (51.6)	31 (100)	
No	15 (48.4)	0	
Issues related to bypass separation			< 0.001
Yes	17 (54.8)	31 (100)	
No	14 (45.2)	0	
Size of the endotracheal tube			< 0.001
Yes	1 (3.2)	31 (100)	
No	30 (96.8)	0	
Anesthesia issues			0.492
Yes	29 (93.5)	31 (100)	
No	2 (6.5)	0	
Prescribed blood products			0.492
Yes	29 (93.5)	31 (100)	
No	2 (6.5)	0	
Urinary output			0.99
Yes	31 (100)	31 (100)	
No	0	0	
Bleeding problems			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Hemodynamics/ heart rhythm			0.99
Yes	30 (96.8)	31 (100)	
No	1 (3.2)	0	
Results of echocardiography			< 0.001
Yes	11 (35.5)	31 (100)	
No	20 (64.5)	0	

Conclusion

Patient handover after cardiac surgery is a complex process that puts patients at risk if not performed properly. In this study, implementation of a standard handover protocol led to fewer disruptions during handover and decreased the frequencies of technical errors and information ignorance in the process of transferring the patients from the cardiac OR to ICU. Operating room and ICU nurses are recommended to use similar instruments in the process of handover and transferring patient from OR to ICUs.

Also, using the handover protocol has benefits for nurses such as saving time, reducing the incidence of unintended events, and improving professional relationships and teamwork.

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Conflicts of interest

The authors declare no conflicts of interest.

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