ORIGINAL ARTICLE

An Appraisal of the Practice of Aseptic Technique in Hospital – An Observational Study

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Summary

Using pre-prepared checklists, detailing important steps in aseptic practice, we recorded 6,455 observations on the practice of handwashing, gloving, wound dressing and catheterisation of the bladder. These procedures, which are commonly done in hospital practice, were selected by ranking. This study was conducted in the medical, surgical, gynaecological and ICU wards in six hospitals on medical officers, house officers, staff nurses and student nurses. We analysed the performance of each of the hospitals and category of staff, and compared their performances. We also instituted remedial measures after identifying the shortfalls, and conducted a post-intervention study. Overall, an improvement in the performance of all the procedures was noted.

Key Words: Aseptic technique, Nursing procedures, Handwashing, Gloving, Dressing of wounds, Setting of intravenous drip, Catheterisation

Introduction

Nosocomial infections cause significant morbidity and incalculable human sufferings, increase mortality in patients, increase treatment costs, and increase the length of hospital stay, depriving other patients of the urgently needed and valuable hospital beds[1]. According to the on-going national study for nosocomial infections being conducted by the Centers for Disease Control, significant hospital acquired infections will be diagnosed in 3 to 6% of all hospitalised patients. Thus, it can be predicted that between 960,000 and 1.5 million of the 32 million patients admitted to hospitals in the United States each year will contract an infection as a direct result of their hospital stay. It is also estimated that about 60,000 deaths per year will be directly attributable to these infections, and that nosocomial infections will add over 7.5 million hospital days and over 6 billion dollars to the U.S. National Health Care costs[2].

The common nosocomial infections are urinary tract infections, wound infections, pneumonias and bacteraemias, and the principal means of transmission of the pathogens is by contact with hospital personnel who are carriers of these resistant pathogens. Infections due to indwelling urinary catheters and vascular cannulae are other common predisposing factors.

Meticulous handwashing before and after each patient contact is thus the most effective single measure in reducing the incidence of nosocomial infections. Strict adherence to aseptic technique when carrying out procedures like gloving, gowning, venepuncture and bladder catheterisation is another important effective measure.

Although other factors like design of facilities and the equipment used and the patient factor also influence the occurrence of nosocomial infections, these factors will be more costly or impractical to rectify, especially when there are constraints in the health care system.

This study was chosen because although nursing procedures that require strict aseptic technique to prevent the occurrence of nosocomial infections are commonly carried out in our hospitals, no study has been done previously to assess the competence of our hospital personnel.

This observational study, using pre-prepared checklists aims at the appraisal of the practice of aseptic technique in carrying out some commonly done and important nursing procedures by the different categories of medical and nursing personnel. Through this study we also hope to improve the practice of aseptic technique by identifying the steps that are commonly omitted and instituting appropriate remedial measures.

Methodology

Fifteen nursing procedures that are related to hospital acquired infections were identified at a nominal group discussion, involving medical and nursing personnel. Each participant was then requested to mark procedures that were regarded as commonly done, and important in the prevention of nosocomial infections. The six procedures with the highest scores were selected for the study, and these were handwashing, gloving, dressing of wounds, setting of intravenous lines and bladder catheterisation in the male and the female patient.

A checklist for each procedure identified was drawn up by the researchers, detailing the steps that are important in the practice of aseptic technique. These six checklists were then discussed with medical, nursing, laboratory and infection control personnel at two workshops, before they were finalised.

Pre-testing of these checklists was then done in the Seremban and Klang hospitals for a period of three months. The checklists were further modified after the pre-test, based on the feedback.

The study proper was then carried out simultaneously in six hospitals from 1991 to 1992, as part of a national HSR project on the control of Nosocomial Infections. The hospitals involved were the Alor Star, Malacca, Johor Bahru, Kuantan, Kuala Terengganu and Kuching hospitals. The study was conducted in the Medical, Surgical, Obstetrics and Gynaecology, Paediatrics and the Intensive Care and Coronary Care wards, and all doctors with less than two years experience, and all Staff Nurses, Assistant Nurses, Student Nurses and Medical Assistants working in these areas were observed.

The checklists were used as the data collecting instrument, and the data collectors were either Sisters or senior Staff Nurses from the respective hospitals. These personnel had earlier been trained by the researchers, using audiovisual aids and by conducting practical demonstrations. During the course of the survey, supervisory visits were also made by the researchers.

The data sheets were checked for completeness and then sent to the Secretariat in the Institute for Medical Research in Kuala Lumpur, where the data were entered into a computer.

At the end of this pre-intervention survey period, the data obtained was analysed. If all the critical steps important in carrying out a procedure aseptically as identified in the checklist were done, then the procedure was considered as correctly done (pass). If any of the critical steps was omitted or wrongly done, then that procedure was considered as incorrectly done (fail). The shortfalls in carrying out the various procedures, and the categories of staff who were less competent were then identified.

During the next phase of the study, remedial measures were instituted in the hospitals. The staff were briefed on the findings, the areas of weaknesses were identified and highlighted, and the correct techniques were demonstrated, using audiovisual aids. This intervention period was over a period of three months.

During the final phase of the study, which was over a period of four months, a repeat survey was done in the same wards, by the same supervisors, using the same checklists. The data obtained were then analysed and compared with the pre-intervention results.

Results

A total of 6,455 observations in the pre-intervention period, and a total of 5,651 observations in the post-intervention period were done.

Pre-intervention results

The overall pass rate for all the procedures observed in the six hospitals was only 51% (3,266 of a total of 6,455 observations).

The pass rate for handwashing was 40% (n = 972), setting of intravenous lines 40% (n = 336), male catheterisation 34% (n = 56), and female catheterisation 40% (n = 141). Dressing of wounds and gloving were relatively better done, with pass rates of 58% (n = 575) and 70% (n = 1,186) respectively (Table I).

When performance of staff was compared between hospitals (Table II), Kuantan (27%, n = 243) and Kuala Terengganu (37%, n = 325) did less well, while Kuching hospital had a relatively high pass rate (73%, n = 443).

In all hospitals, the nursing staff performed the procedures better compared to the doctors (Table III and IV).

Post-intervention results

The overall pass rate improved to 68% (n = 3838). The percentage change was 33% (Table I).

There was improvement in the overall performance in all hospitals and the percentage change was higher in Kuantan (56%) and Kuala Terengganu (59%) hospitals (Table II).

Although the overall performance of all procedures improved, the improvement in the procedure of dressing of wounds was only marginal (percentage change 3%).

There was a decline in performance in some procedures in some of the hospitals, after intervention (Tables II and III). The pass rate for dressing of wounds declined in the Alor Star, Kuantan and Kuching hospitals, and the pass rate for handwashing declined in Kuching hospital.

Results for each procedure

Handwashing

With the exception of Kuching hospital (pass rate 82%) handwashing was poorly done in all the other five hospitals ranging from 12% in Kuantan to 49% in

Table I
Number and pass rates by procedures done

Procedures	Pre-Intervention			Post-Intervention			Percentage Change
	Total Number Done	Passes No.	%	Total Number Done	Passes No.	%	
Handwashing	2418	972	40	1961	1294	66	65
Gloving	1694	1186	70	1619	1408	87	24
Dressing	993	575	58	749	450	60	3
I.V. lines	837	336	40	761	366	48	20
Female Catheterisation	350	141	40	362	196	54	35
Male Catheterisation	163	56	34	199	124	62	82
Total	6455	3266	51	5651	3838	68	33

Table II
Passs rates of procedures done in hospitals

Procedures	Alor Setar		Johor		Kuantan		Kuching		Melaka		K. Terengganu	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Handwashing	41	54	40	42	12	41	82	80	49	50	36	80
Gloving	78	85	64	94	36	77	91	93	74	83	79	89
Dressing	51	39	52	91	63	55	90	81	53	56	51	74
I.V. Drip	64	69	36	63	18	32	73	79	44	60	12	45
Catheterisation (female)	59	88	38	35	24	45	64	93	46	66	19	40
Catheterisation (male)	56	72	24	29	18	31	57	66	24	67	29	65
Average for hospital	58	62	42	53	27	42	73	82	48	59	37	59

Table III
Pass rates in handwashing according to category of staff

Category of staff	Alor Setar		Johor Bahru		Kuantan		Kuching		Melaka		K. Terengganu		Average	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Medical officers	7	35	23	37	3	35	64	71	20	22	16	93	22	49
House officers	37	51	17	41	19	34	69	85	32	9	29	66	34	48
Staff nurses	48	62	46	55	17	60	84	84	55	100	51	99	50	77
Student nurses	45	56	69	35	0	57	100	76	62	84	53	62	55	62
Others	39	72	15	69	11	40	90	73	52	55	18	97	38	68
Average for hospital	41	54	30	51	12	51	82	80	49	68	36	87		

Malacca (Table III) during the pre-intervention period.

Staff nurses (pass rate 50%) performed this procedure better than the doctors (28%). House officers performed better (34%) compared to the medical officers (22%) (Table III).

The critical steps that were omitted most often when washing hands were rubbing of the finger tips, thumbs, dorsum of fingers and the inter-digital spaces (Table V).

Post-intervention, the overall pass rate improved to 66%

(percentage change 65%). However, house officers in Malacca hospital, and student nurses in Kuching and Johor Baru hospitals showed a decline in performance (Table III).

Gloving

This procedure was relatively well done. The overall pass rate in the pre-intervention period was 70% and in the post-intervention period 87%. The percentage change was 24% (Table I).

The nursing personnel performed better (80%) compared to the doctors (62%) in the pre-intervention period. Post-intervention, both groups showed considerable improvement.

The steps that were most frequently done incorrectly were that the hands were not washed before gloving, of if washed, were not dried before putting on the gloves.

Dressing of wounds

The overall pass rate in carrying out this procedure was 58% in the pre-intervention period, and 60% in the post-intervention period (Table I). The percentage change was only 3%.

The staff nurses performed this procedure better compared to the doctors (Table IV).

Alor Star, Kuantan and Kuching hospitals had lower pass rates in the post-intervention period.

The common errors were using the same forceps to handle the dirty and sterile dressings, and removing the dirty dressing with bare hands.

Setting of intravenous lines

The overall pass rates in the pre-intervention and post-intervention periods were 40% and 48% respectively (Table I). The percentage change was 20%.

In the pre-intervention period, Alor Star (pass rate 64%) and Kuching (73%) had better results (Table II).

After intervention, all categories of staff in all the hospitals showed improvement.

The staff nurses again performed this procedure better compared to the doctors (Table III).

The common errors noted were failing to wash the hands prior to preparing the set and also before setting the intravenous lines (Table VI).

Bladder catheterisation

Overall, both male and female catheterisations were poorly done in the pre-intervention period. The pass rate for male catheterisation was 34%, and this improved to 62% post-intervention (percentage change 82%). The pass rate for female catheterisation was 40% initially, and this improved to 54% after intervention (percentage change 35%).

The common errors were failing to use sterile forceps when handling the catheter, failing to lubricate the catheter, and failing to wash the hands prior to doing the procedure (Table VII).

Table IV
Nursing procedures and pass rates by category of staff

Category of staff	Procedure							
	Gloving		Dressing of wounds		Intravenous lines		Catheterisation (Female)	
	No.	%	No.	%	No.	%	No.	%
Doctors	466	62	39	36	226	41	33	37
Staff nurses	437	80	353	55	148	53	86	48

Table V
Five steps frequently omitted in handwashing

Steps omitted	Percentage
Rub finger tips	41%
Rub thumbs	40%
Rub dorsum fingers	29%
Rub interdigital	24%
Rub wrists	18%

Table VI
Five steps frequently omitted in setting intravenous drips

Steps omitted	Percentage
Wash and dry hands before preparing set	45%
Wash and dry hands before setting up drip	37%

Table VII
Five steps frequently omitted in catheterisation

Steps omitted	Percentage
Using sterile forceps insert catheter	30%
Lubricate catheter	24%
Place sterile towel across the patient's thighs	18%
Wash and dry hands (2)	16%
Wash and dry hands	16%

Discussion

In this study, only 51% of the six procedures observed were done according to our set criteria in the pre-intervention period. After intervention, this improved to 68%. It is important to carry out aseptic procedures well, as this will reduce the occurrence of nosocomial infections.

The National Health Institute of U.S.A. carried out a before and after intervention study in order to evaluate the effectiveness of active modification of patient practices in reducing the incidence of post-operative infections. In that study, Greco[3] found that there was a 19% reduction in the occurrence of nosocomial infections after intervention. Covalcante[4] observed in a Brazilian General Hospital that instituting infection control measures and eliminating ineffective practices resulted in an overall decline in wound infection rate from 24.4% in 1987 to 3.5% in 1989. There was also a 74% reduction in the prophylactic use of antibiotics for surgery and there was a total saving of US$2 million.

Sobayo[5] found that the quality of infection control programmes in developing countries is determined by resource allocation to the health care delivery system, as availability of disposable paper towels, gloves, gowns, etc. have a bearing on aseptic nursing procedures. He also found that the success of the programme is dependent on the awareness of infection control measures, and on the presence of trained infection control personnel.

Hastreiter[6] in a study of knowledge, attitude and practice of Minnesota dental hygienists, found that less than half the hygienists were familiar with infection control measures, and this resulted in poor aseptic technique.

In our study, in the pre-intervention period, the staff in Kuching hospital performed far better (73% pass rate) when compared to those in the other five hospitals (average pass rate of 42%). This was probably because of the fact that Kuching hospital had already been carrying out teaching and supervisory activities for some years prior to this study. Checklists for most of the aseptic procedures were available and used to appraise the performance of the staff. If found wanting, these staff were retrained. The other five hospitals did not have a similar system.

Simmon[7] found that frequent and proper handwashing was the most important means of preventing

nosocomial infections. It is estimated that if handwashing practices are improved, about 25% of all nosocomial infections can be prevented. In our study, only 40% of the handwashes were properly done in the pre-intervention period, and this improved to 66% after intervention. Simmon, in his paper, states that even after intervention, handwashing was often not carried out well, and that the rate of handwashing was low too. In a community teaching hospital, the rate of handwashing was 22% before intervention and 30% after intervention. When interviewed, the nurses felt that they were washing properly and appropriately approximately 90% of the time. Broughall[8] too found that nurses often overestimated their actual frequency of handwashing. In our study, the rate of handwashing was poor too. Handwashing was often not done prior to doing procedures like setting intravenous lines and bladder catheterisation. This could have been because our staff were under the misconception that if one were to wear sterile gloves, then handwashing was unnecessary[9].

Albert[10] found that the quality of handwashing suffered from a general lack of attention among hospital staff. Taylor[11] found that the procedure was rarely standardised, and that the thumb and finger tips, and the areas between the fingers frequently remained unwashed. Our findings were similar. The steps that were frequently omitted were rubbing the finger tips, thumbs, interdigital spaces and the dorsum of fingers.

Inadequate facilities[12], for example too few basins for handwashing and lack of paper towels are another reason for poor handwashing. During the period of our study, we noted that most of the wards, including those in the newer hospitals, did not have sufficient numbers of basins suitable for proper handwashing. Often, there was only one such basin in each ward, and in certain wards, it was placed at one end of the ward. This was thus not conducive for frequent and proper handwashing.

Inadequate training and inadequate reinforcement are cited as critical factors that influence the frequency and effectiveness of handwashing[13]. In this study, after the intervention period, the quality and rate of handwashing improved. Gloving was relatively well done. Failure to wash hands or failure to dry the hands after the handwash were the two common faults noted.

Improper technique or poor aseptic practice when dressing wounds, can introduce infection to a clean wound. In our study, there was only marginal improvement in performance after intervention. Possible reasons for this are discussed below.

Intravenous lines are popular because of their reliability in assuring delivery of fluids or nutrition. Maki[14] noted that 25% of patients admitted to hospital received some form of intravenous therapy. Bacteraemia related to intravenous lines accounts for 5-10% of nosocomial infections. Infection is more likely to occur if the lines are not changed after 72 hours[15]. The incidence of infection also correlates to the duration of intravenous therapy[16], and bacterial colonization may occur without local inflammation or tenderness. Failure to wash hands or poor handwashing technique has been found to be a cause for catheter associated infection[17].

In our study, only 40% of the intravenous lines were set correctly in the pre-intervention period and this improved to 48% after intervention. The main shortcoming noted was failure to wash the hands prior to performing the procedure.

Urinary tract infections account for 30-40% of hospital acquired infections, and the most common predisposing factor is the insertion of an indwelling urethral catheter[18]. Hospital surveys show that 10-15% of hospitalized patients have indwelling urinary catheters, and many of them are unnecessary[19].

Although the highest risk of getting urinary infection is after the first two weeks, the risk of developing significant bacteriuria is about 5% per day of catheterisation. Thus it is extremely important to catheterise only when absolutely necessary and to remove them as soon as possible.

Garibaldi[20] noted that optimal technique of catheter insertion and the maintenance of a closed sterile drainage system are important measures in limiting the incidence of catheter associated bacteriuria.

In this study, the technique of bladder catheterisation in both male and female patients was poor. In male patients, the technique was correct in only 34% of the time in the pre-intervention period, and this improved to 62% after intervention. In female patients, the pass rates were 40% and 62% respectively.

The common faults identified were failure to wash hands prior to doing the procedure and handling the catheter wrongly.

Some of the findings in this study were unexpected. As the data collectors (observers) were from the respective hospitals, we anticipated the pass rates to be inflated to reflect a better performance, especially in the post-intervention period. Moreover, since this was an observational study, the staff being observed were expected to perform better than normal, and thus give rise to artificially better results. On the contrary, the post-intervention results were similar to or even poorer when compared to the pre-intervention results in some hospitals. Pass rates in handwashing by House Officers in Malacca hospital and by Student Nurses in Johor Baru and Kuching hospitals were poorer in the post-intervention period (Table III). Similarly, pass rates in catheterisation of female patients in Johor Baru and dressing of wounds in Alor Star hospital were lower post-intervention (Table II).

One reason for this unexpected result was that due to staff turnover over the study period, especially among the House Officers and Student Nurses, the people observed in the post-intervention period were not the ones who had been observed in the pre-intervention period, nor trained during the intervention period.

Other reasons for this discrepancy are merely conjectural. Some of the observers in the post-intervention period were different, again due to staff turnover, and this could have resulted in a different standard in assessment. Furthermore, even the same observers could have been stricter in their assessment post-intervention, and they would have expected a higher standard of performance after the training period. The use of the checklists, while reducing observer bias, would not have totally eliminated it.

The positive aspect here is that the observers were objective in their assessment, as they had been instructed to be.

The poorer performance by the doctors compared to the nurses could be due either to inadequate undergraduate training or to a lackadaisical attitude arising out of the misconception that the use of antibiotics will obviate the need for meticulous aseptic technique.

Some of these probable factors can be ascertained in future studies.

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