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Research Article

Evaluation of an intervention program to prevent hospital-acquired catheter-associated urinary tract infections in an ICU in a rural Egypt hospital

Evaluation eines Interventionsprogramms zur Prävention nosokomialer Katheter-assoziierter Harnweginfektionen auf einer Intensivstation in einem ländlichen Krankenhaus Ägyptens

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Abstract

Aim: Catheter associated urinary tract infections (CAUTI) are the most common hospital-acquired infection in ICUs. The aim of this study was to estimate the effectiveness of an intervention program by implementing urinary catheter bundle elements to reduce the CAUTI frequency in an ICU.
Methods: The intervention study was conducted over a period of 6 months. During a pre-intervention phase, the base line catheter associated CAUTI incidence rates were determined and compared with the incidence rates during the post-intervention phase. The compliance of health care staff with urinary catheter bundle elements was also measured. The implemented CAUTI prevention bundle consisted of hand hygiene, wearing personal protective equipment, use of disposable gloves, cleansing of urethral meatus prior to catheter insertion using sterile saline, assessment of catheter need, aseptic urine sampling technique, and correct draining bag positioning.
Results: During the study period, 55 out of 77 patients were diagnosed with a CAUTI. The mean CAUTI incidence rate for the pre-intervention period was 90.12/1,000 catheter days and for the post intervention phase 65.69/1,000 catheter days. The CAUTIs rate was inversely proportional to insertion bundle elements and maintenance bundle elements compliance rate. This negative relationship was statistically significant only with maintenance bundle elements ($p=0.042$) ($r_s=-0.828$). The compliance rate of the ICU nurses to the bundle elements was raised to 100% during the last 2 months of the post intervention phase.
Conclusion: Increased compliance to recommended catheter associated urinary tract infections preventive practices reduced the incidence of CAUTI in an ICU unit. It is simple and effective and is recommended as a part of patient safety culture.

Keywords: catheter-associated urinary tract infection, infection control, bundle, hand hygiene, compliance

Zusammenfassung

Zielsetzung: Katheter-assoziierte Harnweginfektionen (CAUTI) sind die häufigste nosokomiale Infektion auf der ITS. Ziel der Studie war die Ermittlung der Effektivität eines Interventionsprogramms mit Implementierung eines Bundles zur Prävention von CAUTI auf einer ITS.
Methode: Die Interventionsstudie wurde über einen Zeitraum von 6 Monaten durchgeführt. Während der Präinterventionsperiode wurde die Baseline für die Inzidenz von CAUTI ermittelt und mit der Inzidenz während der Postinterventionsperiode verglichen. Außerdem wurde die Compliance des Personals zur Einhaltung des Bundles ermittelt. Das CAUTI Bundle enthielt die Elemente Händehygiene, Tragen persönlicher

Schutzausrüstung, Benutzung von Einmalhandschuhen, Reinigung des Meatus urethrae vor der Katheterinsertion mit steriler Kochsalzlösung, Beurteilung der Notwendigkeit des Harnwegkatheters, aseptische Harnableitung und korrekte Position des Auffangbeutels.
Ergebnisse: Im Verlauf der Studie wurde bei 55 von 77 Patienten eine CAUTI diagnostiziert. Die mittlere Inzidenz betrug in der Präinterventionsperiode 90,12 CAUTI/1.000 Kathetertage und in der Postinterventionsperiode 65,69 CAUTI/1.000 Kathetertage. Die CAUTI-Rate verhielt sich indirekt proportional zur Einführung der Bundleelemente und zur Compliance der Einhaltung des Bundles. Dieser Zusammenhang war nur für die Einhaltung der Bundleelemente statistisch sicherbar ($p=0,042$) ($r_s=-0,828$). Die Compliance der Pflegekräfte zur Einhaltung des Bundles wurde während der letzten 2 Monate der Postinterventionsperiode auf 100% erhöht.
Schlussfolgerung: Durch verbesserte Compliance für die empfohlenen Maßnahmen zur Prävention von CAUTI konnte die Inzidenz von CAUTI auf einer ITS reduziert werden. Die Einführung eines CAUTI-Präventionsbundles ist einfach und effektiv und wird daher als Bestandteil zur Gewährleistung der Patientensicherheit empfohlen.

Schlüsselwörter: Katheter-assoziierte Harnweginfektion, Infektionsprävention, Bundle, Händehygiene, Compliance

Introduction

Catheter associated urinary tract infections (CAUTIs) are the most common healthcare-associated infections in ICUs with a reported range of 30%–40% of infections. CAUTIs are causing increased morbidity, mortality, hospital costs, and length of hospital stay [1]. The estimated daily risk of developing of CAUTI is from 3% to 7%. The percentage increases with longer catheterization time. It is up to 25% greater at 7 days with mono-microbial infection and 100% greater at 30 days with often poly-microbial infection [2], [3], [4].
The recommended infection control measures to control CAUTIs can reduce their frequency by up to 69% [5]. In the USA, the national goal is to reduce CAUTIs by 25% by 2014 and complete elimination thereafter labeling it as a 'never event' [2], [6].
Measures to prevent CAUTIs have been grouped into a set of practices aiming at prevention of CAUTIs when applied together by the medical staff as a so called "bundle". This bundle constitutes of a group of evidence based measures proven to reduce the occurrence of CAUTIs [7], [8].
The aim of this study was to estimate the effectiveness of implementation of a dedicated urinary catheter bundle (UCB) in reducing the CAUTIs rate at the Kafr Eldawar General Hospital.

Methods

The present pre-post intervention study was conducted over a period of 6 months from July 2012 to December 2012 at the Medical Intensive Care Unit, Kafr El Dawar General Hospital, Ministry of Health, Egypt. Written consent was taken from each patient, and the study was approved by the High Institute of Public Health Ethics Committee.
The study was carried out over 2 phases, phase 1 included a 2 month baseline pre-intervention (July to August), phase 2 the post-intervention phase for 4 months (September to December). September 2012 was considered the run-in period, during which the intervention program was initiated.
In the 2 study phases urine samples were collected for culture from each new case admitted to the ICU immediately after urinary catheter insertion to exclude any patients with preexisting UTIs. Patients with signs and symptoms of UTI on admission were excluded. Exclusion criteria included patients with a positive urine culture ($\geq 10^5$/microorganisms per ml of urine) with no more than 2 species of microorganisms that were suffering from any of the following: fever more than 38 °C, urgency, frequency, dysuria, or suprapubic tenderness with no other recognized cause. It also included patients suffering from at least 2 of the previous signs and symptoms with either of pyuria (urine specimen with ≥10 white blood cells [WBC]/mm^3 or ≥3 WBC/highpower field of unspun urine) or organisms seen on Gram's stain of unspun urine.
Patients were monitored for symptoms of CAUTIs according to the American National Healthcare Safety Network (NHSN) criteria after 48 hours from catheter insertion and weekly regardless symptoms until discharge. The inclusion criteria included any symptoms suggestive of CAUTI after 48 hours of patient's admission to the ICU. In addition, CAUTI that occurred in less than 48 hours after patient discharge but resulted to readmission was also included [3], [9].
The urine samples were collected from the distal end of the urinary catheter after disinfection (70% ethanol). Urine was aspirated with a sterile 10 mL syringe, poured into a sterile urine container and immediately sent to the lab

for microscopic examination and culture using CLED agar [10]. All urinary isolates were subjected to standard identification and antibiotic susceptibility testing [11].
Through the 2 study phases, all nurses were observed for their compliance to UCB practices (insertion and maintenance), recommended by the Healthcare Infection Control Practices Advisory Committee (HICPAC) [12]. These practices included hand hygiene, wearing personal protective equipment, use of disposable gloves, cleansing of urethral meatus prior to catheter insertion using sterile saline, assessment of catheter need, aseptic urine sampling technique, and draining bag positioning. Moreover, physicians were observed for their compliance to hand hygiene practices. During the course of study it was not apparent to HCWs when the observations of UCB were performed. The observations were performed once per week (30 minutes each) and with each new catheter insertion during each study phase. This covered 50 and 118 hand hygiene moments in the first phase while in the second phase it covered 110 and 202 moments among physicians and nurses respectively. It also covered 312 and 663 insertion bundle elements in the first and second phase and 120 and 255 maintenance bundle elements achieved by nurses during the first and second phase respectively.

Intervention program

In September 2012, the CAUTIs intervention program was instituted. UCB informative lectures, including slide presentation and videos, were delivered to the physicians and nurses (once at the beginning of the phase). These lectures emphasized the importance of the hand hygiene adherence, the method of application of alcohol-based hand rub (ABHR), the WHO 5 moments as well as the appropriate way of urinary catheter insertion for both males and females under aseptic technique [12], [13].
Moreover, catheter bundle care and hand hygiene illustrative posters were wall mounted in physicians' and nurses' rooms. ABHR personal bottles were prepared according to the WHO approved formula (80% ethanol, 1.45% glycerol, 0.125% hydrogen peroxide) and supplied to each member of the health care staff [13].
All through the study phases, auditing was conducted to determine the compliance of nurses to the UCB elements (insertion and maintenance with each new catheter insertion) and the hand hygiene moments practices (once per week, 30 minutes each). It was not apparent to physicians and nurses when the audit was performed. This covered 50 and 118 hand hygiene moments in the first phase while in the second phase it covered 110 and 202 moments among physicians and nurses respectively. Moreover, nurses' compliance to 432 and 918 UCB elements was observed in the first and the second study phases respectively.

Statistical analysis

The statistical tests used were the arithmetic mean, fisher's exact test, Monte Carlo test, Chi-square, Mann-Whitney test, Wilcoxon test, Kruskal Wallis test and Spearman coefficient. These tests were used to calculate rates of CAUTIs per 1,000 device-days, total catheter-days, urinary catheter utilization ratio, bundle elements compliance and device utilization ratio [5], [7], [14], [15], [16].

Results

A total of 88 catheterized patients were included in this study, 11 were excluded because they showed symptoms of UTI on admission. Out of the remaining 77 patients, 55 (71.5%) showed symptomatic-CAUTIs after 48 hrs. from catheter insertion (healthcare-associated).
Table 1 summarizes the demographic data for the 55 patients who developed CAUTIs in the 2 study phases. It is apparent that females (56.4%) had higher CAUTIs than males (43.6%) yet this result was not statistically significant (Chi square test). On the contrary CAUTIs was significantly related to age of patients (Chi square test). The highest percentage of patients with CAUTIs belonged to the age group >60 (32.7%) followed by the age group from 50 to less than 60 years (25.5%) and the least number of patients was among the age group from 13 to less than 40 years (p=0.015).
Table 2 provides a summary of the CAUTIs rates and device utilization ratio before and after the implementation of the catheter care bundle elements. The highest CAUTIs rate was during September (107.44 cases/1,000 catheter days), while the lowest infection rate was during December (29.2 cases/1,000 catheter days). To estimate the statistical significance of such reduction in the CAUTIs, weekly CAUTIs rate of the two study phases was done. The infection rate showed a non-significant reduction (p=0.167, Mann Whitney test) though the average infection rate was reduced from 90.12 cases per 1,000 in the first phase to 65.69 cases per 1,000 catheter days in the second one. This is due to the low compliance degree from the ICU nurses to the urinary catheter care bundle during the first two months (September and October) of the second phase (post-intervention). The patient and catheter days as well as the device utilization ratio showed closely related values across the different months of the study. Regarding the device utilization ratio, the lowest urinary catheter utilization was during July and the highest one was during December. The device utilization ratio did not obey a statistically significant reduction in comparison to both phases of the study (p=0.643, Mann Whitney test).
The compliance rate of the ICU nurses to the catheter insertion and maintenance bundle elements in the pre and post intervention phases was illustrated in Table 3 and Table 4. The percentage of nurses, compliance for both insertion bundle elements (IBE) and maintenance

Table 1: Comparison between CAUTIs patients of the two studied phases according to demographic data

	Phase I (n=22)		Phase II (n=33)		Both phases (n=55)		Test of sig.
	No.	%	No.	%	No.	%	
Sex							
Male	7	31.8	17	51.5	24	43,6	χ^2p=0.149
Female	15	68.2	16	48.5	31	56.4	
Age							
<40	4	18.2	7	21.2	11	20.0	χ^2p=0.003*
40–<50	1	4.5	11	33.3	12	21.8	
50–<60	4	18.2	10	30.3	14	25.5	
60+	13	59.1	5	15.2	18	32.7	
Min.–Max.	13.0–80.0		19.0–72.0		13.0–80.0		MWp=0.015*
Mean±SD	55.27±18.81		48.27±11.72		51.07±15.20		
Median	60.0		49.0		52.0		

p: p value for comparing between the two study phases
χ^2: Chi square test, MW: Mann Whitney test
*: Statistically significant at p≤0.05

Table 2: CAUTIs rate and device utilization ratio of 55 infected catheterized patients in the two study phases

Phases	Months	No. of cases	Patient days	Catheter days	CAUTI rate/ 1,000 catheter days		Device utilization ratio	
I	July	9	184	108	83.33	Mean±SD 90.12±19.22	0.58	Mean±SD 0.66±0.11
	August	13	186	136	95.59		0.73	
II	September	13	180	121	107.44	*Mean±SD 65.69±39.98	0.67	*Mean±SD 0.71±0.03
	October	12	186	129	93.02		0.69	
	November	4	180	131	30.53		0.73	
	December	4	186	137	29.20		0.74	

*Mann Whitney test for comparing between the two phases (p=0.643 for device utilization ration and p=0.167 for CAUTI rate)

bundle elements (MBE) were highest in the post intervention months November and December (100%), compared to other months of the study and this proved to be statistically significant (p<0.001, Chi Square test).

Table 3: Compliance of nurses to urinary catheter insertion bundle elements (IBE)

Phase	Months	Total IBE observed	IBE compliance	
			No.***	%
I	July	130	70	53.8
	August	182	98	53.8
II	September	182	98	53.8
	October	169	89	52.7
	November	156	156	100.0
	December	156	156	100.0
	P*		<0.001**	

* Chi Square test
** Statistically significant at p≤0.05
***Total IBE performed

Table 4: Compliance of nurses to urinary catheter maintenance bundle elements (MBE)

Phase	Months	Total MBE observed	MBE compliance	
			No.***	%
I	July	50	20	40.0
	August	70	28	40.0
II	September	70	28	40.0
	October	65	26	40.0
	November	60	60	100.0
	December	60	60	100.0
	P*		<0.001**	

* Chi Square test
** Statistically significant at p≤0.05
*** Total MBE performed

Table 5, Figure 1 and Figure 2 show how IBE and MBE compliance affected the CAUTIs rate. CAUTIs rate was inversely proportional (negative relationship) with IBE and MBE compliance rate. Though this negative relationship was not statistically significant with IBE (p=0.138, Spearman coefficient) (r_s=–0.679) it was statistically significant with MBE (p=0.042, Spearman coefficient) (r_s=–0.828).

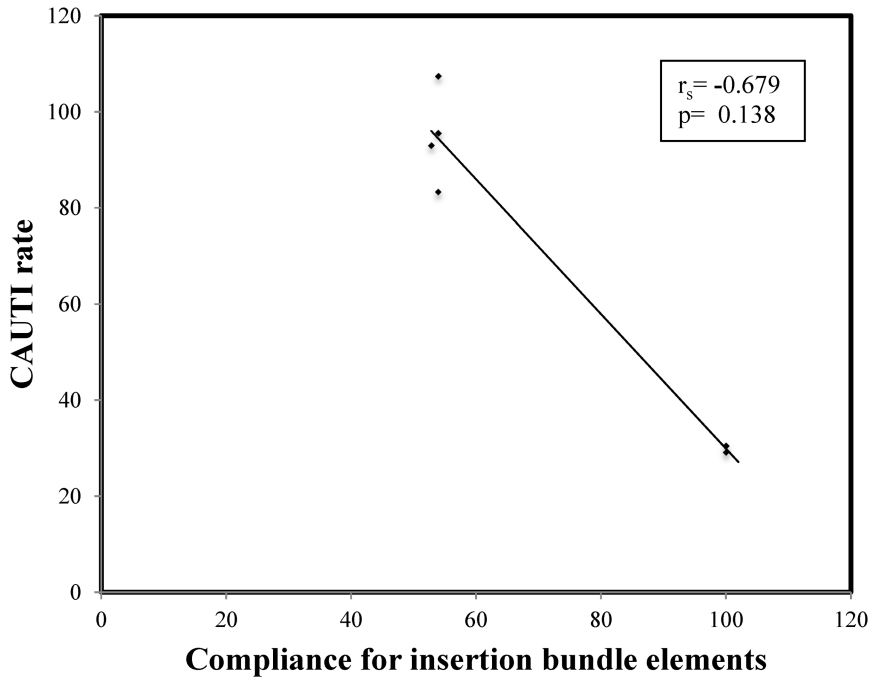

Figure 1: Correlation between catheter-associated urinary tract infection rate with urinary catheter insertion bundle elements compliance all over the study period

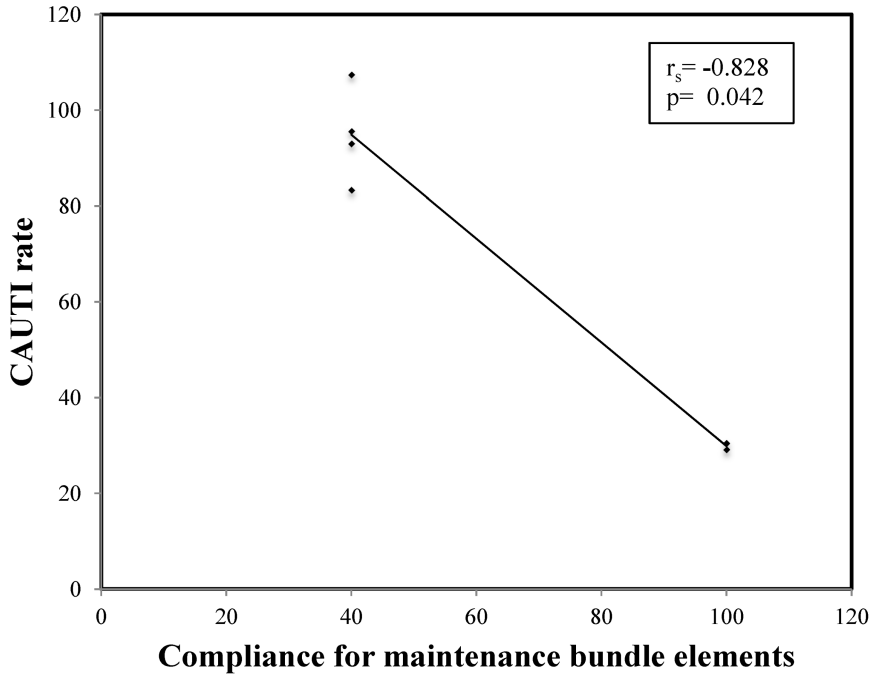

Figure 2: Correlation between catheter-associated urinary tract infection rate with urinary catheter maintenance bundle elements compliance all over the study period

Table 5: Correlation between CAUIT and urinary catheter insertion and maintenance bundle elements compliance

Compliance for	CAUTI rate	
	r_s*	P**
Insertion bundle element	–0.679	0.138
Maintenance bundle element	–0.828	0.042*

* Spearman coefficient
** Statistically significant at p≤0.05

Comparison between physicians and nurses compliance to the different hand hygiene moments shows that all over the study phases, nurses were more compliant than physicians to hand hygiene practices especially in moment 2, where the difference was statistically significant (p=0.04; Table 6, Fisher Exact test).

Table 6: Comparison between physicians and nurses compliance to the different hand hygiene moments

WHO moments of hand hygiene[4]	Compliance to hand hygiene moments						P value[1]
	Physicians			Nurses			
	No.**	No.***	%	No.**	No.***	%	
Moment 1	**35**	10	28.6	**84**	36	42.9	0.145[2]
Moment 2	**48**	10	20.8	**50**	20	40.0	0.040[2*]
Moment 3	**23**	6	26.1	**68**	13	19.1	0.555[3]
Moment 4	**29**	6	20.7	**64**	13	20.3	0.967[2]
Moment 5	**33**	3	9.1	**46**	10	21.7	0.135[2]

1 Comparison between physicians and nurses
2 Chi square test
3 Fisher Exact test
* Statistically significant at p≤0.05
** Total moments observed (should be done)
*** Total moments performed
4 Moment 1: before touching a patient, Moment 2: before clean/aseptic procedure, Moment 3: after body fluid exposure, Moment 4: after touching a patient, Moment 5: after touching patient surroundings

Discussion

In adult medical ICUs, the most common healthcare associated infections (HAIs) are CAUTIs (31%), posing a great challenge to hospital safety and quality healthcare in ICU patients [17], [18].

The average rates of CAUTIs in developing countries ICU patients are far higher than rates reported in developed countries. In 2010, a six year study reported CAUTIs rate to be 6.3 versus 3.3 per 1,000 catheter-days [19]. This finding was much less than the result of the present study, as the overall baseline means CAUTIs rate was 90.12 per 1,000 catheter-days. This finding may be explained by the problem of limited resources in developing countries that affect the implementation of HAI programs. For example, limited resources can result in lack of supplies and high patient to nurse ratio. Also, HAI control programs are not obligatory in some developing countries and there is a lack of quality control measures and accreditation of health care settings [20], [21], [22], [23]. The rate calculated in this study was also higher than the rates reported by the few other studies conducted in Egypt (15.7 and 34.2 per 1,000 catheter-days) [24], [25]. This study was conducted in a hospital in the smaller town of Kafr eldawar that is surrounded by rural areas, opposite other available studies that were conducted in the main urban large cities in Egypt (Cairo and Alexandria). Previous studies have suggested better heath care in urban than in rural populations [26], [27].

It is well known that the immune system goes though changes with ageing. These changes cause a decline in the performance of the immune system's function making elderly patients more susceptible to HAIs [28]. In the present study was a significant difference between elderly and younger patients regarding the development of CAUTIs, where 58.2% of cases were more than fifty years old. Passos et al. [29] and Kobayashi et al. [30] reported that the age factor affected the acquisition of CAUTIs among ICU patients. In their studies, elderly patients seemed to be more susceptible to infections than younger ones and more than 80% of CAUTIs were more common among extremes of age. In the present study 58.2% of infected cases were above 50 years old, 21.8% of patients belonged to the age group from 40 to less than 50 and 20% belonged to the age group less than 40 years old.

Bundles are a set of standard measures when applied during the care of patients are confirmed to reduce the incidence of HAI. The advantage of the performance and check of the elements of a bundle is that it acts a complete and consistent reminder system for prevention of HAI [16], [31].

Education is a foundation for the improvement of urinary catheter care bundle practices. Issues that are covered during educational programs of HCWs should include the scientific facts of the definitive impact of improved catheter bundle on CAUTIs [32].

In the present study, it is noteworthy to emphasize the importance of health education in form of presentations, posters and videos, and the availability of ABHR (distribution of ABHR personal bottles to the physicians and nurses) for hand hygiene compliance where they lead to improvement in the overall HCWs' (physicians and nurses) hand hygiene compliance rate from 0% before (baseline rate) to 37.5% after the multimodal hand hygiene intervention program. As well as the improvement in the nurses' catheter care bundle compliance rate from 53.8% (baseline rate) to 76.6% (post-intervention) and from 40% (baseline rate) to 70% (post-intervention) for insertion and maintenance elements of catheter care bundle respectively.

Hand hygiene is universally acknowledged as a crucial component of effective infection prevention. The CDC supports the concept of accessible hand hygiene products as stated in the CDC hand hygiene guideline administrative measures recommendations: "To improve hand hygiene adherence among personnel who work in areas in which high workloads and high intensity of patient care

are anticipated, make ABHR available at the entrance to the patient's room or at the bedside, in other convenient locations, and in individual pocket-sized containers to be carried by 'HCWs' [32].

A study by Voss et al. [33] showed that the use of ABHR dramatically reduce hand hygiene time to <70%. Another study conducted in an ICU demonstrated that the average time consumed by a nurse to leave a patient's bedside, walk to a sink, wash their hands, and return to patient care is 62 seconds [34]. Moreover, scientific evidence suggests that the compliance of hand hygiene by HCW with alcohol hand rub reduces the HAI rate and is more acceptable and easier to use [35].

In spite of all the aforementioned facts, in the present study the increase in hand hygiene compliance rate was less than that reported by other studies such as Conly et al. [36] who showed that after the launch of an educational program, the compliance of hand washing was raised from 28% to 81%. In the present study, compliance improvement with hand hygiene practice was achieved by physicians as well as nurses, yet it was lower among physicians (20.8%) compared to nurses (40.0%) in the second WHO moment (p=0.040) which could be explained by the fact that poor physician compliance with hand hygiene remains a problem [37], [38], [39]. Increased staff rotation, the lack of responsibility could explain the lower compliance among physicians. Physician may also have a false sense of reassurance by the patient's intake of potent antibiotics.

Different studies have demonstrated the advantages of calculating device-associated HAI rates to control for duration of exposure to the primary risk factors [40], [41], [42]. Device utilization ratio (DUR) is useful for inter-hospital comparisons as long as each hospital has collected the data and the calculated ratios use the same definitions and methods. The DUR is the measure of an ICU's invasive practices that are considered as risk factor for HAI. If the DUR is > the 90th percentile stated by NNIS (which is 0.88 for the urinary catheter utilization ratio in the medical ICU) [43], a hospital should take that as a warning sign and a review of policies should be considered. Fortunately the highest DUR in the present study was 0.74 during December 2012 and this ratio was still below the 90th percentile stated by NNIS.

In the present study, the association between improvement in the rate of catheter maintenance bundle elements adherence and the reduction of DUR was not significant comparing the two phases of the study (p=0.643). On the contrary, several studies documented a negative relationship between DUR and bundle adherence rate implemented by HCWs. For example, results reported by Andreessen et al. [31] mentioned that an overall reduction of 71% in catheter device days and a 56% reduction in catheter use were achieved after implementing a urinary catheter care bundle. Moreover, Venkatram et al. [16] reported a significant decrease in catheter utilization ratio from 0.75 to 0.66 after implementing the UTI bundle. In addition, Titsworth et al. [44] in an adult neurological ICU reported that the urinary catheter utilization rate dropped from 100% to 73.3% after implementation of a UTI prevention bundle (p<0.0001).

In our study, a strong negative relationship (r_s=–0.828) was proved to be significant (p=0.042) between improvement in the rate of catheter maintenance bundle elements adherence and the CAUTIs rate which significantly decreased all over the study period from 107.4 to 29.54 infections per 1,000 catheter-days (p=0.008). This was similar to that reported by Clarke et al. [45] and Jaggi et al. [5] who observed a decrease in the CAUTIs rates related to the a significant increase in catheter care bundle adherence from 5.2/1,000 catheter days to 1.5/1,000 catheter days and from 10.6/1,000 catheter days to 5.6/1,000 catheter days, respectively.

This negative relationship between the CAUTIs rate and bundle adherence after a multimodal catheter care intervention has been documented in several studies. For example, results reported by Titsworth et al. [44] mentioned that CAUTIs rates among patients in a neurological intensive care unit showed a significant reduction from 13.3 to 4.0 infections per 1000 catheter days (p<0.001) after implementation of a comprehensive evidence-based UTI bundle. Moreover, Tsuchida et al. [46] examined the relationship between catheter care and catheter-associated urinary tract infection at a Japanese general hospitals and reported a significant 50% decrease in CAUTIs rate after the implementation of two basic elements of catheter care (closed system and daily cleansing of the perineal area). In addition, a before and after prospective surveillance study to evaluate the effect of an infection control program to reduce CAUTIs rates among pediatric ICU patients carried out by Rosenthal et al. [47] proved that the rate of CAUTIs decreased to 2.6 cases per 1,000 UC-days, indicating a rate reduction of 57%.

In the present study, CAUTIs incidence rate reduction was not proved to be significant (p=0.167) comparing the pre and post intervention phases of the study. This is due to the low compliance degree of the ICU staff to the hand hygiene recommendations stated by both bundles during the first two months of the second phase (post-intervention phase) where the overall percentage of reduction was 27.1% compared with the last two months of the same phase (66.5%). The interventions (lectures, posters etc.) started from the beginning of September. There was a reluctance from the working staff to implement and follow elements of catheter care bundle and there was still low compliance in the first 2 month (September and October) of the intervention phase. Therefore the head of the ICU unit intervened again very strict, only thereafter the staff started to comply. As soon as they started to comply in the following 2 month (November and December), the improvement greatly decreased the CAUTIs rates at this time.

Conclusion

In the present study, the presence of a statistically significant strong negative correlation between the adherence

to the urinary catheter care maintenance bundle elements and the CAUTIs rate suggests their strong role in the prevention of CAUTIs. Adherence to recommended CAUTIs preventive practices (bundle) should become part of a culture of patient safety.

Notes

Competing interests

The authors declare that they have no competing interests.

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