Compliance With Standard Precautions Among Pediatric Anesthesia Providers

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Citation

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Abstract

Barrier precautions can reduce the risk of acquiring blood-borne infections, yet such precautions are frequently ignored, especially by personnel caring for pediatric patients. We observed pediatric anesthesia personnel to determine if patient and/or provider demographics influenced the use of standard precautions, and we determined whether an educational intervention would alter the behavior of anesthesia providers. Two, twelve week, observational periods were conducted during which time anesthesia provider's adherence to standard precautions was observed. The providers included student registered nurse anesthetists (SRNA), second year (CA2) and third year (CA3) anesthesia residents, fellows in pediatric anesthesiology and certified registered nurse anesthetists (CRNA). During period one, a statistically significant difference in glove use between junior and senior anesthesia providers (94% vs. 46%) was found. There were no differences in the use of standard precautions based on age, gender, or race. In the second period of the study, it was noted that compliance with standard precautions improved after an educational intervention. Prior to the educational seminar, 89% of junior providers and 40% of senior providers wore gloves during the induction of anesthesia. After the educational intervention, glove use increased to 100% for junior providers and 70% for senior providers. Glove use during emergence and the percent of providers wearing eye protection also increased. Implications: The greatest differences in the use of barrier precautions are related to the seniority of medical personnel and patient demographics do not influence the use of such precautions. A 30-minute educational inservice is effective in increasing the compliance with standard precautions.

INTRODUCTION

Anesthesiologists are at risk for acquiring more than 20 different infectious diseases that can be transmitted via blood and body fluids.([1,2,3,4,5,6]) Modes of transmission include percutaneous needle stick injuries and exposure to infected blood or secretions through contact with non-intact skin or mucous membranes. Transmission of bacterial, viral, fungal and rickettsial diseases have all been reported in health care workers. The infections of greatest concern include hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) ([7]) . While the prevalence of HIV, HBV, and HCV infections increases, the boundaries defining high-risk patient populations are becoming less well defined. These viruses represent significant infectious risk for the anesthesiologist because of the lack of an effective therapy for infected patients and the lack of a preventative vaccine for HIV and HCV.

In 1991, the Occupational Safety and Health Administration Bloodborne Pathogens Standard was enacted, and in 1992 the American Society of Anesthesiology issued guidelines for the prevention of Occupational Transmission of Infection to anesthesiologists.([8,9]) These original guidelines mandated the use of universal precautions, now referred to as standard precautions (universal application of blood and body fluid precautions designed to reduce the risk of transmission of bloodborne pathogens to health care workers). While these guidelines are designed to protect all patients and health care workers from the transmission of disease regardless of risk factors, efficacy can only be enhanced through vigilant compliance. Most studies involving anesthesia personnel have looked at the statistical risk of occupational exposure, and the anesthesiologist's perception of their own compliance with standard precautions respectively.([10,11,12,13,14]) Tait and associates concluded that most survey respondents reported awareness of the CDC and ASA guidelines. However, this awareness was not associated with a change in the anesthesiologists' practice. Furthermore, compliance appeared to relate to the anesthesiologist's perception of the patient's risk status. Ben-David and Gaitini found that glove use by anesthesia providers resulted in a significant reduction in needlestick

injuries, and that compliance with glove use was poor for pediatric cases.([15],[16]) The first period of this observational study was designed to determine whether compliance with standard precautions by pediatric anesthesia personnel varied based on patient and/or provider demographics. In the second period we sought to identify whether a 30-minute educational program would alter the use of standard precautions among anesthesia providers.

Figure 1

METHODS

This observational study was performed over six months at university-affiliated children's hospital during which time anesthesia provider's adherence to standard precautions was observed. The providers included student registered nurse anesthetists (SRNA), second year (CA2) and third year (CA3) anesthesia residents, fellows in pediatric anesthesiology and certified registered nurse anesthetists (CRNA). These anesthesia providers were unaware of the study. SRNA's, CA2 and CA3 residents spend twelve-week rotations in pediatric anesthesiology at this institution. Fellows in pediatric anesthesiology spend one year in training and certified registered nurse anesthetists (CRNA) are permanent employees. A single observer (GR) recorded adherence to standard precautions. The anesthesia providers were informed that GR was observing the rate of increase or decrease in Halothane concentration. Many staff anesthesiologists were involved in the design of the study and therefore were not included in the study.

Two, twelve week, observational periods were conducted. Period 1 defined practitioners overall use of standard precautions. Observations were obtained to define whether compliance was based on patient age or race, or provider seniority. During period 2, a thirty minute educational in-service about the use of standard precautions was given. Observations of the practitioners' behaviors were made during the 6 weeks before and 6 weeks after this educational intervention.

Since SRNA, CA2 and CA3 practitioners rotate for 12-week periods, there were two different groups of these junior providers observed in Period 1 and Period 2. The same group of fellows and CRNA's were observed throughout the study. During both periods six SRNA, three CA2, three CA3, three fellows, and four CRNA's were observed. In our practice, both junior and senior providers care for the same patient creating more observed patient-provider interactions than patients.

Observations were recorded four times during the course of each anesthetic: induction of anesthesia, placement of intravenous catheters, endotracheal intubation, and emergence from general anesthesia. Demographic data collected on all patients included age, race, gender, diagnosis, and procedure. Patients were divided into three age groups: infants (< 12 months), children (1 year - 12 years), and adolescents (>12 years to 18 years). Because there was an observed a significant difference between junior and senior providers during period 1, the analysis of anesthesia providers were divided into two groups during period 2: junior providers (SRNA, CA2 & CA3 anesthesia residents) and senior providers (CRNA and pediatric anesthesia fellows).

Throughout this study, the necessary equipment to adhere to standard precautions were readily available to all practitioners. Masks with or without face-shields were located outside each operating suite. Nonsterile latex gloves in small, medium and large sizes were located at each anesthetic location. Two needle dispensers mounted on wheels were available in each operating room to allow direct needle disposal without recapping.

Data were analyzed using one way analysis of variance (ANOVA) with post-hoc multiple comparisons using the Scheffe test on period one observations: gender, race, level of training, and age group during each observed action. Independent-sample T-tests were performed (equality of means), on data during period two comparing providers actions before and after the educational intervention and comparing junior vs senior providers. Data are presented as a mean + standard deviation or percentage with $p < 0.05$ considered significant.

RESULTS

During period 1 there were 193 patient - provider interactions observed for 89 patients, and during period 2 there were 123 patient - provider interactions observed for 65 patients. During period one, gloves were worn 75% and 84% of the time on induction and emergence respectively. A statistically significant difference in glove use between junior and senior anesthesia providers (94% vs. 46%) was found. Table 1. There were no differences in the use of standard precautions based on age, gender or race. Senior level personnel used eye protection more frequently than juniors. Table 1. There were also differences among providers in the percent that used gloves while taping endotracheal tubes, but no difference in the percent to use gloves for taping intravenous catheters.

Figure 2

Table 1. Patient and Provider Demographics
(Observational Periods 1 and 2)

	Period 1		Period 2			
			Pre-Intervention		Post-Intervention	
	n	mean ± SD	n	mean ± SD	n	mean ± SD
Age	89	5.3 ± 5.4	32	3.8 ± 3.5	33	4.7 ± 3.8
	n	(%)	n	(%)	n	(%)
Age Group						
Infant	34	(18)	2	(3)	11	(19)
Child	140	(72)	59	(91)	45	(77)
Adolescent	19	(10)	4	(6)	2	(4)
Gender						
Male	131	(68)	42	(65)	41	(70)
Female	62	(32)	23	(35)	17	(30)
Race						
Caucasian	99	(51)	26	(40)	34	(59)
Black	32	(17)	16	(25)	10	(17)
Hispanic	33	(17)	9	(14)	10	(17)
Asian	7	(4)				
Other	22	(11)	14	(21)	4	(7)
Training						
SRNA	47	(24)	5	(8)		(0)
CA2	37	(19)	16	(25)	7	(12)
CA3	29	(15)	19	(29)	21	(36)
Fellow	47	(24)	13	(20)	13	(23)
CRNA	33	(17)	12	(18)	17	(29)

There were 117 provider-patient observations of securing of endotracheal tubes during the study. 42% of providers wore gloves while securing the endotracheal tube. 77 of these provider-patient observations of securing of endotracheal tubes began with gloves in place and 30 (39%) removed their gloves to tape ET-tubes. There were 99 provider-patient observations of securing intravenous catheters during the study, in which 44% of providers wore gloves for this procedure. 67 of these provider-patient interactions of securing intravenous catheters began wearing gloves and 26 (39%) removed their gloves to tape IVs.

In the second period of the study, it was noted that compliance with standard precautions improved after an educational intervention. Prior to the educational seminar, 89% of junior providers and 40% of senior providers wore gloves during the induction of anesthesia. After the educational intervention, glove use increased to 100% for junior providers and 70% for senior providers, a statistically significant difference for seniors. Glove use during emergence increased from 94% to 100% for junior providers and from 27% to 72% for senior providers. Improvements in the percent of providers wearing eye protection were found, and in the percent of providers wearing gloves while taping endotracheal tubes. It was also noted that the percent of practitioners who used gloves while taping intravenous catheters did not significantly change.

Figure 3

Table 2
Patient and Provider differences in the use of Standard Precautions
(Observational period 1)

	Wearing Gloves		Using Eye Protection		Gloves to Tape ETT	Gloves to Tape IV
	Induction	Emergence	Induction	Emergence		
Level of Training	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
sRNA (junior)	47 (96)	44 (90)	47 (6)	44 (7)	11 (82)	5 (40)
CA2 (junior)	37 (97)	35 (100)	37 (30)	35 (29)	9 (100)	0 (0)
CA3 (junior)	29 (90)	26 (100)	29 (41)	26 (35)	†13 (38)	15 (60)
Fellow (senior)	*47 (51)	*44 (70)	*47 (64)	*44 (61)	†21 (24)	10 (10)
CRNA (senior)	*53(42)	*52 (50)	*52 (50)	*52 (50)	†19 (16)	12 (17)
Race						
Caucasian	99 (78)	91 (88)	98 (37)	91 (38)	39 (41)	24 (33)
Black	32 (53)	29 (66)	32 (44)	29 (34)	12 (25)	8 (25)
Hispanic	33 (94)	33 (94)	33 (36)	33 (30)	11 (73)	5 (60)
Asian	7 (100)	7 (100)	7 (29)	7 (43)	2 (0)	2 (0)
Other	22 (59)	21 (67)	22 (36)	21 (33)	9 (44)	3 (33)
Age Group						
Infant	34 (76)	33 (82)	34 (44)	33 (39)	14 (43)	7 (29)
Child	140 (77)	131 (85)	139 (35)	131 (34)	50 (42)	32 (31)
Adolescent	19 (58)	17 (71)	19 (47)	17 (47)	9 (44)	3 (67)
Gender						
Male	131 (76)	122 (83)	130 (33)	122 (32)	47 (47)	23 (35)
Female	62 (74)	59 (85)	62 (47)	59 (44)	26 (35)	19 (32)

* p < 0.05 CRNA, Fellow vs sRNA, CA2, CA3
† P < 0.05 sRNA, CA2 vs CA3, Fellow, CRNA

DISCUSSION

This study reveals that adherence to standard precautions in the care of children at an urban tertiary care pediatric hospital is not related to patient demographics, e.g. age, gender or race. In the first three-month observational period, greater compliance with standard precautions among junior providers was recognized. In the second three-month observational period, this same difference between junior and senior anesthesia providers was confirmed, and adherence to standard precautions was found to improve after a 30-minute educational seminar.

Figure 4

Other studies have also found better compliance with gloving and the use of protective barriers among more junior medical practitioners. ([16,17,18,19,20]). Ben-Davd and Gaitini found that resident anesthesiologists were more compliant with glove use than attending physicians. They also noted a difference in the most senior staff members, age over 55, from the junior staff anesthesiologists. They found gloves were used least often for pediatric cases, average 10%. The current study did not compare the use of protective barriers for pediatric versus adult patients, all of the patients were 18 years of age or younger. Also, attending anesthesiologists were not included. Four attending anesthesiologists participated in the development of this study making observations on the remaining staff impractical. Observations of senior level personnel that included 3 CRNA's, each of whom were greater than 55 years in age, were performed. Gloves were used least often by the CRNAs, but did not differ from that of the younger pediatric anesthesia fellows, age 26 to 36. Table 2. Both CRNA and fellow groups were older, more experienced practitioners when compared to CA2, CA3 anesthesia residents and SRNAs. Compared to Ben-David and Gaitini findings, all of the practitioners observed in this study used gloves more frequently when dealing with pediatric patients.

In both observational periods, it was noted that senior anesthesia providers used protective eyewear more frequently than juniors did. Because eyeglasses significantly reduce the risk of mucous membrane-eye contacts,([21]) we considered eyeglasses, face shields and goggles to be protective eye wear. More of the senior anesthesia providers routinely wear corrective eyeglasses, and therefore more of them used eye protection. Even though face shields were available throughout the study, they were infrequently used. After the educational inservice, compliance with eye protection improved.

Figure 5

Table 3
Influence of an Educational Intervention in the use of Standard Precautions
(Observational Period 2)

	Pre-Intervention		Post-Intervention	
	n	%	n	%
Use of gloves on induction				
Junior	40	89†	29	100
Senior	25	40	30	70*
Use of gloves on emergence				
Junior	37	94†	29	100
Senior	22	27	29	72*
Use of eye wear				
Junior	40	20†	25	45*
Senior	25	72	30	80
Use of gloves while taping ETT				
Junior	11	44	5	80*
Senior	11	9	17	47*
Use of gloves while taping IV				
Junior	13	91†	15	63
Senior	16	31	13	31

† P < 0.05 junior vs. senior practitioner
* P < 0.05 post-intervention vs pre-intervention

Previous studies of the risk of exposure to blood borne infection and their transmission to anesthesia personnel have primarily focused on either statistical analysis of incidence and prevalence data to calculate potential risk in the workplace, or in the case of Tait et al., the anesthesiologist's perception of their own compliance with standard precautions by way of a questionnaire. (10-14) Tait and Tuttle showed that anesthesiologists, while well aware of the CDC and ASA guidelines for the prevention of occupational transmission of HIV and HBV, continue to adjust their behavior situationally. Anesthesiologists change their compliance with standard precautions based on perceived patient risk factors and regional prevalence of HIV. Eighty-eight percent of respondents reported that they always complied with CDC guidelines when presented with an HIV-infected patient, but only 24.7% adhered to the guidelines when the patient was considered low risk. The results of this study indicate that compliance with standard precautions is related to the seniority of the provider, not patient demographics. Unlike adult providers surveyed in the Tait study, we found that pediatric anesthesia providers did not alter their use of standard precautions based on patient age, race or gender. We did not specifically study provider compliance when dealing with known HIV positive patients.

Senior providers did not wear gloves 54% of the time while in contact with patients. Habits that have been long-standing are difficult to change, regardless of the patient's

demographics or perceived risk factors. Our data shows the lowest compliance with glove wearing during taping procedures. Approximately one-third of providers who were wearing gloves beforehand, remove their gloves to tape ET-tubes and IVs. This may be due to the tape adhering to latex gloves or a perceived lack of proprioception making the task of taping more difficult. While performing these tasks, anesthesia providers are still at risk of coming in contact with blood, saliva, and needles that may have been placed next to the patient and uncapped, after the IV was started. Our experience has been that some latex gloves stick to adhesive tape more than others, and that by systematically evaluating a variety of glove manufacturers and tape combinations, a suitable combination can be found that minimizes the inconvenience of tape sticking to gloves. Proprioception and manual dexterity can be improved by using well-fitted gloves. Quality gloves of various sizes should be readily available at all anesthetizing locations.

Besides providing barrier protection and sharps disposals, one way to improve upon the lack of compliance is to provide continuous educational inservices in order to stress the importance of standard precautions. Two previous studies did not find educational information in significantly improve compliance with universal precautions or reduce needlestick injuries. ([22], [23]). There were no significant changes in medical students' risk of exposure to needlestick injuries despite instituting a mandatory course about universal precautions.(22) These authors looked at the actual exposure rate to needle sticks, and not at the adherence to standard precautions. Saghafi and associates evaluated the percent of nurses exposed to blood before and after the implementation of universal precautions combined with an informational campaign. They found an insignificant reduction to blood exposure from 42% of nurses to 27%. In contrast, the current study revealed an improvement in all subjects, both junior and senior, after the educational intervention. The improvement in the use of standard precautions was not statistically significant for junior medical personnel because of their high rate of compliance prior to the educational intervention. We believe this educational reminder about the risk of blood borne infections, their transmission, and ways of reducing the risk of transmission in the workplace, may hold the key to improving compliance with standard precautions. This study shows that education most greatly affects the behavior of senior anesthesia providers, who trained at a time when standard precautions were not a part of the educational curriculum. One question that remains to be answered is "How long after an educational intervention does improved vigilance on the part of anesthesia providers persist, and how often must these refresher courses take place?"

In summary, this study confirms that the greatest differences in the use of standard precautions are related to the seniority of medical personnel and that patient demographics do not influence the use of such precautions. We also found a 30-minute educational inservice to be effective in increasing the compliance with standard precautions.

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