Survey of Syringe and Needle Safety Among Student Registered Nurse Anesthetists: Are We Making Any Progress?

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Healthcare providers are expected to adhere to infection control guidelines. When infectious diseases such as hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), or other bloodborne pathogens are unintentionally transmitted to patients as a result of healthcare personnel violating basic infection control guidelines, the quality of life of the patients and their families is greatly affected. These infections lead to increased morbidity and mortality, and their treatment contributes to the substantial cost of healthcare in the United States today. One method of disease transmission results from unsafe injection practices by anesthesia providers: improper access of multidose vials, improper use of single-dose vials, and improper use or reuse of needles, syringes, and infusion sets. There have been few studies conducted in the United States that assess the rates of unsafe injection practices by anesthesia providers. Further inquiry is required to determine the scope of the problem so that educational needs can be identified, practice improved, and patient safety ensured.

Historically, it was common to draw medication into a sterile syringe, inject it into a patient's intravenous (IV) port, change the needle, and reuse the syringe to draw up additional medication for another patient. It was also commonplace to prepare IV infusions and use the same bag and IV tubing for all patients receiving treatment in a day. Research over the past several decades has demonstrated that bloodborne pathogens can be transmitted between patients by such practices. The Centers for Disease Control and Prevention (CDC) stated that needle and/or syringe reuse and the improper use of medication vials are preventable healthcare errors that should never occur. Unfortunately, lapses in infection control still occur in the healthcare setting, leading to the transmission of disease to those previously uninfected.

Multiple mechanisms explain how disease transmission can occur between and among patients. First, the reuse of needles and syringes between patients allows direct transmission of potentially infected blood and body fluids from one patient to the next. This can occur even if the needle or syringe is used only to access the y-port of the IV tubing. Second, once a syringe is empty, the inside barrel is open to air and can become exposed to contaminants that could infect a patient. Another potential cause of transmission stems from the multiple use of single-dose vials or flush solutions. These items do not contain additives that inhibit the growth of microorganisms and if accessed multiple times, become contaminated, potentially causing an infection. Finally, improper use of multidose vials can lead to the transmission of disease. Although they contain additives to prevent the growth of microorganisms, these solutions can still be mediums for transmission if they are contaminated. Contamination occurs by inserting a used syringe or needle (or both) into a multidose vial with the purpose of obtaining additional medication. When used on subsequent patients, the solution may contain infectious...
organisms that can be transferred to the next patient and result in an infection.

A lack of compliance with infection control guidelines that prohibit the reuse of needles, syringes, and IV tubing is evidenced by the outbreaks of healthcare-associated infections that still occur. Most of these lapses occur in healthcare settings outside the hospital. Since 1999, there have been more than 30 outbreaks of viral hepatitis and other healthcare-associated infections, requiring that more than 125,000 Americans be notified of their potential exposure and resulting in 448 people becoming infected with HBV or HCV.3,4 In 2001, a private physician office in New York put 2,192 patients at risk, resulting in 19 HCV infections, because of syringe reuse and medication vial contamination.4 In 2002, an outpatient pain clinic in Oklahoma infected 31 patients with HBV and 71 with HCV, requiring that 908 people be notified of their potential exposure.4 The Certified Registered Nurse Anesthetist (CRNA) involved in the Oklahoma incident reported that he routinely prepared a needle and syringe for each of the 3 medications used in the clinic and used those same 3 needles and syringes for every patient treated during a clinic session.5 As a result of his actions, the Oklahoma Board of Nursing revoked his license and issued a fine.5 In another case in 2002, an endoscopy clinic in New York placed 84 patients at risk by using contaminated medication vials on multiple patients, resulting in 4 HCV infections.4 In 2007, approximately 9,000 patients from an anesthesiologist’s office were placed at risk, and 3 were infected with HCV because of syringe reuse and contamination of multidose vials.4

Perhaps the largest and most well-known breach of injection safety involves the Endoscopy Center of Southern Nevada in Las Vegas. In 2008, more than 40,000 patients were placed at risk, and 6 were infected with HCV because of syringe reuse and contamination of single-dose propofol vials used in multiple patients.6 The investigation is still ongoing, and additional patients may still present with infection. It is estimated that the cost to notify and test those involved in the Nevada outbreak was between $16 million and $21 million.3

Other causes linked to healthcare-associated transmission of HBV and HCV include preparing injections in contaminated environments, sharing fingerstick devices or glucometers, using insulin pens on multiple patients, failing to wear gloves or perform hand hygiene, failing to properly clean dialysis equipment between patients, and workers abusing drugs.4,6 These examples are only a small sampling of healthcare worker–associated infections that have occurred in the past decade but demonstrate that the problem still exists.

Not only are there costs associated with the notification process, but additional monies must also be spent on testing those involved, providing prophylactic treatment, and continuing treatment of those who subsequently become infected. The cost of treating an individual with HIV from the time of diagnosis until the time of death has been estimated to cost from $80,902 to $371,600, with an estimated annual cost of $20,114.7,8 The lifetime cost to treat an individual with HBV can range from $39,654 to $70,678, but these estimates do not include the additional costs associated with treating cirrhosis or hepatocellular carcinoma, which would add substantially to that estimate.7 Further costs incurred by those involved in healthcare-associated transmission of infection include the following: fines, legal fees, or increased malpractice premiums; discipline against the licensee; sanctions or revocation of a provider’s professional license; loss of income; and decreased production. All these costs could be eliminated if healthcare workers would abide by the standards of care set forth by federal agencies, state agencies, and their associations and institutions.

Through a review of the literature and a study of student registered nurse anesthetists (SRNAs), this study aimed to identify the extent of improper injection practices in anesthesia today. This will provide current data that can be used to identify educational needs among anesthesia providers. Once the inconsistencies in injection practice are identified, corrective steps can be implemented to improve practice, which will ultimately protect the patient from harm, improve outcomes, and reduce healthcare costs.

Review of Literature

In 2009, the American Association of Nurse Anesthetists (AANA) adopted Position Statement Number 2.13, “Safe Practices for Needle and Syringe Use.”9 It includes 6 statements that are intended to reflect current safe practice standards for needle and syringe use by CRNAs. They are as follows: (1) Never administer medications from the same syringe to multiple patients, even if the needle is changed. (2) Never reuse a needle, even on the same patient. (3) Never refill a syringe once it has been used, even for the same patient. (4) Never use infusion or IV administration sets on more than 1 patient. (5) Never reuse a syringe or needle to withdraw medication from a multidose medication vial. (6) Never reenter a single-use medication vial, ampoule, or solution.

The review of literature yielded only 3 studies addressing injection practices in the United States, and none addressed all 6 statements found in the AANA position statement9 from 2009.

One study was completed in 1995 and addressed only anesthesiologists’ reuse of syringes on more than 1 patient. It found that 20% of those surveyed frequently or always reused their syringes for multiple patients.10 To the author’s knowledge, this was the only published study on this topic directed exclusively toward anesthesia providers. An AANA telephone survey conducted in 2002 was intended to determine provider attitudes and practices regarding
reused; included CRNAs, other nurses, oral surgeons, anesthesiologists, and other physicians; and addressed syringe or needle reuse, including reuse on multiple patients. The survey found that 3% of anesthesiologists and 1% of CRNAs reused syringes or needles on different patients, 42% of anesthesiologists and 18% of CRNAs reused syringes or needles overall, primarily on the same patient, and 8% of respondents reused IV tubing.

In 2010, a total of 68 ambulatory surgical centers were inspected to observe infection control practices, as these facilities showed an increased incidence of healthcare-associated infections. Researchers found that none of those centers observed used needles or syringes for more than 1 patient, but 28% used single-dose vials for more than 1 patient, 2.5% used prefilled syringes for more than 1 patient, and 1.6% used fluid infusion and administration sets for more than 1 person.

To round out the global extent of the drug contamination problem, the literature review was expanded to include international studies. Many of these studies were conducted in underdeveloped countries and primarily focused on unnecessary injections, availability and costs associated with using disposable equipment, and availability of proper disposal containers for “sharps,” as HBV, HCV, and HIV are much more prevalent in these countries. Most of the studies had small sample sizes, especially considering that many were attempting to assess practices across the entire country. Only the studies from the UK, Taiwan, and New Zealand were directed toward anesthesia providers, and none of the international studies addressed all 6 statements found in the AANA position statement.

Syringe reuse between patients was reported at rates from 0% to 60% in the international studies. All studies, except one focusing solely on infusion set reuse, addressed this issue. Needle reuse was reported at rates from 0% to 50%. Only the Romanian study differentiated between needle reuse on the same patient and needle reuse on multiple patients with rates at 1.6% and 0%, respectively. Rates of refilling syringes for use on the same patient were reported at 2.2% and 8%. Reuse of IV infusion sets ranged from 2.2% to 54% and focused solely on IV set reuse by anesthesia providers. The Mongolian study did observe that IV infusion sets were reused on multiple patients, but did not report percentages of the observed behavior. A study completed in New Zealand revealed that 41.3% of anesthesia providers used multidose vials for more than 1 patient, but did not address whether or not clean needles and syringes were used to access the vials. Had this occurred, there would be no breach of care because multidose vials are designed to be safe for use on multiple patients if proper procedures are utilized. Finally, the use of single-dose vials for use on more than 1 patient was addressed in only 1 study and occurred at a rate of 86.3%.

Please answer “yes” or “no” to the following questions:

1. Have you ever administered medications from the same syringe to multiple patients?
2. Have you ever reused a needle on the same patient?
3. Have you ever refilled a syringe once it has been used, even for the same patient? (This includes the syringe on propofol infusions.)
4. Have you ever used infusion or intravenous administration sets on more than one patient?
5. Have you ever reused a syringe or needle to withdraw medication from a multidose medication vial?
6. Have you ever reentered a single-use medication vial, ampoule, or solution to prepare doses for multiple patients, even if the needle/syringe is clean?
7. Have you ever witnessed a CRNA do any of the prior 6 activities (listed in questions 1-6)?
8. Have you ever been asked or instructed by a CRNA to do any of the prior activities (listed in questions 1-6)?

Table 1. Survey on Syringe and Needle Safety
Abbreviation: CRNA, Certified Registered Nurse Anesthetist.

**Methods**

Data were collected using an online survey tool (SurveyMonkey, http://www.surveymonkey.com). Questions were derived from the 6 statements found in AANA Position Statement Number 2.13. The survey was directed toward SRNAs, but additional questions were asked regarding student observation and experience with CRNAs. A total of 8 yes-no questions were included in the survey (Table 1). The survey and a cover letter were presented to the institutional review board (IRB) of Excela Health in Greensburg, Pennsylvania, and IRB exemption was obtained. Informed consent was implied by participant completion of the survey.

Student registered nurse anesthetists in the United States who had at least 3 months training in the clinical setting were chosen to participate in the study. This level of experience was selected because it enabled the students to respond using their own personal experiences. With the use of convenience-sampling methods, all 110 school program directors listed in the December 2010 issue of the AANA Journal were contacted via email requesting the participation of eligible students in the survey. Thirty-seven program directors agreed to allow their eligible students to participate. An email, containing a cover letter and a link to the confidential online survey, was sent to the program directors with instructions on forwarding it to the appropriate students. Program directors were requested to not direct student responses in any way. The SurveyMonkey program was used to analyze the results.
Nurse anesthesia program directors were asked to indicate how many students they forwarded the survey to, but 10 directors did not supply this information, leaving the author to estimate the total number of SRNAs who received the survey as more than 1,063. Of the SRNAs contacted, 325 responded: 23 first-year students, 123 junior students, 177 senior students, and 2 not identifying their year in the program. Of those responding, 14 SRNAs (approximately 4%) indicated they have administered medications from the same syringe to multiple patients, 59 (18%) have reused a needle on the same patient (2 students did not respond to this question), and 266 (82%) have refilled used syringes, even if only for use on the same patient (Table 2). Furthermore, 2 students (0.6%) reported they have reused infusion or IV administration sets for more than 1 patient; 71 (22%) have reused a syringe or needle to withdraw medication from a multidose medication vial; and 160 (49%) have reentered a single-use medication vial, ampoule, or solution to prepare doses for multiple patients, even if the needle/syringe is clean and even if only for use on the same patient (Table 2). Two junior students reported that they refused to violate standards when their CRNA asked or instructed them to do so.

Discussion

The survey results demonstrate that an educational need exists, as unsafe injection practices still occur in the anesthesia setting. Not only are CRNAs continuing with unsafe needle and syringe practices but also SRNAs have adopted these aberrancies into their own practice. Of all the literature reviewed that addressed educational issues, only one study’s authors believed that education regarding hygiene during surgery and anesthesia should not be extended because of the amount of money, time, and human resources required. Although healthcare-associated infections are not the primary source of HBV or HCV transmission in the United States, the outbreaks that have occurred demonstrate that increased efforts must be made in the education and training, oversight, and follow-up of anesthesia providers.

Education on injection safety needs to be part of the curriculum that begins in schooling, continues throughout the provider’s career, and is evaluated by annual competencies. Repeated training is a necessary element required to change behaviors. Oversight of staff includes not only holding oneself accountable but also holding coworkers accountable for their infection control practices. Specially trained infection control practitioners employed by the healthcare institution need to observe staff behaviors, make corrections where needed, and assist in the development of educational programs for staff members. Those in management and administration need to set the expectation that proper infection control practices are to be carried out by all staff 100% of the

<table>
<thead>
<tr>
<th>Question</th>
<th>No. (%) of responses</th>
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<tbody>
<tr>
<td>Have you ever administered medications from the same syringe to multiple patients?</td>
<td>14 (4) 311 (96)</td>
</tr>
<tr>
<td>Have you ever reused a needle on the same patient?</td>
<td>59 (18) 264 (82)</td>
</tr>
<tr>
<td>Have you ever refilled a syringe once it has been used, for the same patient? (This includes the syringe on propofol infusions.)</td>
<td>266 (82) 59 (18)</td>
</tr>
<tr>
<td>Have you ever used infusion or intravenous administration sets on more than one patient?</td>
<td>2 (0.6) 321 (99.4)</td>
</tr>
<tr>
<td>Have you ever reused a syringe or needle to withdraw medication from a multidose medication vial?</td>
<td>71 (22) 254 (78)</td>
</tr>
<tr>
<td>Have you ever reentered a single-use medication vial, ampoule, or solution to prepare doses for multiple patients, even if the needle/syringe is clean?</td>
<td>160 (49) 165 (51)</td>
</tr>
<tr>
<td>Have you ever witnessed a CRNA do any of the prior 6 activities (listed in questions 1-6)?</td>
<td>257 (81) 62 (19)</td>
</tr>
<tr>
<td>Have you ever been asked or instructed by a CRNA to do any of the prior activities (listed in questions 1-6)?</td>
<td>184 (58) 135 (42)</td>
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Table 2. Survey Responses

Abbreviation: CRNA, Certified Registered Nurse Anesthetist.

Some responses do not total to 325 (the number of survey respondents) because some students did not answer those questions. Percentages are rounded.

Results

Nurse anesthesia program directors were asked to indicate how many students they forwarded the survey to, but 10 directors did not supply this information, leaving the author to estimate the total number of SRNAs who received the survey as more than 1,063. Of the SRNAs contacted, 325 responded: 23 first-year students, 123 junior students, 177 senior students, and 2 not identifying their year in the program. Of those responding, 14 SRNAs (approximately 4%) indicated they have administered medications from the same syringe to multiple patients, 59 (18%) have reused a needle on the same patient (2 students did not respond to this question), and 266 (82%) have refilled used syringes, even if only for use on the same patient (Table 2). Furthermore, 2 students (0.6%) reported they have reused infusion or IV administration sets for more than 1 patient; 71 (22%) have reused a syringe or needle to withdraw medication from a multidose vial; and 160 (49%) have reentered a single-use medication vial, ampoule, or solution to prepare doses for multiple patients, even if the needle or syringe was clean and even if only for use on the same patient (Table 2).

Two additional questions directed at obtaining data regarding observed CRNA practice demonstrated that 257 students (81%) have witnessed a CRNA breach at least 1 of the 6 safe practice standards (6 students did not respond to this question), and 184 (58%) have been asked or instructed by their CRNA to violate at least 1 of the 6 standards (6 students did not respond).

Overall, students witnessed all 6 standards being violated and were asked or instructed to violate all 6 standards. The most frequently witnessed CRNA violations were refilling used syringes, even for the same patient, and using single-dose vials for use on multiple patients. The most frequent request made of students by CRNAs was to refill used syringes, even for use on the same patient. Two junior students reported that they refused to violate standards when their CRNA asked or instructed them to do so.
time, without creating an environment of fear, as lapses and poor processes need to be openly discussed in order to improve outcomes. Professional associations also develop guidelines and standards that providers need to incorporate into their practice. Finally, federal and state institutions such as the Joint Commission, CDC, Centers for Medicare and Medicaid Services, and the US Department of Health provide expectations and oversight. They help set standards for facilities, inspect and accredit them, and can levy fines for standard violations.

Educational advancements have already taken place, but additional investments must be made. The Safe Injection Practices Coalition was founded in 2008 with a focus on halting unsafe injection practices. The coalition, in conjunction with the CDC, launched the “One and Only Campaign” in hopes of increasing awareness of injection safety among healthcare providers and the public. Their goal is to have everyone insist on using 1 needle and 1 syringe 1 time for every injection. They recently launched a 10-minute video for healthcare providers on safe injection practices. Although these national efforts, including the AANA’s adoption of Position Statement Number 2.13 in 2009 and mailing copies of the AANA Injection Control Guide for Certified Registered Nurse Anesthetists to CRNAs in 2002, are steps in the right direction, more focused efforts need to take place in schools and individual facilities, especially ambulatory care centers, as this is where most of the reported outbreaks have occurred.

Unfortunately, having voluntary access to this information will not necessarily result in practice change if individuals do not believe they have any reason to modify their practice or do not know the information is available. Facility training should center on mandatory in-services, competencies, and observations of practice. This would ensure that all staff receive the same education and can be held to the same standards without excuse. As people need to see a reason to change, reinforcing the negative outcomes associated with unsafe injection practices and inappropriate handling of medications may be the impetus some need to change their practice.

There are multiple strengths associated with this study. The purpose of documenting the extent of improper injection practices that occur today was achieved. The survey was an appropriate tool to use to obtain objective data, and the project was peer-reviewed. However, several limitations can be identified. First, a convenience-sampling method was used. Future studies would ideally use random sampling techniques. Also, since the pool of students surveyed obtain their clinical experiences at a small number of clinical sites, it is possible that some of the students reporting on observed CRNA practices actually witnessed the same CRNA in practice. This would exaggerate the results and give the impression that unsafe injection practices among CRNAs occur at higher than actual rates. In addition, some of the students could have possibly misinterpreted their observations, which would also overestimate the incidence of unsafe CRNA practice. Finally, this study obtained information only from SRNAs. Future researchers could send the surveys directly to CRNAs to gather firsthand reports of their practice, rather than that observed by students. Obtaining information from both students and practicing CRNAs would more accurately reflect current practice.

It is imperative that the data obtained in this study be shared with other healthcare providers because one worker can negatively affect thousands of patients through substandard practice. Empowering institutions with information may encourage them to implement additional educational programs and allow anesthesia providers to examine the effects of their practice on the patients in their care and implement change. As anesthesia providers are guided by the basic ethical principle of beneficence, they need to make a conscientious effort to always follow the safe practices outlined by the AANA, which will ensure that no harm will come to a patient as a result of inappropriate injection practices. It is unacceptable to put patients at risk and potentially transmit deadly diseases when the cost of a syringe is less than 50 cents US. The financial burden placed on the healthcare system as a result of healthcare-associated infections is enormous, but no dollar amount can be placed on the devastation a patient feels when he or she contracts a disease as a result of poor practice.

REFERENCES


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