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Master of Public Health Research Project

Adherence to the American College of Surgeons (ACS)
recommendation on double gloving, hand free zone and blunt
suture needle use among Surgeon ranks

by

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Epigraph

In thy name

Have We not expanded thee thy breast?-

And removed from thee thy burden

The which did gall thy back?-

And raised high the esteem (in which) thou (art held)?

So, verily, with every difficulty, there is relief:

Verily, with every difficulty there is relief.

Therefore, when thou art free (from thine immediate task), still labour hard,

And to thy Lord turn (all) thy attention.

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Abstract

Background: The American College of Surgeons guidelines suggest the use of intact gloves, double gloving, hands-free zone technique to pass sharp instruments, and blunt tip suture needles to protect patients, as well as the surgical team. This study estimates the extent to which these guidelines are followed in a large academic health system.

Methods: Over a two-month period in the spring of 2010, 320 general surgical attendings, subspecialty surgical attendings, and surgical resident physicians practicing at a large academic health system, were approached during or after surgical conferences to participate in a cross-sectional study. Nearly 1/3rd completed an anonymous and voluntary self-administered survey. The survey included questions regarding knowledge of each technique, beliefs about effectiveness of each technique, and adherence to the guidelines. Responses were compared by surgeon rank.

Results: Awareness of ACS recommendation guidelines was high among surgical attendings (68%) and residents (60%). While 60% of residents adhered to these recommendations, only 43% of attendings adhered. Both attendings (65%) and residents (64%) had similar negative perception toward double gloving in terms of tactile sensation and hand free zone hindrance during procedural operations during cases. Forty percent of residents and attendings agreed on unhindered concentration to hand free zone technique. Blunt tip suture needle use had low awareness and usage regardless of surgeon rank (~40%).

Conclusion: Increased promotion of the ACS guidelines is warranted. Continuing medical education for surgical attendings may promote more widespread adoption of techniques to promote safety.

Introduction:

The National Institute for Occupational Health and Safety (NIOSH) estimates 600,000 to 800,000 needle sticks and other percutaneous injuries annually in US hospitals.¹ Percutaneous injuries led to 16,000 cases of hepatitis C, 66,000 cases of hepatitis B and 1,000 cases of HIV, with combined medical and work productivity estimated cost of \$188.5 million in 2004.¹ Surgical team members have more frequent exposure to blood and higher rates of percutaneous injury than individuals in other healthcare settings.² Suture needles are involved in as many as 77% of injuries³ and high risk injuries to surgeons are usually from hollow bore vascular access needles.⁴ The overall rate for percutaneous sharp object injuries was 16.88 per 100 occupied beds per year for non-teaching hospitals and 44.32 injuries per 100 occupied beds per year for teaching hospitals.⁴

The Occupational Safety and Health Administration (OSHA) requires use of Universal Precautions, which is the enactment of the blood borne Pathogen Standard.⁵ The Needlestick Safety and Prevention Act of 2000⁶ explicitly requires health care employers to provide safety-engineered needles and sharp instruments “with a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident.”⁶ The risk-exposure reduction guidelines are namely, elimination of hazard; substitution of hazardous procedure with a less hazardous one; administration of policies and procedures to reduce employee exposure; and personal control of employees when interacting with the hazard.⁴ Effective precautionary measures for operating room personnel include double gloving⁷, the use of blunt suture needles, and neutral instrument passing zones (hands-free technique).^{8,9,10}

The operating area has the greatest concentration of sharp instruments with the risk of percutaneous injuries from contaminated sharp objects greatly increased.¹¹ Thoracic surgeons and scrub nurses have perforation rates as high as 61% and 40%, respectively.¹² Double gloving reduces the risk of exposure by as much as 87% when the outer glove is punctured.⁷ The practice of wearing two pairs of gloves offers a high degree of protection, with reduction of blood volume on a suture needle by 95% when passing through two glove layers, reducing viral load in the event of a contaminated percutaneous injury.¹³ The use of the neutral zone to transfer sharp instruments reduces health care workers’ (surgeons, OR nurses and scrub techs) exposure during operations.^{9,10} While overall rates of percutaneous injuries have decreased,¹⁴ surgical teams remain at highest risk

for exposure in part due to low compliance to the Universal Precaution recommendations.^{9,15} Hand free zone technique usage is not widespread;¹⁶ up to 16% of injuries occur while passing sharp instruments hand-to-hand (range 6% to 16%).⁴ Lack of compliance among surgeons may be due to perceptions that double gloving reduces tactile sensitivity and manual dexterity among other things, hand free zone as not being very useful in sharp injury prevention, and blunt tip sutures lengthening operational time and having limited usage. Therefore, the purpose of this study was to determine the knowledge of and adherence to the American College of Surgeons recommendation guidelines regarding double gloving, hands-free zone, and blunt suture tip needle use among surgeons in a large academic health system.

Methods:

Study Population

This was an IRB approved study performed at the Virginia Commonwealth University Medical Center. Eligible participants included general surgery attendings, subspecialty surgery attendings, fellows, and resident physicians. The survey was conducted over a two-month period (March—April, 2010) during grand round conferences, subspecialty rounds, surgical residency cases, trauma cases, and gynecology case-discussions or other inter-departmental conferences. The anonymous and voluntary questionnaire survey was distributed to a total of 320 eligible surgery attendings and residents to complete. The survey was dispersed five to ten minutes prior to the start of each conference to surgeon physicians, which was self-administered with participants completing the survey during or after these conferences. Returned surveys were placed in a designated location (e.g. a table, a box or a person for collection). While it was likely that potential participants were approached multiple times, those who had already completed the survey did not redo the survey by choice. We received 104 completed surveys, however 4 surveys were completed by OR nurses and were excluded. Our final sample consisted of 100 surgeons, attendings and residents.

The survey examined surgeon's adherence to the American College of Surgeons' guidelines and included three conceptual domains: awareness of the guidelines, effectiveness of the guidelines, and surgeon's attitude. For each of these domains, separate questions were asked regarding double gloving, hand free zone, and blunt tip suture needle use (See Appendix). Participants were

specifically asked about awareness of the ACS guideline recommendation, as well as surgeons' attitude toward them in injury prevention. Response choices were a 5-point Likert scale with "1" meaning strong disagreement and "5" meaning strong agreement. For simplicity and ease of understanding, the five-point scale was collapsed into three-level scale by combining Strongly Disagree and Disagree and Strongly Agree and Agree. These questions were modified slightly for use in this study, but were validated in previous studies.¹⁵ Surgical rank was self-reported as surgeon, attending or resident.

Statistical Analysis

We describe the number of survey participants by surgeon rank (attending and resident, N=31, N=69, respectively) and department. This was determined by those residents who completed and returned the survey, out of the total number of residents in each specific surgical specialty. Frequencies were calculated to determine the percentage of participants for each category (double gloving, hand free zone and blunt tip suture needles) of the survey. For each domain, an overall distribution of Likert score for variability on response rate to questions was compared among surgeon rank (attending, resident). Simple descriptive statistics and frequency distribution for the questionnaire responses were calculated to define the number and proportion of surgeon awareness, attitude and behavior towards the guidelines. A comparison of the response rates was performed to determine adherence to ACS recommendation guidelines. Fisher's exact test and chi-square contingency table was conducted to examine differences in the response rates. The data was presented as relative odds ratios with 95% confidence interval and a p-value ≤ 0.05 was considered to be statistically significant.

Results:

Overall response rate was 31.3% for the study, with rank specific responses being 9.7% for surgical attendings and 21.6% for surgical residents. Resident response rates differed by departments: 90% orthopedic; 44% general surgery; 42% gynecology; <40% other surgical subspecialty departments. Table 1 shows the distribution of knowledge of ACS guidelines and beliefs about effectiveness of the strategies recommended in the guidelines by surgeon rank. Attendings tended to

be more likely to report awareness of double gloving as a prevention strategy relative to residents (68% vs. 58%; p-value=0.24). Nearly one third (33%) of attendings disagreed with the role of double gloving in preventing injury relative to 13% of residents (p-value=0.077). No differences in awareness of hand free zone technique or blunt tip suture needles use as prevention strategies were observed between attendings and residents; 60% residents agreed that hand free zones prevented injuries relative to 53% of attendings (p-value=0.175). While 46% of residents and 43% of attendings reported blunt suture needles use as a prevent measure for needle sticks; 20% of attending disagreed with the role of blunt tip suture needles use compared to 5% of resident (p-value = 0.11).

Figure 1 shows the percentage of usage during surgical operations of ACS recommendation guidelines to double gloving, hand free zone and blunt tip suture needle use. About 37% of surgery residents reported wearing double glove in 75-100% of their cases compared to 29% for attendings. Attendings and resident did not double glove in 54.8%, and 50% of operations, respectively. Specifically, there was a difference of 26.4% between attendings and residents not double gloving at all, in zero percent of the cases that was statistically significant (p-value = 0.008). Surgical residents' responses to the use of hand free zone technique was only 8.2% compared to 7.7% for attendings in the 75-100 percent usage during their operations. Almost 50% of both attendings and residents did not use hand free zone as a method of needle stick prevention. The blunt tip suture needle also had low usage from respondents of the survey. Only 10.7% of attendings and 3.2% of resident made use of blunt tip suture needle for safety prevention of needle sticks in the 76-100 percent of the cases. Nearly forty percent of attendings and 75% of resident did not make use of blunt tip suture needle during operations among the survey responders. There was a significant difference between attendings and residents in the percent usage of blunt tip suture needle use.

Table 2 shows perception to tactile sensation and hindrance of concentration and how it affects surgeons during case operation by surgeon rank. The influence of double gloving on surgeon perception and sensation was clear. There was a strong agreement on decreased tactile sensation for both attendings and residents, (64.5% vs. 63.8%). Nearly one third (29%) of attendings and one fourth (23.2%) of residents disagreed with the notion that double gloving decrease tactile sensation and negatively affects their work during cases. Nonetheless, more residents and attendings attributed a negative effect to double gloving than those who had positive effect. There was a significant

difference between those who agreed with decreased tactile sensation and those who disagreed. ($p < 0.05$). The hand free zone has been implicated in causing distraction of concentration during surgery operations. The surgery residents' response to hand free zone as a distraction of concentration was 15.4% compared to 25.9% of attendings during cases. Of those who completed the survey, 38% of residents, and greater than 40% of attendings reported unhindered concentration. There were more attendings and residents who disagreed with hand free zone concentration hindrance during cases than those who agreed with the distraction. A comparison between those who reported being distracted and those unhindered, indicated no significant difference ($p < 0.079$).

Discussion:

This is the first study to look at surgeon rank for adherence to ACS recommendation guidelines in VCU Medical Center. Current ACS recommendation guidelines for the use of double gloving, hand free zone technique, and blunt tip suture needle are methods of injury prevention in the operating room (OR). The ACS provides guidelines for work practices that strive to eliminate, protect, or standardize the use of sharp instruments in the OR for the safety of patients and the prevention of injuries to surgeons. Our study found that approximately 68% of surgical attendings and 60% of surgical residents were aware of the ACS recommendation guidelines in regards to double gloving and hand free zone but only about 52% vs. 48% for blunt tip suture needle use, which is consistent with findings of other hospitals.¹⁷ Previous studies have reported low rates of compliance among surgeons for all of the above-mentioned guidelines.¹⁸ This is expected since older surgeons are more likely to have habits and practices that are consistent with how they were trained, which may be different than what are now in the guidelines.

Surgeons who responded to our survey, were comparable to results reported by Jagger et al.¹⁵ About 50% of surgeon physicians were in agreement with blunt suture needle use as a preventative measure for needle sticks. The awareness and attitude statistics translated to behavior when time presented for their use in the operating room. Surgical attendings double gloved 29% of the time in most of their cases compared to 37% of residents. However, 32% of attendings and only 6% of residents were not adherent at all with the recommendation of double gloving, which may be due to the perception of decreased tactile sensation and manual dexterity.¹⁸ The use of blunt suture needle

was not much higher, with usage rate of 11% attendings and 3% of residents. Contrary to its recommendation, 40% vs. 75% of attendings and residents respectively, did not make use of blunt suture needle as prevention for needle sticks.

A number of studies have since examined the effectiveness of precautionary measures for operating room personnel, including double gloving, neutral zones and the use of blunt suture needles.³ Glove perforation is a common event during surgery and the frequency varies from 22% to 61% during various types of surgical procedures.^{19, 20} The highest have been reported in orthopedic, thoracic and traumatology surgery (gen. surgery, trauma) because surgeons face sharp fractured bones and bony structures in the field of operation. According to previous studies, double gloving increased perforation detection by 86% and decreased the surgeon's skin contact to possible infected blood contamination.²¹ Although overall rates of percutaneous injuries have decreased,¹⁴ recent research indicates surgical personnel still remain among the most at risk for exposure with low compliance to recommendations. More attendings felt that double gloving was not a preventative measure for needle stick injuries than residents. The percent use of double gloving in the OR was significant for not double gloving among surgeon rank; although about a third of attendings and residents wore double gloves in most of their cases. Mostly all of the studies recommend the practice of double gloving; with a study by Tokars²² showing hand contact with patient's fluids were 72% lower for those surgeons who double gloved. Yet, surgery residents and attendings had similar responses in regards to double gloving affect on tactile sensation. This may be one reason for not double gloving during all operations, but other reasons cannot be excluded, such as limited dexterity or limited-knotting ability.²³ Surgeons must balance the benefits of wearing double gloves to protect themselves against the minor disadvantage of loss of sensitivity that diminishes with use.

Hand free zone during OR time had limited usage, only 8% of both residents and attendings reported usage in 76-100 percent of the time but only 20% of surgeons were not using this technique at all during cases. This limited usage could be a result of their perception toward hand free zone, since 15 to 26 percent of surgeon physicians implicated its use to hindrance of concentration. Currently there is limited data about the efficacy of hand free zone in sharp injury reduction in the OR.^{5, 7, 24} Despite recommendations from professional societies, the hands-free technique is not widely used, and a little more than half of the respondents were aware of the guidelines. Residents

were more likely to disagree with the usefulness of hand free zone compared to attendings. According to other studies, hand free zone has been implicated for surgeon's limited use due to hindered concentration during operations, and the perception of low priority in preventing injury, which about 25% of attendings attested to in our study. Surgeons who did not use the hands free zone technique during previous studies, have mentioned that picking up sharp instruments from a field or basin would make them remove their eyes from the surgical site for brief moments or might increase the length of surgery.²⁵ However, those surgeons who used the hands-free zone technique with no perceived deterioration in technique or overall patient care corresponded to 40% of our survey respondents. Hand free zone use may become more prevalent with increased pressure from reports that suggest an increased number of intra-operative pathogen transmissions. The ACS recommends the use of hand free zone as an adjunctive safety measure to reduce sharp injuries during surgery except in situation where it may compromise the safe conduct of the operations, in which case a partial hand free zone can be used.²⁶

Almost eighty percent of surgeons did not use blunt tip suture needle for needle stick injury prevention and only about 10% used it in fifty to hundred percent of their cases. The results could be misleading if the data are not relevant to the types of surgeries performed. For example, surgeries in ENT, plastics, ophthalmology, and to a certain extent gynecology often do not use blunt needle because of suture size and type of tissue being sutured. It has been suggested that the use of a blunt tip suture needle does not increase injury prevention, but studies have shown that the risk of injury increases during emergency procedures, procedures that have longer duration, and with increased number of needles used.²⁷⁻³⁰ Routine use of blunt tip suture needles minimizes sharp injuries during closure of large and thick tissue (ie. fascia, muscle, connective tissue). Wright and colleagues reported that the use of blunt tip suture needle during hip arthroplasty considerably decreased glove perforations,²⁴ as well as three other prospective randomized trials have demonstrated notable benefits of blunt suture needle use.³¹⁻³³

There were strengths and limitations to this study. This was a cross-sectional survey study and study personnel with standardized data collection forms collected all data. The relatively small number of responses posed a challenge in obtaining strong statistical results, particularly the case upon stratification by rank and department. Since the study relied on a survey that examined

operating room personnel's experience to double gloving, hand free zone, and blunt tip suture needle use, the results can be an underestimation of the actual numbers.⁹ Another possible limitation of this study may be the uncontrolled confounding from the inability to measure individual characteristics such as previous experience of a surgeon (attending or resident).

We examined the effect of adherence to ACS recommendation guidelines by surgeon rank to assess several factors. Primarily, it was to obtain a baseline percent of surgeon physicians in VCU Medical Center awareness of the ACS guidelines and adherence to its application to daily practice. It is interesting to discover the unawareness of surgeons to the recommendations by the American College of Surgeons in our study was about 40—50%, with no statistically significant differences in surgeon rank. These findings have clinical and epidemiologic importance. Our study points to the need for interventions to increase awareness about the guidelines and the effectiveness of the recommended approaches. It is surprising to discover that about half of surgeons, regardless of rank were unaware of the recommendations, and may not be considering them during their daily practice in the OR. One potential reason for this could be how resident learn the practice of surgery and the habits, behaviors and to a certain extend certain perception of teaching attendings during the course of their training.³⁴ Moreover, there is no well-documented methodology for the modification of physician behavior. The impact of age or experience on behavior malleability is inconclusive as indicated by the literature.³⁵ There are elegant techniques, such as cognitive feedback with modeling of physician behavior and cybernetic systems, may be worth additional efforts.^{36, 37} Economic incentives to modify behavior need to be examined in the context of the shift from fee-for-service reimbursement to performance care reimbursement.³⁷

Awareness of the risk of exposure to blood and body fluids containing HIV, HBV and most recently HCV have created a new era in surgical infection prevention practices. Just as patients must be protected from wound contamination and infections, so must providers be protected from intra-operative injuries and exposure to patients' blood and other body fluids. The emotional impact of a needle stick injury can be worrisome, particularly if the exposure involves HIV, even in cases of non-transmission. Therefore, it is best to follow guidelines and recommendations since their created purpose have been for safety and protection of patients, surgeons and all others involved.^{38, 39}

Conclusion:

There needs to be more awareness of the ACS recommendation guidelines, because the next generation of surgeons will adopt the habits of their residency, which will carry into their careers. Previous studies have reported varying improvement in adherence with Universal Precautions after implementation of an educational program. Ongoing educational programs (eg. seminars, talks, discussions, weekly conferences) may be the best strategy to reinforce adherence to Universal Precautions among surgical personnel.⁴⁰ Further investigation may be needed to determine the optimal method of increasing adherence to the ACS recommendation guidelines in academic health systems. A team approach to sharps safety is critical to reduce the risk of blood borne infections resulting from sharps injuries in the operating room. It is essential residents be taught the best and up-to-date practices so their standard of patient care, performance and safety is within the current guidelines. Our finding supports the need for prevention programs that are targeted to mitigate the risk of blood borne pathogens exposure and needle stick injuries. When there is a lag of guideline application in practice, there is an injury waiting to happen.

Table 1: Self-reported knowledge of ACS guidelines to prevent blood borne pathogen exposures in the operating room by surgical rank

| | Attending N=31 | Resident N=69 |
|-----------------------------|------------------------------------|------------------|
| Awareness | Percentage | |
| Double gloving | 67.7 | 58.0 |
| Hand Free Zone | 61.3 | 60.9 |
| Blunt tip suture needle use | 51.6 | 47.8 |
| Attitude | Percentage Strongly Agree or Agree | |
| Double gloving | 54.8 | 62.3 |
| Hand free zone | 53.3 | 59.7 |
| Blunt tip suture needle | 43.3 | 46.4 |

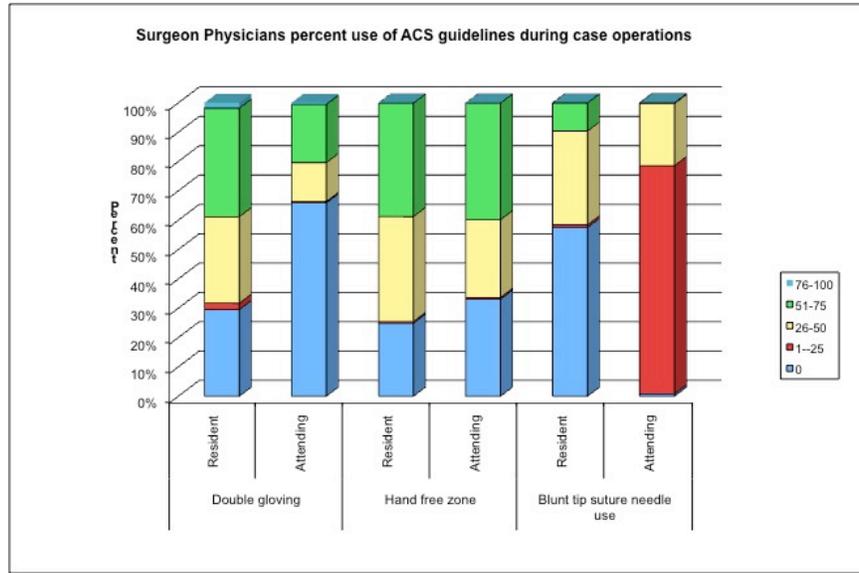


Figure 1: Self-reported percent usage during case operations by surgical rank

Table 2: Self-reported surgeon perception of the affects of double gloving and hand free zone during operations by surgical rank

| Surgeons Perception | Attending | Resident |
|---|---|----------|
| | N = 31 | N = 69 |
| | <u>Percent Strongly Agree/Agree</u> | |
| Double gloving – decrease tactile sensation | 64.5 | 63.8 |
| Hand Free Zone – hindrance to concentration | 25.9 | 15.4 |
| | <u>Percent Strongly Disagree/Disagree</u> | |
| Double gloving – decrease tactile sensation | 29.0 | 23.2 |
| Hand Free Zone – hindrance to concentration | 40.7 | 38.5 |

Appendix: Study Survey

Thank you for your assistance in completing this short survey on American College of Surgeons (ACS) Guidelines. Note the Survey is Double Sided

YOUR PARTICIPATION IS VOLUNTARY AND YOUR RESPONSES WILL BE KEPT ANONYMOUS.

By Completing this survey you acknowledge that you are participating in a research project, and that you are doing so in a completely voluntary manner

PLEASE CIRCLE YOUR POSITION AND PROVIDE DETAIL WHERE SPECIFIED:

Resident (program)_____ Fellow (program)_____ General Surgery Attending
Surgery Subspecialty Attending (specialty) _____ OR nurse (position)_____

PLEASE CIRCLE ONE RESPONSE TO EACH OF THE FOLLOWING QUESTIONS

Double Gloving

1. Are you aware of the ACS double gloving recommendation for the prevention of blood borne pathogen exposures in the OR? **Yes** **No**

2. I feel that double gloving helps to prevent needle stick injuries?

Strongly Disagree **Disagree** **Neither Agree nor Disagree** **Agree** **Strongly Agree**

3. What percentage of the time is double gloving used during your cases?

0% **1-25%** **26-50%** **51-75%** **76-100%**

4. The option to double glove is not offered at the beginning of a case

Strongly Disagree **Disagree** **Neither Agree nor Disagree** **Agree** **Strongly Agree**

5. I feel that double gloving negatively affects tactile sensation

Strongly Disagree **Disagree** **Neither Agree nor Disagree** **Agree** **Strongly Agree**

6. The proper liner (inner) glove is not available in the OR

Strongly Disagree **Disagree** **Neither Agree nor Disagree** **Agree** **Strongly Agree**

7. I feel double gloving is not promoted in the OR

Strongly Disagree **Disagree** **Neither Agree nor Disagree** **Agree** **Strongly Agree**

Hands Free Zone

1. Are you aware of the ACS recommendations for using Hands Free Zones (HFZ) in the OR to prevent needlestick injuries/blood borne pathogen exposures? **Yes** **No**

2. I believe that Hands Free Zone technique helps prevent needlestick injuries and blood borne pathogen exposure

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

3. What percentage of the time is the Hands Free zone technique used in the OR?

0% 1-25% 26-50% 51-75% 76-100%

4. I feel that the Hands Free Zone distracts from and breaks concentration on the case

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

5. I feel that the OR staff is not trained properly to institute the Hands Free Zone during a case

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

6. I feel that the surgical leadership encourages the Hands Free Zone

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Blunt Tip Suture Needles

1. Are you aware of the ACS recommendations for blunt tip suture needles when suturing deep fascia and muscle? **Yes No**

2. I feel the use of blunt tip suture needles helps prevent needlestick injuries and blood borne pathogen exposures?

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

3. What percentage of the time are blunt tip suture needles used in the OR?

0% 1-25% 26-50% 51-75% 76-100%

4. I feel that blunt tip suture needles are not available for use in the OR

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

5. I feel blunt tip suture needles do not have the same penetrating abilities as conventional sutures and are therefore less effective

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Thank you for your participation in this survey.

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