

Aseptic techniques for labour epidurals: A survey and review of neuraxial anesthesia practice

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ABSTRACT

Background: Aseptic technique is essential for the prevention of infection during labour epidural procedures. The literature suggests there is significant variability in aseptic practice among clinicians which often depends on personal beliefs rather than scientific evidence. The main objective of this survey was to determine which components of aseptic precautions in labour epidural anesthesia were considered essential by anesthesiologists.

Methods: A self-administered questionnaire regarding commonly used aseptic techniques during epidural insertion was distributed via regular mail to 1047 practicing anesthesiologists in Ontario, Canada. Questions were formulated with assistance from community and university based obstetrical anesthesiologists. The survey focused on practice demographics, methods of asepsis during preparation, and aseptic technique during epidural insertion.

Results: The response rate for this survey was 42% (40% were non-teaching and 60% academic physicians). The major findings revealed significant heterogeneity; 38% of respondents wore a sterile gown, 68% selected chlorhexidine gluconate as their ideal antiseptic, 32% used povidone iodine, and 78% did not consider the use of a filter needle essential to aseptic practice. Furthermore, while all respondents acknowledged hand-washing essential to aseptic practice, high variability regarding details of hand-washing technique was evident between individuals. Significant differences in aseptic practice were also observed between non-teaching and teaching hospitals.

Conclusion: Aseptic technique for labour epidural insertion varies among individuals and institutions.

KEY WORDS

Aseptic, labor, epidural, anesthesia

INTRODUCTION

Asepsis is critical to the performance of epidural anesthesia in the prevention of contamination and associated complications. Although obstetric complications due to labour epidurals are rare, the resulting outcomes are often catastrophic and can result in serious morbidity or mortality (1-3). In response to the severity of these complications, published standards of care for aseptic technique during insertion of an epidural catheter on the labour floor exist; however, rates of adherence to such guidelines are not well known. Furthermore, the components of sterile technique considered essential are controversial amongst physicians.

There are few published guidelines for practice of aseptic techniques during epidural placement (2). However, local practice and adherence to different components of aseptic techniques is not known. Breaches in sterile technique by the anesthesiologist during spinal or epidural placement can be a source of infection. Similarly, bacteria can be introduced into the epidural space from distant sites such as the vaginal tract via the blood stream or from patient skin or other human factors (4,5). The sources of infection related to the technical aspects

of the epidural insertion include contaminated equipment or solutions before or during the initiation of the anesthetic block or tracking of organisms, such as skin contaminants, along the catheter site (6). Taken together, these facts underscore the importance of meticulous attention to aseptic technique.

In light of emerging data, several published reports have expressed concerns regarding the practice of proper aseptic technique and adherence to standardized protocols. For example, in July 2006, the American Society of Regional Anesthesia (ASRA) published guidelines for aseptic technique for neuraxial anesthesia, but recognized there was a paucity of supporting evidence at the present time (7). Recently, in 2014, the Association of Anaesthetists of Great Britain and Ireland published concise guidelines regarding skin antisepsis for central neuraxial blockade (8). Similarly, it has generally been assumed that during the teaching of invasive technical skills such as epidural insertion, improvement in aseptic technique parallels improved technical skills and manual dexterity. However, in a study conducted in our institution we found that manual skills for epidural insertion improved with increasing experience, but aseptic technique

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did not (9). Therefore, before improvements in clinical practice can occur and standards of care are developed, we believe that there is a need to determine what physicians currently believe are the essential components of aseptic precautions during the performance of labour epidural anesthesia.

The goals of this study, therefore, were to establish which components of aseptic precautions are considered essential by physicians. With this data, we aimed to assess physician adherence to recommended aseptic technique. Furthermore, we aimed to determine whether differences in aseptic technique exist between non-teaching community and academic practice.

METHODS

Following REB approval (REB No. 08-0183-E) a survey regarding commonly used aseptic techniques during labour epidural insertion was distributed via regular mail to 1047 practicing anesthesiologists in Ontario, Canada. The participants mailing address were obtained from the College of Physicians and Surgeons of Ontario (CPSO). The survey included a pre-paid return envelope and a brief cover letter describing the purpose of the questionnaire. Participant confidentiality was maintained by coding each subject's response according to a specific number and their addresses were only used for distribution purposes.

The survey was designed in the form of a self-administered descriptive questionnaire. Items in the questionnaire

were formulated with the help of experienced obstetrical anesthesiologists practicing in both community and university affiliated hospitals in Ontario. (Appendix 1). The questions aimed to highlight the experience and clinical practice of the individual anesthesiologist as well as determine the different methods used to maintain aseptic technique while performing labour epidurals.

Analysis

Completed survey results obtained from the questionnaire were analysed according to the responses. Means, proportions and percentages were calculated for the main categories. A secondary analysis comparing the practices between community and university hospitals was also completed utilizing a two-tailed Fisher's exact test with $p < 0.05$ considered as statistically significant. All statistics were calculated utilizing GraphPad Prism Software (Version 6).

RESULTS

The response rate for this survey was 42%. The respondents included 40% non-teaching community and 60% academic physicians. The majority of respondents were from academic institutions, with work experience of 5-10 years and a frequency of 1,000 to 4,000 epidural insertions at their hospitals (Table 1).

TABLE 1: Survey demographics

Responses (n=439/1047)	(Percentages)
Practice	
Community/teaching/both	40/60/0
Work Experience (<5, 5-10, >10 years)	18/46/38
Frequency of epidurals (<1000, 1-4000, >4000)	32/54/14
Preparation – Hand Cleaning	
With soap, extending up to the elbow x3 and sterile towel.	38
With soap, without extending up to elbows	60
With isopropyl alcohol	2
Don't consider hand wash at all	0
Removal of Jewelry	78
Wearing of a sterile gown	39
Wearing sterile gloves	100
Wearing a surgical hat and a fresh face mask	91
Short nails	69
Anti-septic solutions	
Chlorhexidine with alcohol	68
Povidine Iodine	32
Use a filter needle	22
Use of sterile drapes/towels	98
Number of support persons in the room	
One support person	78
More than one support person	12
No support person	10
Patient to wear an operating room hat	46

There was a heterogeneous practice with respect to the wearing of sterile gowns, the type of antiseptic preparation solution, and the use of a filter needle for drawing local anesthetic solutions (Table 1). Specifically, only 39% wore a sterile gown, 68% selected chlorhexidine gluconate as their ideal antiseptic, 32% used povidone iodine, and 78% of physicians did not consider the use of a filter needle essential to aseptic practice. Furthermore, although 100% of physicians considered hand cleaning essential, there was significant variation regarding the protocol utilized; 38% of respondents washed their hands and forearms up to the elbow with soap and dried with a sterile towel while 60% of respondents washed their hands with soap without extending up to the elbows and did not use the sterile towels. An additional 2% of respondents acknowledged washing their hands with isopropyl alcohol (Table 1). In contrast, little to no variation was observed amongst physicians in terms of using sterile gloves (100%), a surgical hat/fresh face mask (91%) and sterile drapes/towels (98%).

In addition to comparing Ontario anesthesiologists, significant differences were observed between academic and non-teaching community hospitals with respect to aseptic technique during epidural preparation and antiseptic solutions. Of the 38% of respondents that washed their hands with soap extending up to the elbow, the majority were from teaching hospitals rather than community (34% versus 4%, $p < 0.0001$). In contrast, 1.7% of the 2% of respondents that washed their hands with isopropyl alcohol were also from community hospitals ($p < 0.0001$, Table 2). Regarding antiseptics, the majority of the respondents that utilize chlorhexidine gluconate were from academic hospitals (84%),

while 9% ($p < 0.0001$) of the physicians utilizing povidone iodine were from academic hospitals. Academic hospitals also had a significantly higher proportion of physicians utilizing filter needles [(18% of the 22% respondents), $p < 0.0001$].

No significant differences were observed between academic and community hospitals regarding the number of support persons in the room, removal of jewelry, short nails, and the wearing of a sterile gown, surgical hat and fresh face mask. Almost all anesthesiologists answered yes to wearing a surgical hat and fresh face mask and the use of a sterile drape; however, 31% of respondents did not consider short nails to be essential practice and 22% of respondents did not remove jewellery (Table 2).

DISCUSSION

Our study revealed significant variation in aseptic practice amongst Ontario anaesthesiologists with respect to gowning, the antiseptic solution used for skin preparation, and filter needles for local anaesthetic withdrawal. Furthermore, while all 439 respondents acknowledged sterile gloves and hand cleaning as essential aseptic practices, significant differences existed in hand cleaning techniques before performing labour epidurals.

"Aseptic precautions" is an umbrella term encompassing all aspects of aseptic technique. While this term lacks a comprehensive definition, several components of aseptic precautions are commonly considered routine within institutions (8) and typically encompass both the preparation for and performance of the procedure. We chose to survey each individual component of aseptic precautions, as a breach in sterility of any

TABLE 2: Non-teaching community versus academic institutions comparisons

Responses (n=439/1047)	Community physicians (%)	Academic physicians (%)	P Value (Fisher's Exact Test, P < 0.05)
Preparatory Antiseptic Steps			
With soap, extending to elbow x2 and sterile towel	11	89	$p < 0.0001$
With soap, without extending to elbow	60	40	
With isopropyl alcohol	85	15	$p < 0.0001$
Removal of jewelry	49	51	$p = 0.87$
Wearing of a sterile gown	41	59	$p = 0.17$
Wearing of sterile gloves	40	60	$p = 0.0071$
Wearing of surgical hat/fresh mask	43	57	$p = 0.068$
Short nails	49	51	$p = 1.00$
Anti-Septic Solutions and Procedural Antisepsis			
Chlorhexidine gluconate	16	84	$p < 0.0001$
Povidone Iodine	91	9	
Use of a filter needle	18	82	$p < 0.0001$
Use of sterile drapes/towels	39	61	$p = 0.0026$
Number of Support Persons in room			
1 support person	41	59	$p = 0.88$
> 1 support person	33	67	
No support person	40	60	

step has the potential to cause epidural catheter colonization. Our questionnaire was designed to include all the major steps of aseptic technique recommended while administering an epidural in addition to examining differences in practice between teaching and non-teaching community hospitals.

Sterile gowns are considered a method to prevent cross-contamination between patients and healthcare providers by blocking the exchange of infectious material. However, recent studies suggest that the use of gowns may not reduce infection or mortality rates (10,11). For instance, a study conducted by Siddiqui et al found no difference in epidural catheter colonization between gowned and ungowned practitioners. The researchers attributed the low incidence of colonization rates without gowns (<10%) to the overall sterile precautions undertaken, unlike previous studies that indicated a colonization rate in excess of 50% (6). In this survey, 39% (n = 171) of respondents considered gowns essential aseptic practice while performing an epidural.

Variability among responses was also observed for antibacterial skin preparation, an essential step prior to the performance of any invasive procedure. Some of the most commonly used antiseptics are 0.5-2% chlorhexidine gluconate and povidone iodine. Chlorhexidine gluconate has been shown to have a very long-term efficacy. When combined with isopropyl alcohol, clinical studies show accelerated bactericidal effects with a greater degree of potency (11). In contrast, povidone iodine has a delayed onset of action (several minutes) and limited duration in effect, often requiring reapplication every 24 hours to maintain antimicrobial activity (4,13). Consequently, a combination of chlorhexidine gluconate and isopropyl alcohol is considered a near ideal skin disinfectant. In general, the respondents of our survey reflect these views. While some variation did exist, the majority of total respondents (68%) selected chlorhexidine gluconate as their ideal antiseptic.

Regarding the use of filter needles, variation amongst respondents was observed. Bacterial filters are recommended to prevent foreign material from gaining access to the epidural space and to filter bacteria present within the perfusing solution (4). Any particulate matter injected in the epidural space can provoke an inflammatory reaction, putting the patient at risk of serious complications. Specifically, needles with a 5 µm filter at the catheter hub are recommended when withdrawing solutions from a multi dose vial through a rubber stopper (14). Despite these recommendations, only 22% of respondents acknowledged using filter needles as essential to aseptic practice. This variability amongst anesthesiologists may reflect the lack of scientific evidence supporting the use of filter needles, in addition to the problem of widespread availability of filter needles.

No significant differences were observed between Ontario anesthesiologists regarding use of sterile drapes and sterile gloves. Self-adhesive fenestrated large drapes with a centre hole for regional techniques are currently considered standard practice (9,15). Moreover, covering the skin puncture site with either a tight occlusive dressing or a fixation device before removing the drape is recommended as studies indicate that epidural catheter colonization is largely due to microbial

organisms from the skin (16,17). In this survey, 98% of respondents considered sterile drapes/towels essential aseptic practice. Likewise, consistent with current recommendations, 100% of respondents acknowledged wearing sterile gloves while performing epidural anesthesia.

WHO guidelines consider proper hand hygiene the most important aspect in the prevention of cross-contamination between healthcare providers and their patients (18). Hand hygiene aseptic techniques vary, ranging from basic soap and water to alcohol-containing solutions. Antiseptic solutions combined with an alcohol compound have been shown to result in significantly slower rates of bacterial regrowth (19,20). Therefore, it is currently recommended that healthcare providers utilize an alcohol-based antiseptic solution, in addition to soap and water, for maximal bactericidal effect. Based on the survey results, 100% of respondents considered hand cleaning an essential aseptic practice. However, the majority of respondents did not partake in the use of alcohol-based antiseptic solution in addition to hand cleaning, nor did they extend the scrub up to the elbows. Central to the principle of extending hand cleaning to the elbows is the concept of bacterial fallout from the forearms as a potential source of contamination of the equipment and sterile field below. There is, however, a lack of scientific evidence regarding the best practices of handwashing, especially for short term regional anesthesia techniques, highlighting the need for further research.

The variations in the anesthesiologists responses that were observed in our survey are similar to those in an Australian survey of obstetrical anaesthesiologists. Similar to our results, Sellor et al observed wide variation in practice of what was considered essential aseptic precautions, reflecting a lack of scientific data to support the comprehensive practice of aseptic techniques as a whole (5). Although small differences were observed between the two studies, for example, Sellor found that fresh face masks were not considered aseptic practice by 29% of respondents while only 9% of our respondents did not use fresh face masks, such variation is likely due to the fact that they conducted their survey before ASRA published aseptic guidelines for epidural insertions.

Finally, significant differences were observed between institutions when comparing the aseptic practice of teaching versus non-teaching community hospitals. Notably, physicians within academic hospitals reported significantly higher rates of handwashing with soap and extending to the elbow, wearing sterile gloves, utilizing chlorhexidine gluconate as the primary antiseptic solution, employing a filter needle, and using sterile drapes. Physicians from community hospitals had a significantly greater proportion of individuals washing their hands with isopropyl alcohol and selecting povidone iodine as their antiseptic of choice.

Overall, our results reflect significant variation from published guidelines on sepsis. While the most recent guidelines suggest cap, mask, sterile gown, gloves, and a sterile drape as barrier precautions, this practice is not currently consistent amongst all anesthesiologists. Furthermore, it is recommended that

chlorhexidine in alcohol be used for skin antisepsis following thorough handwashing; however, only a small percentage of respondents engage in this practice. Such deviations from current guidelines may be a reflection of the timing at which this survey took place.

One of the limitations of our study include physicians' abilities to self reflect on aseptic technique. Although items in the questionnaire were designed to accurately gauge physicians' practice, self-reporting may not reflect a true picture.

Epidural anesthesia for labour carries an increased risk of a breach in sterility during the procedure for several reasons. First, labour epidurals are performed in a delivery room on the obstetric floor – a more vulnerable environment for infectious complications compared to an operating room. Second, these procedures are often performed in urgent situations or the request for epidural occurs late in a patient's labour. Such time constrictions may result in lapses in aseptic precautions and less precise technique. Fortunately, since obstetrical patients are typically young and healthy, infectious complications are not as common in this population as compared to others. However, we cannot assume that all parturients have the immunity to protect against lapses in aseptic technique and infectious complications can result in serious, life-threatening conditions, including meningitis, permanent nerve damage, and in severe cases, death (4). Considering the variability observed in this study between both individual anesthesiologists and institutions, evidence based guidelines are necessary for all steps of epidural catheterization, starting from the preparation to the procedure itself. This will ensure more rigid aseptic technique in order to better protect the obstetric population from infectious complications. Knowing the practice among the anaesthesiologists in performing labour epidurals will not only point out the areas of concern, but also help to take vital initial steps in either formulating, updating and enforcing the much-needed aseptic guidelines.

CONCLUSION

Our results suggest the practice of aseptic technique for labour epidural insertion currently varies among individual physicians. Furthermore, there is a lack of consensus between academic and non-teaching community hospitals as to the essentials of aseptic practice.

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APPENDIX 1: The questionnaire**Section – 1 (Practice)**

1. How long have you been practicing as an anesthesiologist independently?
 - a) Less than 5 yrs
 - b) 6-10 yrs
 - c) More than 10yrs

3. How many labor epidurals do you perform/supervise in a week?
 - a) Less than 10
 - b) 10-20
 - c) More than 20

4. Where do you practice?
 - a) University teaching hospital
 - b) Non-teaching community Hospital
 - c) Both

5. How many epidurals are performed at your centre per year?
 - a) Less than 1,000
 - b) 1,000-4,000
 - c) More than 4,000

Section – 2 (Preparation)

6. How do you wash your hands before performing epidurals?
 - a) With soap up to elbow and pat dry with sterile towel.
 - b) With soap without extending up to elbows.
 - c) With Isopropyl Alcohol (prior donning sterile gloves).
 - d) Don't consider hand wash at all.

7. Which of the following do you practice while performing epidural?
 - a) Remove jewelry such as rings, wrist watches, bracelets, etc.
 - b) Wear a sterilized gown.
 - c) Wear sterile gloves.
 - d) Wear a surgical hat and a fresh face mask.
 - e) Keeping short nails as essential component of proper aseptic technique.

Section – 3 (Technique)

8. Which of the following is supplied in your epidural tray?
 - a) Local anesthetic
 - b) Sterile prep solution
 - c) None

9. What do you use for skin prep?
 - a) Pre-packed single application prep sticks
 - b) Multiple use prep-solution bottles.

10. Which anti-septic solutions do you use?
 - a) Chlorhexidine Gluconate and Isopropyl Alcohol
 - b) Povidine Iodine
 - c) Combination of Povidine Iodine and Chlorhexidine Gluconate.

11. Do you routinely use a filter needle for drawing local anesthetic solutions for:
 - a) Epidural
 - b) CSE
 - c) Spinal
 - d) Top ups

12. Does your kit contain sterile drapes?
 - a) Yes and I apply it to patients' back to isolate the sterile field
 - b) Yes, but I don't I apply it to patients' back to isolate the sterile field.
 - c) No, but I make sure to create a sterile field with the help of sterile towels.
 - d) No, and I don't create a sterile field with the help of sterile towels.

13. To secure and maintain the cleanliness at the insertion site, do you use:
 - a) Sterile fixation device.
 - b) Sterile opsite or similar dressing
 - c) Sterile gauze with adhesive tape.
 - d) Adhesive tape only.

14. For labor epidurals with the exception of nurses and trainees, do you have a limit for number of support person in the room?
 - a) I allow only one support person in the room.
 - b) I allow more than one support person in the room.
 - c) I don't allow any support person in the room.

15. Do you require all support individuals present in the room to wear:
 - a) OR hat
 - b) Fresh facemask
 - c) both
 - d) neither
 - e) not applicable

16. Do you require the patient to wear an operating room hat?
 - a) Yes
 - b) No