

Antiseptic solutions for central neuraxial blockade: which concentration of chlorhexidine to use?

Chlorhexidine in alcohol is the recommended skin disinfectant for central neuraxial blockade (Cook et al, 2009). However, the risk of permanent neurological injury has resulted in controversy over the correct concentration. This article reviews the safety and efficacy arguments for and against 0.5% chlorhexidine with ethanol (e.g. Hydrex, Ecolab Limited, Leeds) and 2% chlorhexidine in isopropyl alcohol (e.g. ChlorPrep, Carefusion, Basingstoke).

The case for 0.5% chlorhexidine

There are several case reports linking chlorhexidine skin preparation for central neuraxial blockade with permanent neurological damage. While one was a known accidental injection of chlorhexidine into the epidural space, others have been judged to be the result of contamination of equipment by an unrecognized splash (Bogod, 2012). Given that very small amounts are sufficient to cause permanent neurological injury, it would be irresponsible to use any higher concentration than necessary to effectively sterilize the skin. Malhotra et al (2011) studied the effectiveness of one *vs* two sprays of 0.5% chlorhexidine. They demonstrated that a single spray of 0.5% chlorhexidine was sufficient to render the skin sterile.

Existing studies assessing safety of 2% chlorhexidine for central neuraxial blockade are underpowered given that the incidence of permanent nerve injury ranges from 1:24000 to 1:54000 (Cook et al, 2009). The largest study analysed 12000 central neuraxial blockades using 2% chlorhexidine and found no attributable cases of neurological injury (Sviggum et al, 2012), but the numbers are too few for the expected complication rate.

0.5% chlorhexidine is effective as an antiseptic for central neuraxial blockade. Using 2% chlorhexidine – four times the effective

concentration – puts the patient at unjustifiable risk of permanent neurological injury.

The case for 2% chlorhexidine

The argument that central neuraxial blockade antiseptics with 2% chlorhexidine has an increased risk of neurological injury is based on supposition from case reports. 2% chlorhexidine is routinely used for neurosurgical skin preparation. Safety advice from the most recent datasheet for ChlorPrep has changed from stating that it should not be used ‘for lumbar puncture’ to something very similar to the 0.5% solution warning: ‘direct contact with neural tissue... must be avoided’ (Carefusion, 2013).

The 2% solution has superior antibacterial properties. A study by the National Blood Service found a 10-fold reduction of bacteria on donor skin pre- and post-disinfection with 2% chlorhexidine compared to 0.5% (McDonald, 2011). The 2% solution has a greater log₁₀ reduction factor for *Staphylococcus epidermidis* in biofilm enriched with human serum (4.7 *vs* 3.6) (Adams et al, 2005).

However, the advantages of 2% chlorhexidine are as much in its preparation as the solution itself. Unrecognized contamination of equipment with a measurable amount of chlorhexidine was proposed as the cause of several cases of permanent neurological injury following central neuraxial blockade. This may have been from a splash from the gallipot on the sterile trolley or droplets from a pre-soaked swabstick (Bogod, 2012). This risk also applies to the spray form where droplets are aerosolized. 2% chlorhexidine comes as a single use applicator, with the solution sealed within until immediately before use. This reduces risk of contamination of the solution and equipment. Each applicator contains a limited amount of solution, enough to sterilize the skin but insufficient to cause streams and pooling seen with excessive application of sprayed or freely poured chlorhexidine. Overgenerous application increases the drying time and risk of chemical injury should there be prolonged contact.

2% chlorhexidine has superior antibacterial properties. The single use applicator reduces the risk of contamination of the solution and provides the most effective method of preventing equipment contamination, the most probable cause of chlorhexidine-related permanent neurological injury.

Conclusions

Although 2% chlorhexidine has greater antibacterial properties, 0.5% chlorhexidine provides adequate antiseptics for central neuraxial blockade. However, a single use applicator where a limited volume of the solution is kept separate until the moment of use then discarded immediately, reduces the risk of equipment contamination, contamination of the solution itself and problems of excessive application. An applicator stick with 0.5% chlorhexidine would be ideal but is not available.

Whichever solution is used it is essential to maintain meticulous sterile technique and ensure that there is absolutely no contamination. **BJHM**

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