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# Skin Preparation for Joint Injections & Surgery: Biology, Technique & Importance

Preparation of a horse's skin for either intra-articular injection or surgery is one of the most important aspects of preventing complications after the procedure. Skin cannot be sterilized, but by significantly reducing the bacterial load present on the skin surface the risks associated with joint injections or post operative infection (POI) can be kept very low. A major challenge in reducing the incidence of infections is the difference between what we think we do and what we actually do. Studies performed in the human and veterinary literature have found large gaps in perception versus reality with regards to sterile technique. Consequences of failure to adequately disinfect the skin or adhere to aseptic principles include increased hospitalization and cost, decreased positive outcomes, and in some cases loss of the patient. Horses do not tolerate infected joints well, and while it is still a rare occurrence following sterile procedures, the outcome may be devastating when it does occur as well as a source of litigation.

## Biology of Skin Preparation:

Much of what we know regarding skin preparation comes from the human literature. However, equine skin tends to be dirtier than human skin and it has many more hair follicles and glandular structures which are heavily laden with bacteria. Most methods of skin preparation are effective at reducing the number of surface bacteria from the skin however hair follicles and glandular structures harbor bacteria that can repopulate the skin quickly. Debris or even a plug of skin from the patient may be introduced by the needle entering the joint. Many of the surgical scrubs used for skin preparation are inactivated by organic material or spores so a "rough prep" should be performed using a neutral soap wash of the area to cleanse it prior to the actual aseptic skin preparation. It is a very common practice to perform this initial rough prep with the same biocides used during the aseptic preparation but this should be avoided because long and repeated scrubbings with medicated soaps can induce skin reactions and lead to bacterial resistance.

Alchohols: Alcohols are the most potent of antiseptics and show an increased bacterial kill rate over povidone-iodine or chlorhexidine. Alcohol kills bacteria by denaturation of proteins. They are inactivated by a variety of organic debris and show no residual activity after evaporation. Alcohol has a synergistic effect with povidone iodine so may be used as a rinse

after povidone-iodine is used as a surgical scrub. Isopropyl alcohol has a very rapid onset of action but is short lived, so is generally used in combination with other antiseptics.

Chlorhexidine (CHX): Chlorhexidine is the most commonly used biocide used for skin preparation in horses and works by breaking down the bacterial cytoplasmic membrane. CHX binds to proteins present in the skin and forms a persistent residue that is effective at killing bacteria that emerge from hair follicles and sweat glands during surgery, although recent work has suggested that the prolonged bacterial kill of CHX has been overestimated. Chlorhexidine does not stain the skin like iodine compounds and is thought to be less irritating to the skin.

Iodine Compounds: Iodine has a very broad spectrum of activity when compared to other agents and has been shown to have superior activity against *methicilin resistant staph. Aureus* (MRSA). Elemental iodine has a broad spectrum of activity and penetrates the cell wall of bacteria and disrupts protein and nucleic acid. The rapid onset of action is one of the reasons resistance is less likely to build to iodine compounds when compared to CHX compounds. The combination of iodine with carriers that release the elemental iodine overtime maintains the antibacterial activity of the iodine while reducing tissue irritation and staining (ie Betadine). Polyvinylpyrroldone (PVP-$I_2$) or Betadine is generally supplied as a 10% solution has approximately 1% free iodine unless it is diluted which makes the solution more bactericidal.

Technique:

The process of preparing skin for either a joint injection or surgery is similar. In standing horses caution should be taken as horses can object to having their legs worked on and often resent the sensation of liquid or soap running down their legs. If the patient becomes fractious they should be sedated for the skin preparation. In fractious horses, oftentimes by the time the skin preparation is complete and the veterinarian is ready to proceed, repeat sedation may be necessary.

Prior to beginning, the work area should be assessed with attention paid to safety. Ideal settings include an area sheltered from the wind and dust that is clean and well lit. Ample room in the work space will decrease the likelihood of injury for all involved. A site may be well prepared, but if the body of the patient is dirty above the site, debris may fall into the sterile field. Therefore, beginning with a quick grooming is essential. If the area of interest is anywhere close to the horses' tail the tail hair should be braided or folded back on itself and secured with tape so it doesn't inadvertently contaminate the area.

The first step is to determine the exact site for the needle entry or the incision to be made and confirmed with the veterinarian. The exact site may vary between veterinarians so one should never hesitate to ask exactly where the skin needs to be the cleanest. A "rough prep" involving a mild soap and water should begin as soon as feasible. The single most important factor in skin preparation is contact time, so while the veterinarian is preparing for the procedure or going over the procedure with an owner, skin preparation should begin. Once the rough prep is completed

and the skin is clean (generally several minutes) the aseptic preparation should begin. Scrubbing the skin with the biocide scrub should always begin at the site of needle puncture or incision and work outwards either with circular motion beginning at the center and working outwards or in a "starburst" fashion from the center out. Oftentimes the veterinarian will have to palpate adjacent landmarks so a wide area should be prepped. Also many veterinarians will place a finger adjacent to the site especially for needle puncture to stabilize their hand so preparing a wide margin is essential.

Clipping the hair for joint injections has been shown to be less important than was previously thought. Some veterinarians may choose to clip a small patch of hair immediately over the site for needle puncture to facilitate identification of the area that needs to be the most clean and for palpation of landmarks. For standing surgery the hair is generally clipped with a #40 blade over the surgical area and the surgeon will give input for how wide of an area to clip. As a rule of thumb approximately a 4 inch area of hair should be clipped beyond where the incision will be created. An effort should be made to avoid abrading the skin ("clipper burn") as bacteria may colonize areas of skin abrasion and increase the chances of infection.

Care needs to be taken by the technician during skin preparation to avoid loose clothing or jewelry that may accidentally brush against the prepared skin. Once the skin preparation has been completed, all parties involved should closely monitor that nobody touches the area inadvertently. This should extend to clients, pets, and anyone observing the procedure.

Once the "rough prep" is completed with a mild soap and moist gauze or towels no debris should be present on clean gauze wiped across the surface of the area of interest. Human skin contains multiple bacteria species that may be transferred to a patient so during skin preparation so exam gloves should be worn and changed several times. Technicians should be trained to properly don sterile gloves to be used during surgical preparation. Once the skin is clean the single most important variable is contact time. Approximately five minutes of contact time is generally sufficient to provide an aseptic environment. Typically a sterile prep will begin in the area of interest and work outwards so the site of incision or needle puncture is in the "cleanest" area of the skin and the level of cleanliness decreases with distance from the site. A common mistake made during skin preparation is once the site is thoroughly scrubbed, an inexperienced technician may wipe the area clean from a distant site dragging a gauze or sponge from the less clean area towards the area of interest.

There are many well accepted protocols for sterile joint preparation. Most practices use either a combination of a betadine scrub with an isopropyl alcohol rinse or a CHX scrub with a saline or alcohol rinse. The specifics of which to use is variable depending on practice preference but done correctly, all have been shown to be effective at reducing surface bacteria. Approximately five minutes of contact time is generally deemed sufficient regardless of the method used. Several studies have shown that contact time is more important than the actual act of mechanically scrubbing. For this reason the scrub should be worked up into a lather on all sites

regardless of whether or not one site is being scrubbed or another. In our practice, once the patient has been brushed and a rough prep with mild soap has been completed, two 3-minute preps are done with betadine and alcohol changing gloves in between. For example to prepare hocks for injections the tail would be taped up on itself, the rough prep would be completed and then the inside and outside of the first hock is prepared and while the soap is still on the skin the second hock is scrubbed while the soap sits on the first one. By alternating joints and leaving soapy residue on each leg the contact time for both hocks may still be 5-6 minutes.

While some practices take the importance of contact time to a new level by applying the scrub quickly and just letting it sit there for the duration of the prep, the author feels like there is a better perception of sterility if an active joint preparation is performed. While rare, joint infections following arthrocentesis or surgery is devastating and it is preferable to appear to take the skin preparation very seriously then to leave any room in client's minds as to the validity of the preparation.

In conclusion, developing a sound practice for aseptic skin preparation that is effective and efficient will maximize the value technicians add to the procedure while decreasing the morbidity and mortality associated with iatrogenic infections. Technicians should take care to make the situation as safe as possible for all those involved. Remembering that the skin preparation technique that we use is far less important than how we do it is critical. Putting in the extra effort at the time of the procedure may yield huge benefits down the road!