# Hand hygiene—to rub or to scrub? That is the question

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*Hand hygiene is of critical importance in the daily duties of the veterinary profession. It plays an even more significant role in theatre practice*

The link between hand hygiene and hospital acquired diseases and surgical site infections is not new. In the mid nineteenth century an obstetrician named Ginaz Philip Semmelweis noticed a dramatic decrease in mortality rates in a maternity ward in Vienna after he had introduced scrubbing with chlorinated lime solutions before every physical examination (Verwilighen *et al* 2011b). In 1865, John Lister, a professor of surgery at the Glasgow Royal Infirmary, acknowledged the importance of Louis Pasteur's germ theory of "instead of forcing ourselves to trying to kill microbes in wounds, would it not be more reasonable not to introduce them" a statement, which has stood the test of time (Verwilighen 2011b pg.515). Lister introduced a disinfectant regime where the hospital clinical environment and equipment were cleaned with carbolic acid. This regime included the surgical team washing their hands in a solution of 5% carbolic acid prior to undertaking surgery (Tanner 2008a). This resulted in a reduction of surgical site infections and presurgical treatment of the hands of surgical staff became a globally accepted procedure (Verwilghen 2011b).

This is of major consequence for the veterinary profession as MRSA and MRSP infections are increasingly occurring in veterinary practices (Weese et al 2006). Studies by Loeffluer *et al* (2005), O'Mahony et al (2005) Rich et al (2006) and Weese *et al* (2006) illustrated and reported on MRSA colonisation and transmission of MRSA within veterinary practice. Mayne (2010) in their study found between 10% and 20% of companion animals are found to carry MRSA each year and these numbers are increasing yearly. These studies also suggested that veterinary surgeons and nurses may be regularly exposed to MRSA. Bustiner et al undertook a recent study in 2010, which indicated that the veterinary profession had a higher rate of carrying MRSA than the general population. They collected nasal swabs from 341 attendees of the 2008 American College of Veterinary Surgeons Symposium in 2008. The results showed that 17% of veterinarians and 18% of veterinary technicians were MRSA positive and, interestingly, showed that there was no difference between small and large animal personnel. Therefore, correct hand hygiene and infection control precautions are even more critical to reduce the risk of both human and animal exposure (Weese 2008).

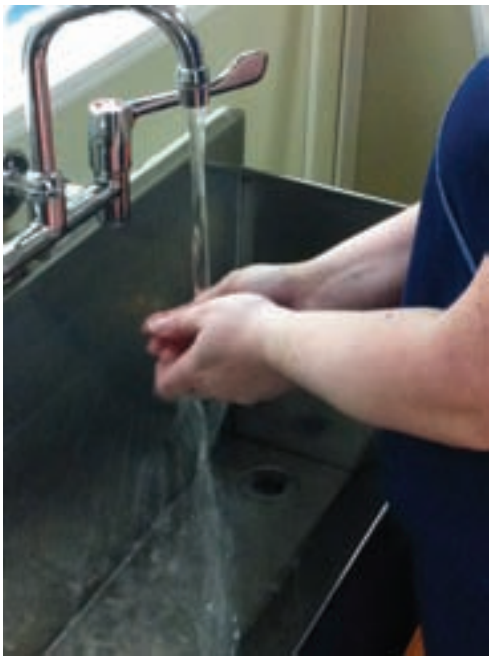
MacDonald's (2008) study confirmed that correct hand hygiene especially with the introduction of an alcohol hand rub method significantly reduced nosocomial MRSA infection rates and antibiotic use in general hospitals. As a veterinary profession we should learn from our human counterparts and become increasingly aware of the issues regarding these potential important pathogens and recognise the principles of reducing them, by following correct antimicrobial use, correct hand hygiene protocols and infection control surveillance.

In recent years, surgical hand antisepsis has undergone three main changes; the decline in the use of scrub brushes, the introduction of new alcohol rub solutions and a reduction in the length of time to perform a surgical scrub prior to surgery (Tanner 2008a). Traditional instructions for surgical hand antisepsis included scrubbing the hands and arms with a brush (Gardner and Mann 2001). However in 2002 Springer suggested that the practice of scrubbing hands and arms be stopped because of skin micro-abrasions and increased bacterial counts detected. Despite this recommendation a recent web based questionnaire carried out in 2011 by Tudor, demonstrated that 99.2 % of veterinary nurses were still scrubbing for surgery with a brush.

Alcohol hand rubs such as Sterilium were introduced in the 1990s as an alternative to the traditional aqueous based antiseptic solutions. Alcohol rubs do not require the use of a nail brush thus reducing microabrasions on the skin. They also require shorter scrub time and require less water. As recently as 2009 leading opinion leaders in the field of infection control such as the World Health Organization, The Association of Perioperative Practice and Association of Perioperative Registered Nurses have reviewed their perioperative standards and recommended practices for surgical hand antisepsis. All groups strongly recommend alcohol-based hand rubs for both hygienic and pre surgical hand treatment.

Traditionally in veterinary surgery, the surgical hand scrub involved scrubbing the hand and forearms with a brush or impregnated sponge/brush for six minutes, using either a timed method or an anatomic stroke-count method.

The new brushless techniques consist of vigorously rubbing an antimicrobial agent on the hands and arms for approximately one-and-a-half to three minutes. Alcohol-based scrub agents have been suggested as an alternative to the traditional method as human studies have shown



that prolonged and repeated scrubbing with a scrub brush increases skin damage and microbial skin counts (Kampf *et al* 2004b).

The aim of hand hygiene is to remove gross dirt on the skin and for the elimination and reduction of both transient and resident microorganisms respectively on the skin (Travolacci *et al* 2006). Resident flora live in the deeper layers of the skin within the sebaceous glands. The resident flora consists mainly of coagulase-negative staphylococci, Corynebacterium spp. and rarely cause infection. Transient flora colonise the superficial areas of the skin and can be transferred by direct contact to other people, animals or the environment. They are the most common cause of surgical site infections. Transient microorganisms are removed easily by hand washing. Good hand hygiene dramatically decreases the risk of bacterial cross contaminaton and surgical site infections in patients. Surgical site infections remain a serious surgical complication and are responsible for the increase in human and veterinary health care costs; due to increased use of antibiotics, prolonged hospital stays for intensive cases and delayed wound healing (Plowman 2000). Studies that evaluate surgical hand hygiene can be divided in two categories; those measuring colony forming units on hands and those measuring surgical site infections in patients. Measuring colony forming units on hands are easier to conduct and are inexpensive. These methods test the presence of microorganisms on the fingertips as the bacterial burden is the highest in this location and reflects general hand contamination (Kampf *et al* 2006). Studies that measure surgical site infections require consent from patients, the scrub team must perform the same scrub protocol and the patient must be followed for thirty days postoperatively.

It is a documented fact that surgical staff have higher bacterial skin counts and a greater percentage of pathogenic organisms on their hands than non surgical staff (Verwilighen 2011b). Hand hygiene of the veterinary surgeon is further complicated by the fact that they may deal with either small and large animal patients or indeed both, with soiled hands being common before performing surgery particularly when dealing with larger species. Veterinary patients are more likely to have higher bacterial counts on their body surface than human patients, resulting in higher contamination loads on the hands of veterinary surgeons and veterinary nurses compared to their human counterparts (Traub-Dargatz *et al* 2006). Animals are not bathed regularly; they are haired over most of their bodies and reside in areas of close proximity to their body wastes.

Surgical gloves have been used in operating rooms for over one hundred years and their use is critical in providing a barrier against the two way transmission of microorganisms such as Staphylococcus PseudIntermedius and *Staphylococcus aureus* being introduced to the surgical site (Tanner2008b). Sterile surgical gloves do not act as a reliable barrier to pathogens. A meta analysis on more than 20,000 used surgical gloves proved that 18.2% of the gloves had perforations (Kralj *et al* 1999, Widmer et al 2010), and overall the non dominant hand sustains more perforations than the dominant hand (Turnquest *et al* 1996, Louis *et al* 1998, Laine *et al* 2004). Increased permeability of gloves, human fatigue, the nature of the surgery and the use of instrumentation are all implicating factors (Yinusa *et al* 2004). Hayes *et al* 2011 study confirmed that there is a high incidence of glove perforations in small animal surgery particularly when the length of surgery is over one hour in length, when orthopaedic procedures are performed and when power instruments are being used. In orthopaedic surgery double gloving is common practice, however, punctures are still observed in 4% of cases after the procedure (Thomas *et al* 2001). This emphasises the importance of appropriate hand washing prior to any surgery.

Traditional surgery scrub techniques used aqueous solutions (including chlorohexidine and iodine derivatives), a nail brush and copious amounts of water. In the traditional hand scrub the temperature of the water is important. Warm water makes antiseptics and soap work more effectively but if too hot it removes protective fatty acids from the skin (Smith 2008, Widmer *et al* 2010). Jehel *et al* 2008 study found that one surgical hand scrub preparation using a traditional scrub agent used twenty litres of water. This is a staggering figure in our current climate. Indeed Pseudomonas spp. specifically P. aeruginosa and other Gram negative bacteria have been frequently isolated from taps in hospitals and have been linked to infections in intensive care units (Heal et al 2003). A good drying technique is also essential, as damp hands will spread bacteria more effectively than dry hands (Vincent 2012). Sterile towels are most commonly used

for drying hands within the surgical suite and though several methods for drying hands have been tested no significant differences between techniques has been found (Gustafson 2000). However it is imperative that all parts of the hands and forearms come in to contact with the alcohol based hand rub during rubbing.

Recent studies have discouraged the use of nail brushes. Scrubbing with a brush causes microabrasions on the skin with subsequent increased bacterial colonisation on skin surfaces (Wan *et al* 1997). In 2007, Judith Tanner completed a national survey on hand antisepsis among surgeons in the UK. The study highlighted that a hand surgical scrub procedure using either chlorhexidine gluconate or povodine iodine was the preferred method. This survey

suggested that the main reason for selecting an antiseptic agent was related to skin sensitivity of the surgeon rather than its effectiveness in reducing bacterial populations. The study also confirmed that the majority of practitioners spent between three and five minutes on an initial surgical scrub procedure and demonstrated that there was a lack of clarity regarding the optimal surgical hand antiseptic and also the correct amount of time to carry out such a procedure.

Research carried out by Rotter (1999) and Peitch (2001) provided evidence that traditional methods of surgical hand antisepsis contain gaps in their antimicrobial efficacy, lack a long term effect and can lead to skin irritation and occupational dermatitis. The use of 4% concentration of chlorhexidine gluconate in aqueous solutions poses some concern for veterinary practice. While it has bacterial activity against Gram negative and Gram positive bacteria (Kampf 2008) it has no sporicidal activity and there are concerns about its suitability for prevention of MRSA (McLure *et al* 1992).

Alcohol rub solutions are now available as an alternative to traditional scrub techniques. The alcohol rub is a rapidly acting disinfectant, which penetrates rapidly in to the deeper tissues of the stratum corneum reducing the residual flora and eliminating the transient flora of the surgical team's hands within one-and-a-half minutes. It is proven to have a persistent antimicrobial efficacy of up to six hours with no potential for the development of resistance (Rotter *et al* 2008). This is essential in veterinary surgery where surgery duration may be long and where sharp instrumentation and power tools are being used for example orthopaedic surgery especially as these increase the risk of glove puncture. This is essential in veterinary surgery where surgery duration may be long and where sharp instrumentation and power tools are being used for example orthopaedic surgery especially as these increase the risk of glove puncture. Indeed, the World Health Organisation guidelines 2009 recommend alcohol hand rubs as the most effective method for surgical hand antisepsis in human medicine.

One of the main advantages of using surgical hand rubs over traditional hand scrubbing techniques is the lack of microabrasions to the skin, no nail brush is needed and significantly less water is used. Furthermore surgery preparation times are dramatically shorter when using alcohol rubs (typically ninety to one hundred and twenty seconds). Travolacci *et al* (2006) in their study confirmed that surgical hand rubbing is a cost effective alternative to surgical hand scrubbing cost by 67%.

Verwilighen et al (2011a) compared povodine iodine, chlorhexidine gluconate with an alcohol hand rub solution. The study identified that the alcohol rub was as effective in reducing bacterial counts prior to surgery as chlorhexidine and povodine iodine. These findings were similar to previous studies by Parenti et al (2002), Kampf and Ostermeyer (2005) and Tanner et al (2008a). It is interesting to note that povodine iodine provided less residual activity when compared with alcohol gel and chlorhexidine. This is further supported by the Marchetti et al (2003) study. It is critical to note that not every alcohol hand rub is suitable for surgical hand antisepsis as they may contain different alcohol concentration. Kramer (2002) indicates most alcohol–based hand gels have a rather lower concentration of alcohol (less than 70%) and fail to

meet the European efficacy requirements. These products should not be used in hospitals. Therefore, it is critical that products for surgical hand disinfections pass two European Standards, pr EN 12504 which tests bactericidal activity and pr En 12791 which determines bactericidal efficacy (Marchetti *et al* 2003).

A recent study carried out by Ghorbani *et al* (2012) compared the effects of two hand decontamination methods on the microbial burden of operating staff hands. A traditional surgical hand scrub using a povodine iodine solution over six minutes was compared with a non antibacterial soap and alcohol hand rub technique for three minutes. Samples were taken from the hands of both groups before and after washing for microbial culture and to determine bacteria colony count. The findings showed that the bacterial colony counts of the hands was reduced after both hand washing techniques with no significant differences between the two groups. This result supported findings from other studies (Hingst *et al* 1992, Travolacci *et al* 2006). The results in this study showed that the alcohol rub techniques showed similar efficacy when compared with traditional techniques such as povodine iodine. Furthermore, the study suggested that the use of the alcohol hand rub resulted in longer lasting bacterial inhibition effect.

Verwilighen *et al* (2011a) reviewed current habits for surgical hand preparation amongst veterinary surgical specialists. Despite the recent literature and current recommendations of the World Health Organization the majority of veterinary surgical specialists are still currently using aqueous solutions as the primary method for hand antisepsis prior to surgery with 81.4% using chlorhexidine as their preferred choice.

In conclusion, scientific evidence and ease of use both support the use of hand rubs for surgical hand antisepsis. They are microbiologically more effective, save time and have better compliance when used correctly. It is an excellent alternative to the traditional scrub especially in veterinary practice when antimicrobial efficacy, time for the procedure and limited access to sinks and water are of concern. As a profession we must embrace change, research and challenge it. With the introduction of new products, education and training are key and they must take a fundamental primary role. This will ensure that all patients entering our theatres receive the best evidence based care that we can provide. Prevention of infection is the goal; irrespective of which antiseptic agent is used or which scrub technique is practiced. However, after recent research the habitual techniques found in veterinary practice must be examined further to consider the suitability of some our protocols.

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## Reader Questions and Answers

**1. THE AIM OF SURGICAL HAND DISINFECTION IS THE ELIMINATION AND REDUCTION OF?**
a) Resident flora
b) Transient flora
c) Gross dirt
d) All of the above

**2. TRANSIENT FLORA ARE EASILY REMOVED BY HAND WASHING?**
a) True
b) False

**3. THE NEW BRUSHLESS SURGICAL HAND RUB TECHNIQUE CONSISTS OF VIGOROUSLY RUBBING AN ANTIMICROBIAL AGENT ON THE HANDS AND ARMS FOR APPROXIMATELY?**
a) One and a half to three minutes
b) Five minutes
c) Seven minutes
d) 10 minutes

**4. ONE SURGICAL HAND PREPARATION EPISODE WITH TRADITIONAL AGENTS USES**
a) 5L of water
b) 10L of water
c) 20L of water
d) 35L of water

**5. WHICH OF THE FOLLOWING STATEMENTS ARE TRUE ABOUT ALCOHOL HAND RUBS?**
a) No nail brush is required
b) Equal or better efficacy
c) Reduced increase of micro abrasions on the skin
d) All of the above

ANSWERS: 1. D, 2. A, 3. A, 4. C, 5.D