Pre-Operative Surgical Clipping: New Advances in Efficiency and Infection Prevention

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- Kathleen is the Infection Prevention Strategic Resource Manager at the Saint Luke's Health System in Kansas City. In her role, she offers a unique clinical perspective into the development of evidence-based policies, procedures, and practice designed to improve health outcomes. Prior to this, Kathleen served as an Infection Prevention and Control Coordinator, responsible for all aspects of the Infection Prevention Program including data analysis, education, and implementation of the Infection Prevention policies, procedures and protocols.
- Kathleen is a member of the Kansas Health Care Associated Infections Advisory Group. Kathleen has served as President of the Kansas City Area Chapter of the Association for Professionals in Infection Control and Epidemiology (APIC) and is currently the Chair of the Education Committee.
- Kathleen was a member of the CDC's 2009 H1N1 Investigative Working Group and contributed to multiple peer-reviewed publications including the New England Journal of Medicine and The Journal of Respiratory Pathogens on the epidemiology of the Novel H1N1 Influenza.
- Kathleen received her BSN and MBA from Avila University and has been practicing Infection Prevention and Control since 1996. She has been a certified Infection Prevention and Control Professional since 2002.

Agenda

- Why? Clinical Rationale for Clipping
- How, What, When and Where to Clip – Does it Matter?
- The Cleanup: Issues, Risks and Solutions
- Vacuum-assisted Technology in Surgical Clipping
- Summary

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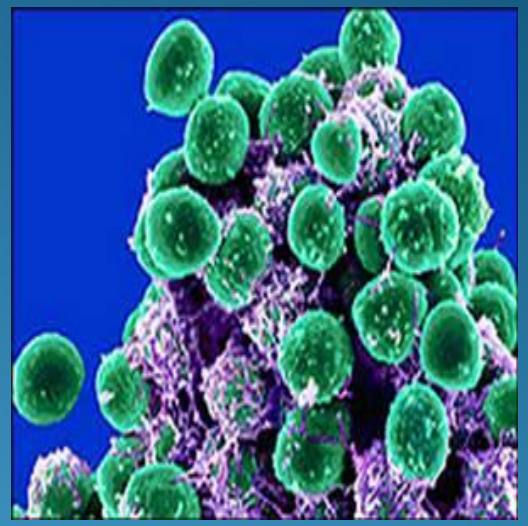
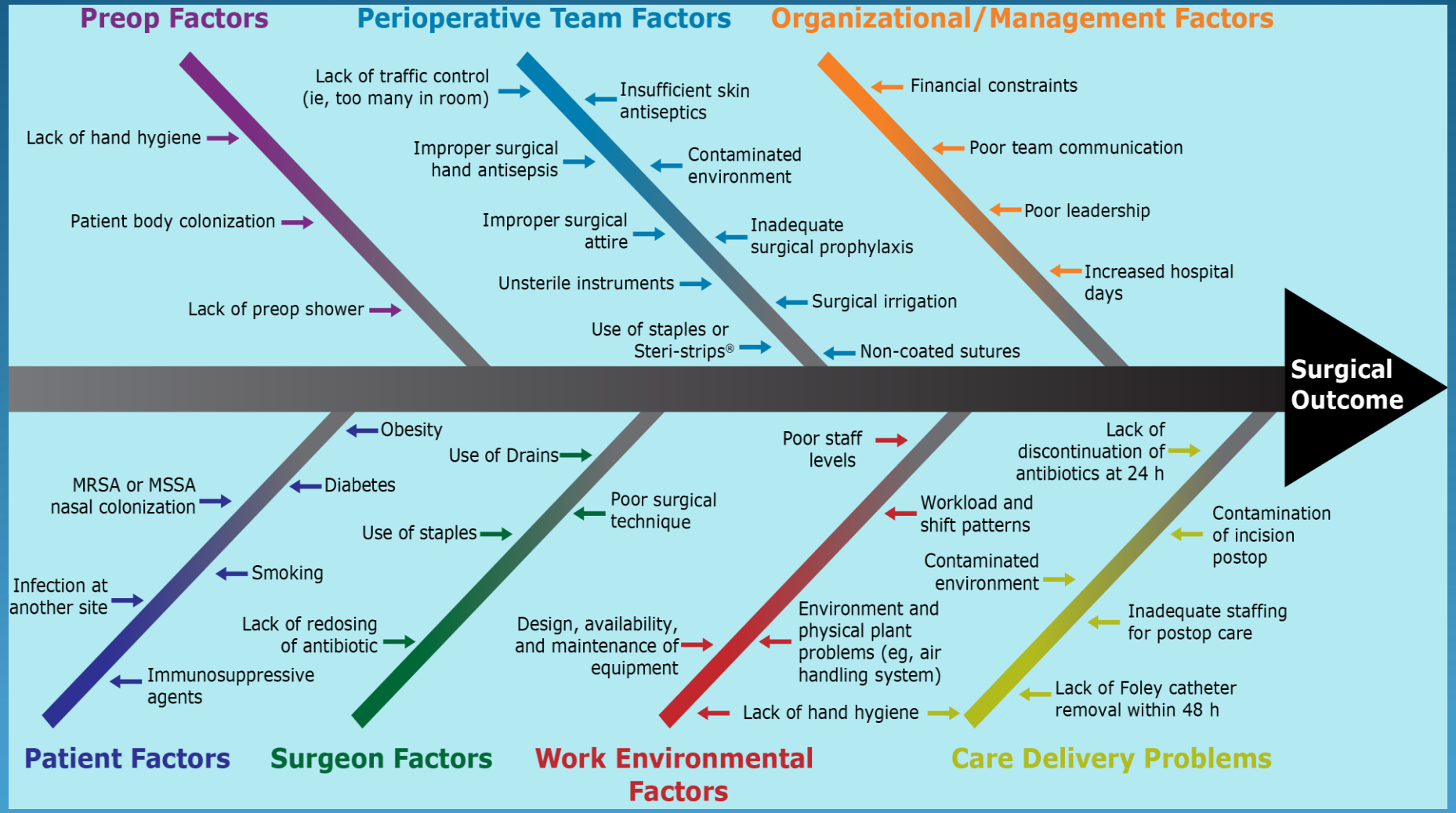
Why Do We Clip?

- Hair can interfere with surgical field of vision and is associated with a lack of cleanliness - its removal linked to infection prophylaxis[1]
- HAI outbreaks have occasionally been traced to organisms isolated from the hair or scalp (S. aureus and group A Streptococcus)[2,3]



Appropriate hair removal is a key component of skin preparation, as part of an overall HAI prevention strategy

Many Variables Contribute to Risk of HAI



Adapted with permission from Spencer M. Working Toward Zero Healthcare Associated Infections. Available at: http://www.workingtowardzero.com. Accessed August 4, 2014.

To Clip or Not To Clip?

- CDC and AORN recommend that hair should *not* be removed unless the hair at or around the incision site will interfere with the surgical procedure[4,5]
- Most common procedures associated with hair removal[6]:
  - Orthopedic lower extremities
  - Cardiovascular
  - OBGYN
  - Neurosurgery/head
  - Orthopedic upper extremities
  - GI

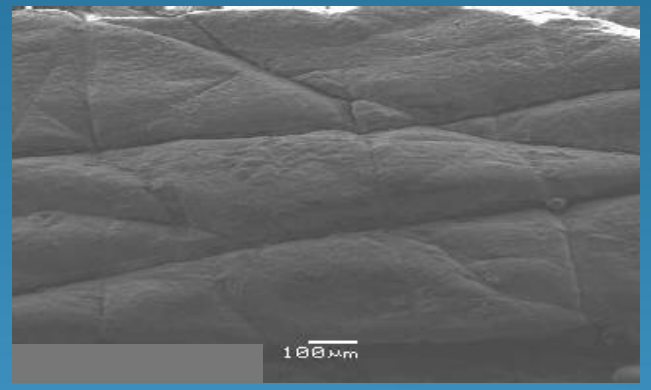
Not clipping? Remember, antisepsis agents require extended dry times (up to an hour) for skin with hair still present

To Shave or Clip?

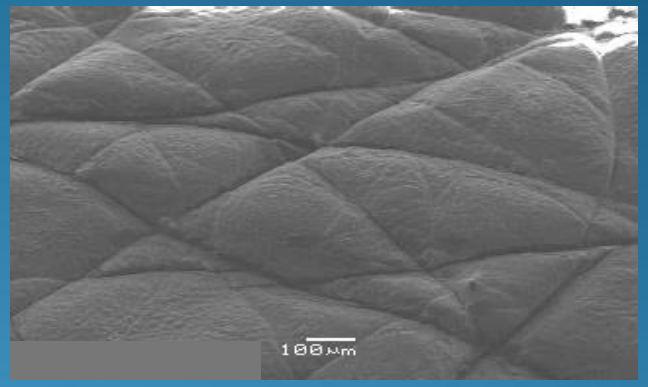
Micro-abrasions Caused by Razors Create a Portal For Infection

- Studies show that shaving damages the skin and increases infection risk[7-12]
- Source pathogens for most HAIs are skin-dwelling microorganisms[4,13]
- Razor shaving increases infection risk by creating micro-abrasions that allow skin-dwelling microorganisms to collect and multiply.[4]

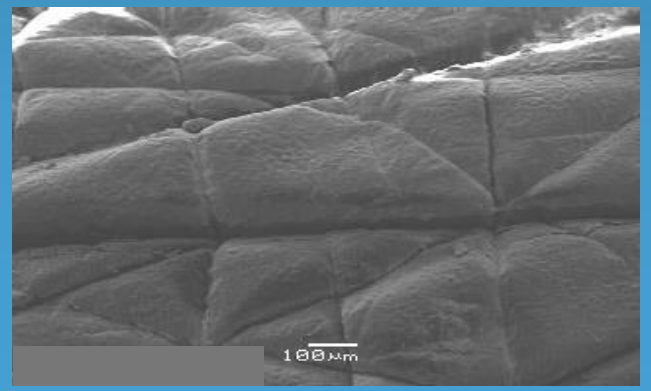
Before Clipping



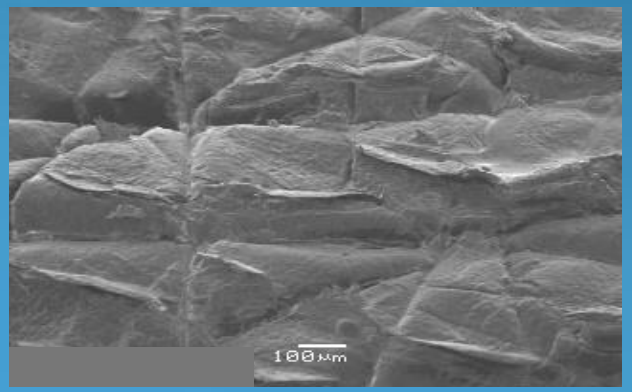
After Clipping



Before Shaving



After Shaving



Multiple Studies Show Lower HAI Rates With Clipping Vs. Shaving

- When used properly, electric clippers are less likely to damage the skin and are associated with lower infection rates.[4,10]

Study	Razor	Clipper
Liau (2010)	3.1%	0.5%
Graf (2009)	3.6%	1..8%
Trussel (2008)	3.5%	1.5%
Dellinger (2005)	2.3%	1.7%
Alexander (1983)	6.4%	1.8%
Ko (1992)	1.31%	0.6%

When Clipping is Necessary, US & International Guidelines Overwhelmingly Recommend Clippers Instead of Razors

US Agencies

- AORN
- CDC
- HICPAC
- 2008 Compendium
- IHI
- SCIP
- AST Standards of Practice for Skin Prep of the Surgical Patient

International

- NICE
- NHS High Impact Intervention #4
- The Association for Perioperative Practice (AfPP)

98% of Surgical Nurses are Clipping, Rather Than Shaving Their Patients According to a Recent AORN Survey[6]

When To Clip – Does Timing Matter?

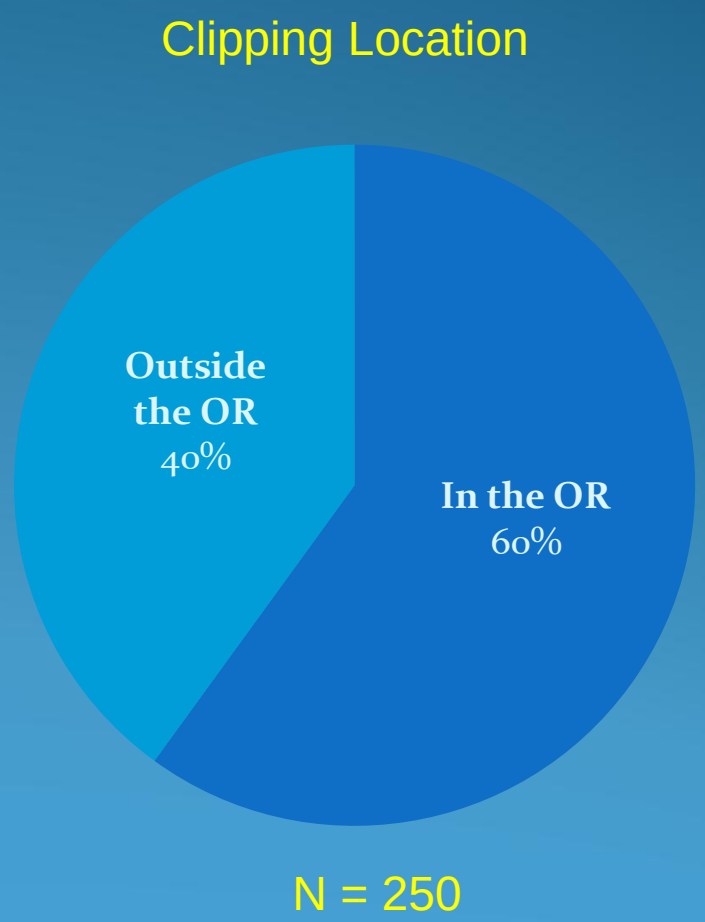
Clipping hair immediately before an operation is associated with a lower risk of HAI than clipping the night before[4]

Studies	>24 hours before	24 hours before	Night before	Day of Surgery	Immediately before
Alexander, Masterson, Sellick, Ko			4.0%		1.8%
Tanner		8%		4%	
Seropian (shaving)	>20%	7.1%			3.1%

Both AORN and CDC recommend that if hair is removed, remove immediately before the operation, preferably with electric clippers.[4,5]

Where to Clip - Inside the OR or in Preop?

- CDC and AORN recommends hair removal is performed *outside* the operating room because clipping is associated with dispersion of hair fibers, lengthy clean-up and possible contamination of the operative field[4,5]
- Observational data and surveys show that in actual practice, most clipping is done <u>inside</u> the OR[6]
- Reasons for clipping <u>inside</u> the OR[6]:
  1. Patient privacy
  2. Reduce the potential for delay
  3. Emergency situations
  4. Preference to clip under anesthesia
  5. Training



Summary of Periop Hair Removal Recommendations[4,5]

- If the presence of hair will interfere with the surgical procedure and removal is in the best interest of the patient, the following precautions should be taken:
  - Hair removal should be performed the day of the surgery, in a location outside the operating or procedure room
  - Only hair interfering with the surgical procedure should be removed
  - Hair should be clipped using a single-use electric or battery-operated clipper, or clipper with a reusable head that can be disinfected between patients

Clipping is associated with a lower HAI rate than shaving, and is more cost effective

Issues With Surgical Clipping

Good Technique is Critical!

- Manufacturers' directions for use and training are essential for safe use of surgical clippers
- Direction, angle and blade type are all fundamentals of proper use
- Raking (seen at right) is a common technique issue that can severely damage the skin, creating a portal for microorganisms resulting in a cancellation or delay in surgery
- Also, very hairy body parts are prone to the HCW making multiple passes – increases the risk of skin damage

Surgical Hair Clipping Waste - More Than A Mess, An Infection Risk

- Surgical hair clippings can contain the same pathogenic bacteria and normal flora as skin
- Hair and airborne particles left behind from surgical clipping on the patient, linens and floor, can potentially contaminate the surgical environment and may increase HAI risk
- Airborne dispersion of surgical hair clippings can be more than a foot from the patient[15]

Clipped Hair Cleanup - Adhesive Tapes and Sticky Mitts May Add to the Problem

- Potentially contaminated hair on linens, wheels, and floor can migrate into the OR and elsewhere in the hospital or ASC
- Adhesive tapes, commonly used for hair cleanup, are not sterilized or kept under controlled conditions, and the same rolls are frequently used on multiple patients - often containing hair from previous cases
- 70% of nurses surveyed said they "sometimes or always" notice the contamination of the tape roll left in the drawer[6]

These issues increase the risk of cross-contamination

Adhesive Tape Cross Contamination Redelmeier et al[16]

- Hypothesis: Adhesive tape rolls may become colonized with organisms and contribute to HAIs
- Study examined the contamination rate of rolls of adhesive tape obtained at a large hospital
  - 40 used tape rolls were collected throughout the hospital (active group), with two 2cm samples from each roll incubated for 1 day. Specimens were compared with positive (used) and negative (unused) control specimens
- 74% of tape specimens collected were colonized by pathogenic bacteria, with some specimens exhibiting polymicrobial growth
  - The active group showed significant growth, with colonies *too numerous to count* in 24 of 59 specimens

Berkowitz, et al[17]

- Study conducted in a 16-bed ICU of a 560-bed teaching hospital
- 24 fresh rolls of adhesive tape were opened, tested to ensure they were free of microorganisms, then placed into use in the ICU (13 immediately, 11 after 1 day in a storage cabinet)
- At intervals of 1, 5, and 7 days after initial culturing, each roll was re-cultured and its location in the unit recorded
- 100% of adhesive tape rolls used (23) became contaminated with opportunistic bacteria, including Pseudomonas, Escherichia coli, Klebsiella, Enterobacter, and coagulase-positive staphylococci
- 5 of the 23 tape rolls migrated to at least 1 different location in the unit, demonstrating the additional risk for cross-contamination

Harris et al[18] (1/2)

- Study to determine whether surgical adhesive tape has the potential to act as a fomite in health care settings
- Study showed that the *side surfaces of the tape rolls* (i.e., the outer edges) were contaminated with greater numbers of bacteria than the tape surface.
- Researchers theorized that:
  - Side surfaces provide a larger surface area for bacterial growth
  - Tape rolls often are placed on their side surfaces when not in use, exposing those areas of the tape to various environmental surfaces
  - Side surfaces are coated with a sticky residue from the adhesive substance of the tape, which may cause greater numbers of bacteria and other particulates to adhere to the side surfaces

Harris et al[18] (2/2)

- Researchers concluded removing a portion of the circumferential surface of the adhesive tape would make no difference in reducing microorganisms, because the majority were found on the side surfaces of the tape roll

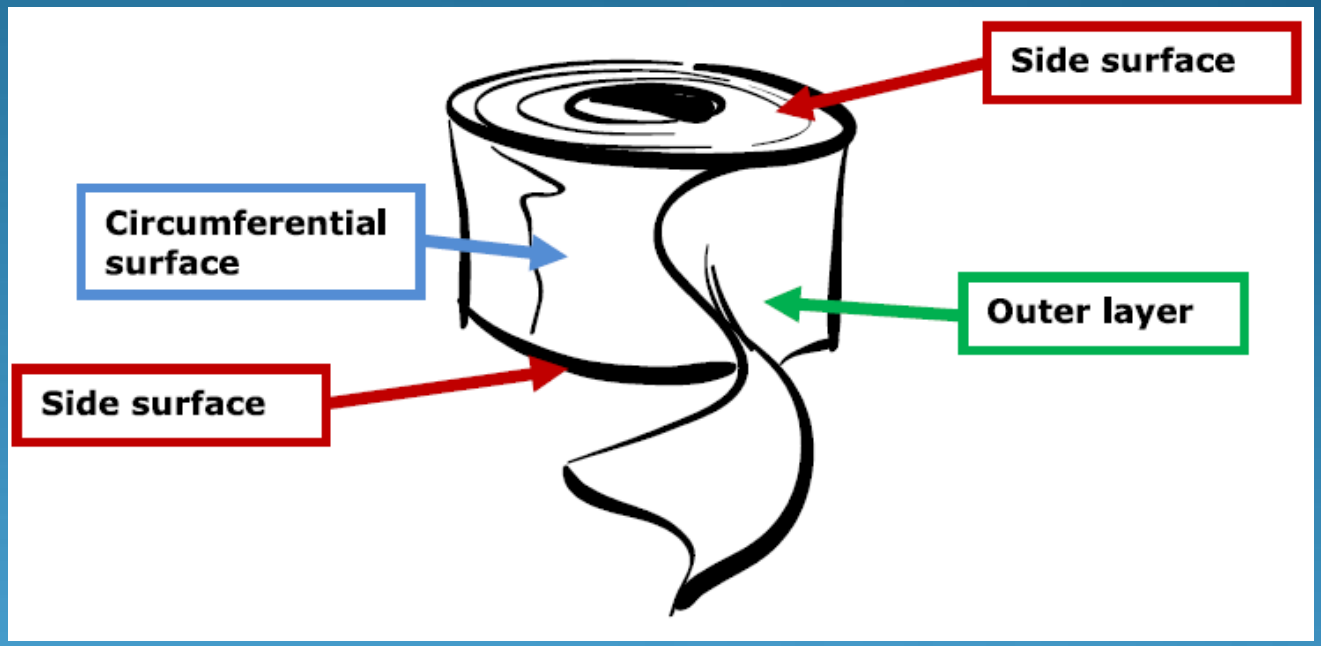


Image from AORN Journal, February 2014 Vol 99 No 2 p324

Is Disposing of Adhesive Tape Rolls After Each Use Practical?

- An *Infection Control Today* article cited studies of two separate hospitals that collected unused adhesive tape from a total of 20 patient rooms and 55 discharges respectively[20]
- Average tape usage was only 1 yard out of a 10-yard roll and 2 yards in each hospital respectively
- Projecting this usage to the hospitals' annual activity, would result in combined wastage of 20,670 rolls – or 126 miles of tape*

*73 and 53 miles of adhesive tape were estimated to be wasted in the two hospitals studied, for a combined wastage of 126 miles of tape

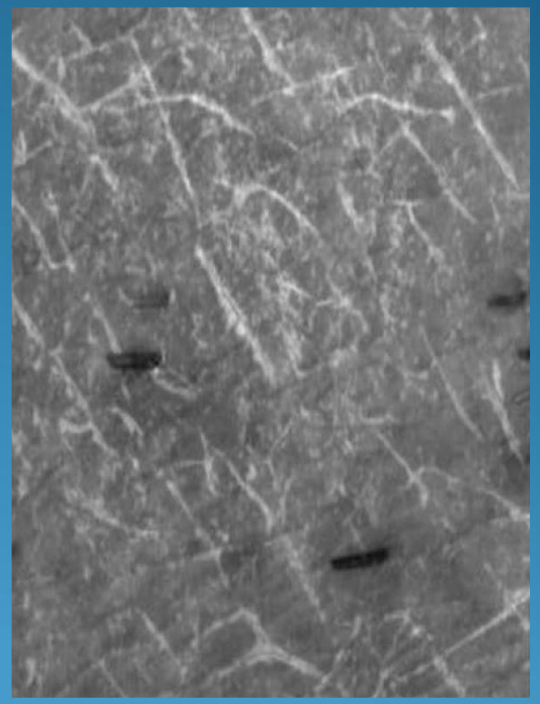
Tape and Sticky Mitts Can Also Damage Skin

- Skin stripping and micro-abrasions are common problems associated with tape
- Tape can damage soft, friable skin and cause adverse skin reactions
- Gloves can tear or rip from tape adhesive during removal process

Before

Visioscan® digital image of lower leg skin surface prior to removal of residual hair with adhesive tape

After



Visioscan® digital image of lower leg skin surface (same individual) after multiple applications (3) of adhesive tape

Data on file from a pilot study conducted by Bioscience Laboratories, Inc. on behalf of Surgical Site Solutions, Inc.

Time Required for Surgical Clipping Cleanup Impacts Efficiency

- Time associated with clipping cleanup using tape and sticky mitts has not been well documented
- A recent survey, 241 surgical personnel reported that the average amount of time devoted to clipping cleanup is 4.1 minutes per case[6]

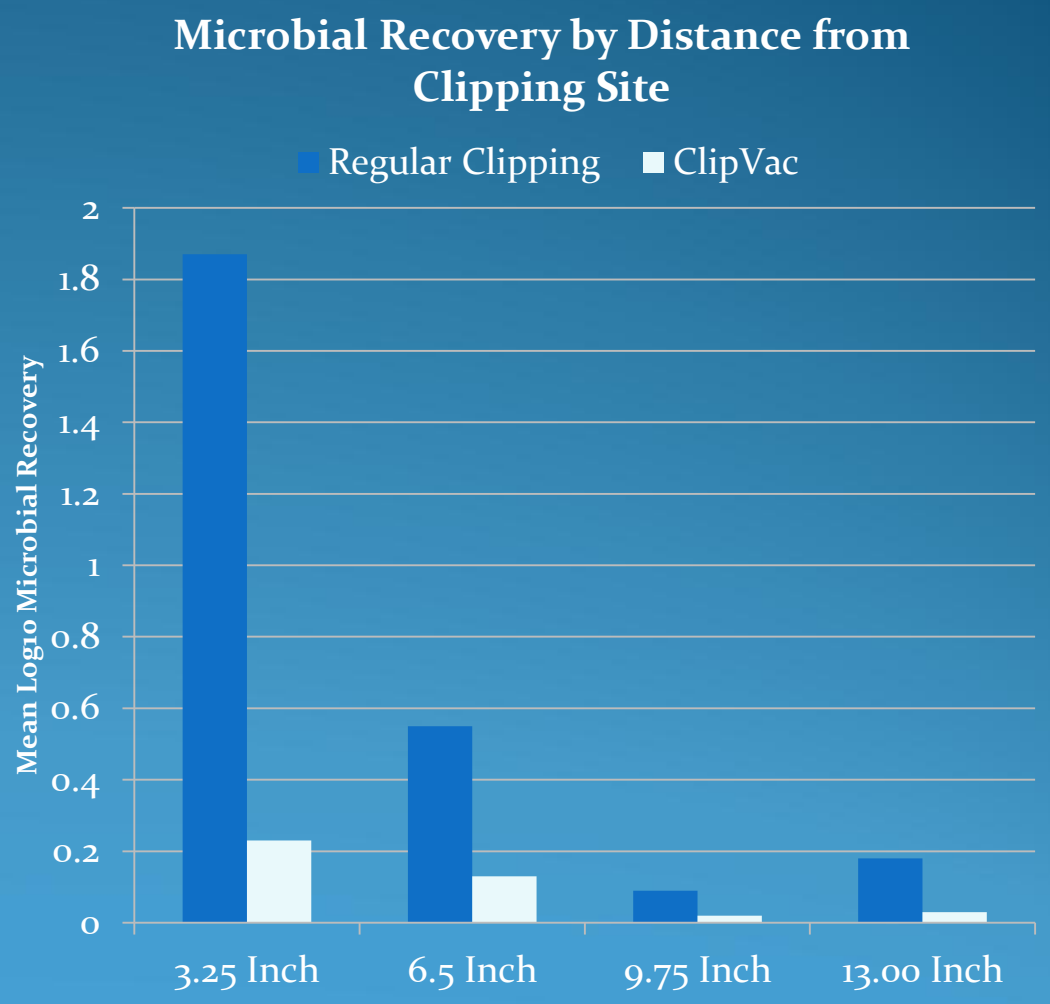
Is Cleanup With Tape Very Effective?

- Little data exists to quantify how much clipped hair is actually picked up using the tape method
- In the same survey, surgical professionals estimated on average only 71% of hair was collected using tape[6]

New Vacuum-assisted Technology to Eliminate the Need for Surgical Clipping Cleanup

A Pilot Analysis of Vacuum-assisted Clipping Technology To Reduce Airborne Contamination

- Objective: To quantify reduced hair dispersal using a vacuum-assisted clipper and microbial contamination in hair left behind by a standard clipper
- Methods. Hair dispersion and microbial contamination adjacent to the prepping site were assessed gravimetrically and by settling plates. Residual hair was recovered using adhesive tape or sticky glove and microbial burden assessed
- Results: A significant reduction ($p<0.001$) in microbial recovery and hair particle dispersion was observed following use of vacuum-assisted clippers (ClipVac)
- 98.5% hair capture achieved with vacuum-assisted clipper (ClipVac)



Data on file from a pilot study conducted by Bioscience Laboratories, Inc. on behalf of Surgical Site Solutions, Inc.

Background & Objectives

- AORN recommends that body hair should be removed when it may interfere with surgery and that hair removal should limit particle dispersion[5]
- Preoperative body hair removal using surgical clippers requires a lengthy cleanup process and can contaminate the operative field[22]

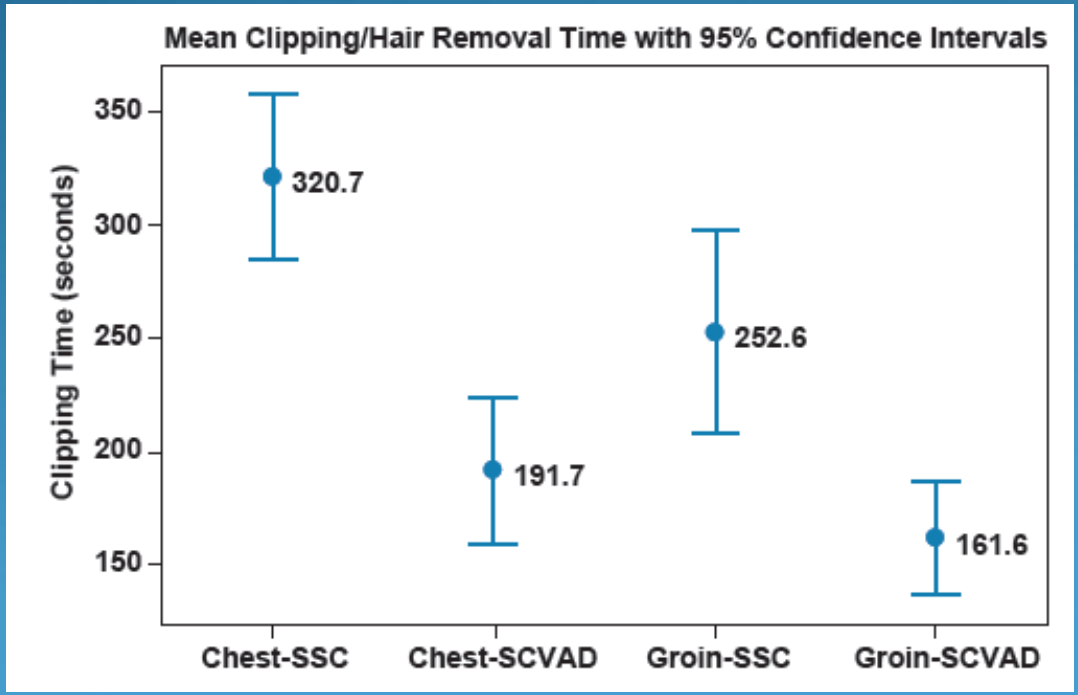
This study compared clipping duration and amount of loose hair/microbial contamination following clipping with standard surgical clippers (SSC) with removal of dispersed hair via surgical tape and clippers fitted with a vacuum-assisted hair collection device (SCVAD)

Methods

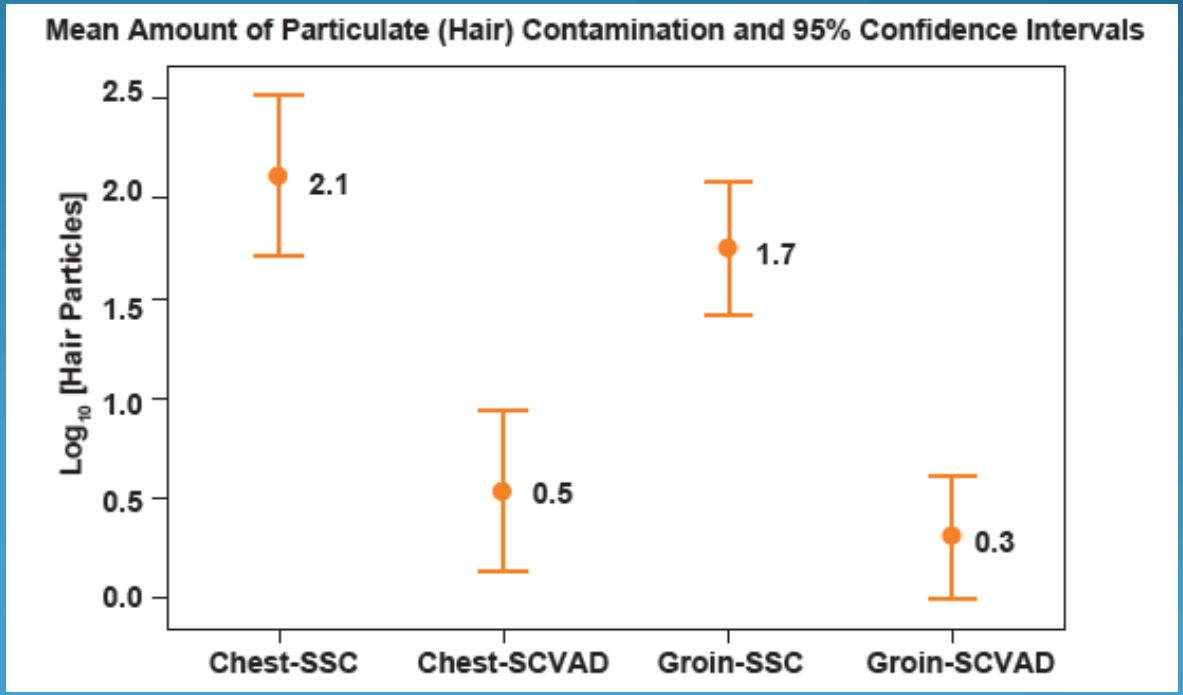
- Trained (RN) nurses clipped the chest/groin of 18 male subjects, clipping a randomized side of the chest or groin with a Standard Surgical Clipper (SSC) and the other with a Surgical Clipper fitted with a Vacuum-Assisted hair collection Device (SCVAD)
  - Total clipping and clean-up times for SSC and SCVAD were assessed
  - Particulate matter (hair) and microbial contamination was measured prior to and during clipping using settling plates
  - Transepidermal water loss (TEWL) was measured on the chest prior to and following clipping

Results 1/3

Significant (p<0.01) reduction in total clipping/ clean-up time with use of SCVAD

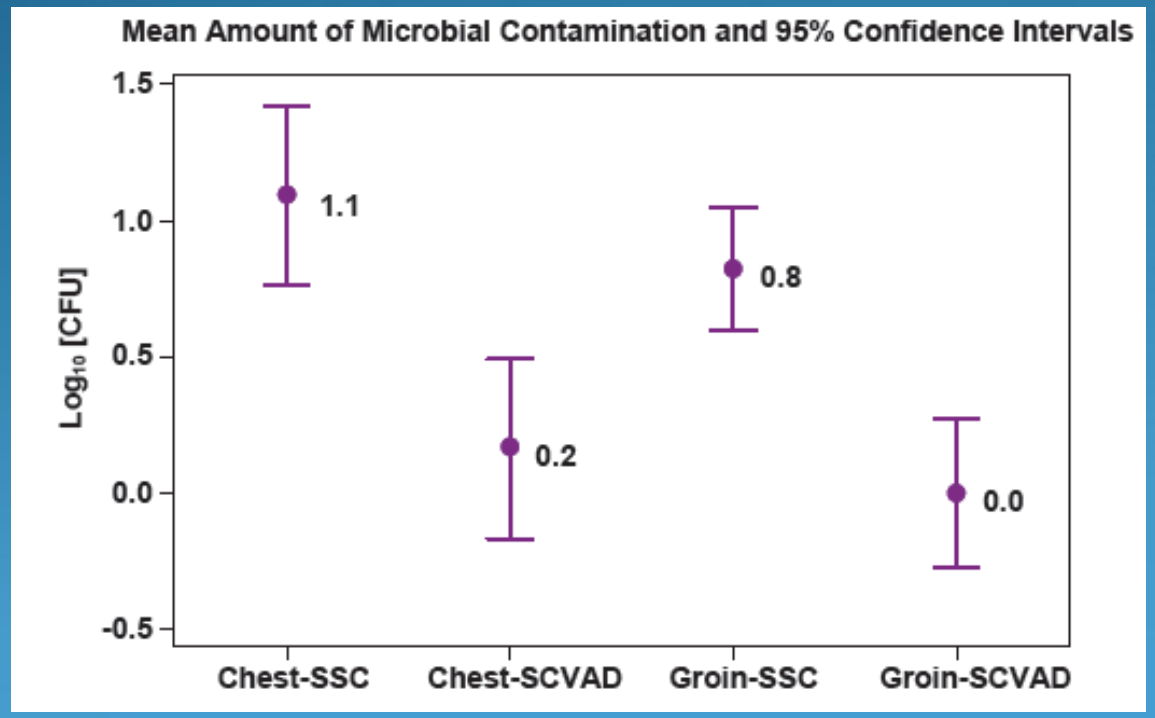


Significant (p<0.01) reduction in amount of hair contamination with use of SCVAD

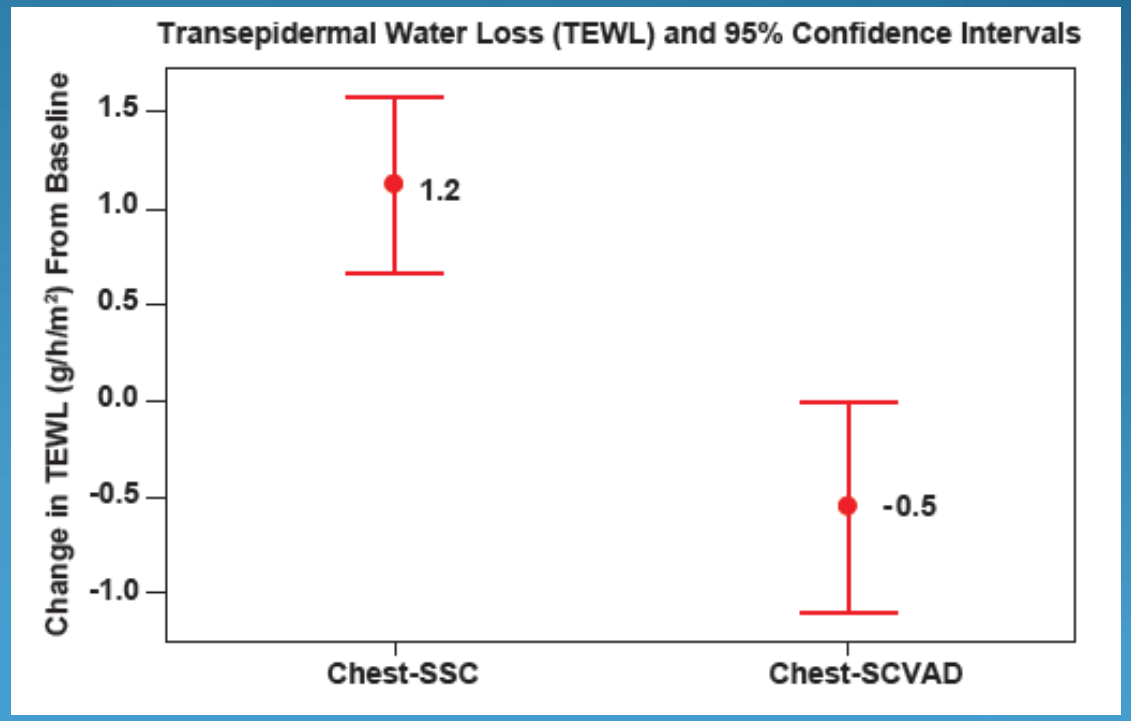


Results 2/3

Significant ($p<0.01$) reduction in amount of microbial contamination with use of SCVAD

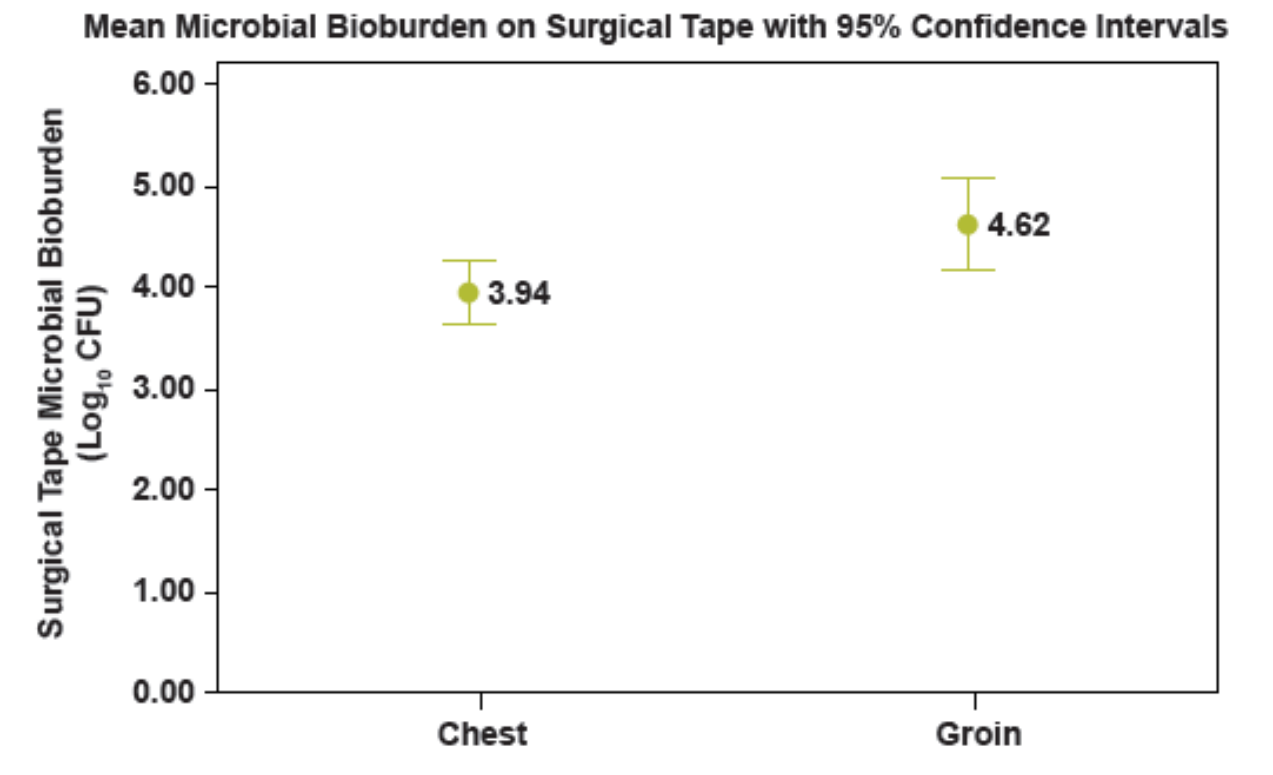


Significant ($p<0.01$) reduction in trans-epidermal water loss with use of SCVAD



Results 3/3

Surgical tape harbors a significant microbial bioburden



Human skin normally has approximately 3.0-7.0 log10 CFU depending on location (hands ~5.0 log10, armpits and groin ~7.0 log10, and most other exterior skin is ~3.0 log10)[23]

Conclusions & Implications

- The use of SCVAD resulted in significant reduction in amount of time required to clip and clean up dispersed hair compared to SSC
- The use of SCVAD eliminated a need to physically remove dispersed hairs from the operative field, which could harbor significant microbial bioburden
- The slight observed increase in TEWL with use of SSC suggests possible damage to the barrier function of the epidermis
- An independent rating of SSC vs. SCVAD by the nurses and study subjects suggest that major perceived benefits were an increase in speed of clipping, an increase in “cleanliness”, and a more comfortable experience for patients

ClipVac™ - A 1-Step Solution for More Effective and Efficient Surgical Hair Cleanup

- Small, portable, battery operated vacuum with a single-use tip and filtered reservoir
- Specifically designed to fit the CareFusion surgical clipper to create a "Complete Clipping Solution"

ClipVac Unit

- Rugged ABS plastic housing with carry strap – easy to wipe clean
- Lightweight and portable
- High efficiency, long life motor
- Lithium ion battery lasts 75 minutes when run continuously
- 4 hours to full recharge

ClipVac's Surgical-grade Filter Captures an Average of 98.5% of Clipped Hair and Debris[21]

- Captures hair and debris down to 0.3µ
- Single patient use
- Non-sterile
- Latex Free
- Recyclable

Summary –Hair From Surgical Clipping is a Potential Cross-contamination Risk

- More than just a mess, hair and airborne particles left behind on the patient, linens and floor from surgical clipping can potentially contaminate the periop environment
- Adhesive tapes used in the cleanup process are not kept under controlled conditions, and the same rolls are frequently used on multiple patients - often containing hair from previous cases
  - 74% of tape specimens collected in one hospital were colonized by pathogenic bacteria[16]
  - 70% of nurses surveyed said they "sometimes or always" notice the contamination of the tape roll left in the drawer[6]

Summary - ClipVac

- Clips and collects hair all in one step
- Surgical-grade filter effectively captures an average 98.5% of the clipped hair and debris, down to 0.3 μ[21]
  - Participants in research reported an average of only 71% of hair is collected using adhesive tape[6]
- ClipVac's filter, containing all the vacuumed material, is disposed of after each use - eliminating the risk of cross-contamination possible with adhesive tape rolls
- ClipVac's 1-step process is efficient - saving time on each case

Thank You

BD

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Surgical Clipper Model 5513E from BD

Feature review:

- Improved ergonomics
- Battery indications for charging and expected life
- Stronger exterior
- New push button technology
- Easier, more detailed blade application
- Two piece charging station for easier cleaning