Tourniquet Contamination (1)

This document present published data that show:

- **ALL non-sterile tourniquets are contaminated** with a variety of pathogens, including MRSA;
- **Disinfecting tourniquets by detergents in the OR is insufficient** to eradicate bacteria;
- **Draping over contaminated tourniquets become ineffective** as a barrier over time;
- **The longer the tourniquet time, the higher the incidence of Surgical Site Infection (SSI)** in orthopedics;
- **Blood transfusion is an independent risk factor for SSI.**

We further present published data that show that **HemaClear® is sterile** and that the use of **HemaClear significantly reduces SSI incidence and blood loss.**

Studies that show that ALL non-sterile tourniquets are contaminated

	Title	Authors	1⁰ finding	Conclusion
1	Microbial Colonization of Tourniquets Used in Orthopedic Surgery	Walsh et Al Rhode Island Hospital, USA ORTHOPEDICS 2006; 29:709	"100% of Tourniquets used in the operating room were contaminated"	**Tourniquet contamination may be a risk factor for the development of surgical site infection in orthopedic surgery.**
2	A study of microbial colonization of orthopedic tourniquets	Ahmed et Al Weston General Hospital, UK ORTHOPAEDICS Ann R Coll Surg Engl 2009; 91: 131–134	"All sampled tourniquets were contaminated with colony counts varying from 9 to > 385"	In addition to the manufacturers' guidelines, **we recommend the cleaning of tourniquets with a disinfectant wipe before every case**
3	Tourniquets and exsanguinators: a potential source of infection in the orthopedic operating theater?	Brennan et Al Cappagh National Orthopaedic Hospital, Dublin, Ireland Acta Orthopaedica 2009; 80 (2): 251–255	Bacteria commonly implicated in surgical site infections were prevalent.	**Infectious organisms reside on the tourniquets and exsanguinators presently used in the orthopedic theater and may possibly be a source of surgical site infection.**
4	The effect of sterile versus non-sterile tourniquets on microbiological colonization in lower limb surgery	Thompson et Al St Peter's Hospital, UK Ann R Coll Surg 2011; 93: 589-90	23/34 of sampled non-sterile tourniquets were contaminated. 36 HemaClear were used, with no contamination.	**There was significant contamination of 68% of orthopedic surgical tourniquets** used regularly in procedures involving the placement of prosthesis and metalwork, and **can act as a potential source of infection.**
5	Microbial colonization of Orthopaedic tourniquets: A potential risk for surgical site infection	Sahu et Al VSS Medical College, India Indian J Med Microbiol 2015; 33, Suppl 115-8	All the tourniquets were colonized with bacteria. After antiseptic treatment, the colony count was significantly reduced.	**"We recommend the routine treatment of orthopedic tourniquets with a disinfectant, preferably an alcohol-based solution, to reduce the risk of contamination of surgical fields."**
6	Microbial Colonization of Pneumatic Tourniquets in the Orthopedic Operating Room.	Mufarrih et Al, Aga Khan University, Karachi, Pakistan Cureus. 2019 Aug 2;11(8): e5308.	Four out of 12 (33%) samples obtained after simply wiping the pneumatic tourniquet with a cloth soaked in sodium hypochlorite cultured coagulase-negative Staphylococci.	**Tourniquets, wiped with a cloth soaked in sodium hypochlorite and ready to be used on the next patient, were found to be contaminated with species notorious for causing surgical site infections following implant-related surgeries,** .

Published data that show the use of **Sterile HemaClear significantly reduce SSI incidence.**

Table 4
Comparison of Infection Rates.

Infection Rate	Group 1 (n = 255)	Group 2 (n = 227)	*P*
Total	7 (2.7%)	17 (7.5%)	0.0168
Deep	2 (0.78%)	6 (2.6%)	0.111
Superficial	5 (1.96%)	11 (4.85%)	0.0776

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Ann R Coll Surg Engl 2011; **93**: 589–590
doi 10.1308/147870811X13137608455334

The effect of sterile versus non-sterile tourniquets on microbiological colonisation in lower limb surgery

SM Thompson, M Middleton, M Farook, A Cameron-Smith, S Bone, A Hassan

St Peter's Hospital, Chertsey, UK

Tourniquet Contamination (2)

	Organisms
1	coagulase-negative staphylococci, Bacillus, Staphylococcus aureus, Streptococcus sanguis, Aerococcus viridans, and Cornyebacterium species
2	Mostly Coagulase-negative Staphylococcus spp. Some tourniquets had growths of important pathogens including **methicillin-resistant Staphylococcus aureus (MRSA), Pseudomonas spp., and S. aureus.**
3	coagulase-negative staphylococci, Staphylococcus aureus and Proteus spp. **We also found a resistant strain of Acinetobacter and Candida**.
4	Different organisms including coagulase-negative Staphylococcus spp, Staphylococcus aureus, Sphingomonas paucimobilis, Bacillus spp, and **coliforms.**
5	coagulase-negative staphylococci, Staphylococcus aureus, Bacillus, **diphtheroids, Pseudomonas, Acinetobacter, enterococci, enterobacteria, and Candida.**
6	Coagulase-negative Staphylococci.

Myth 1: Draping prevents bacterial migration to the sterile field.
Fact 1: published data show that **draping over contaminated tourniquets become ineffective** as a barrier over time.

- AW Blom, et Al., Bristol, United Kingdom Journal of Orthopaedic Surgery 2007;15(3):267-9

Fact 2: Field dryness and reduced intraoperative blood loss help reduce **Surgical Site Infection (SSI)** in orthopedics When surgical field is not dry **cautery (i.e. burning) and suction are used** throughout surgery for hemostasis. Both are risk factors for incisional contamination. As such, **Blood transfusion is a risk factors for SSI:**

- Kim JL, Park JH, Han SB, Cho IY, Jang KM. Allogeneic blood transfusion is a significant risk factor for surgical-site infection following total hip and knee arthroplasty: a meta-analysis. J Arthroplasty. 2017;32(1):320-5. https://doi.org/10.1016/j.arth.2016.08.026.
- Everhart JS, Sojka JH, Mayerson JL, Glassman AH, Scharschmidt TJ. Perioperative allogeneic red blood-cell transfusion associated with surgical site infection after total hip and knee arthroplasty. J Bone Joint Surg Am. 2018;100(4):288–94. https://doi.org/10.2106/JBJS.17.00237.

- Top: Healing skin infection
- Mid: Bilateral TKA with HemaClear L leg; Pneumatic on R

- Surgical Site Infection (SSI) is a significant complication of all orthopedic operations.
- The cost and suffering are enormous with >$60,000 per case with post TKA infection, often needing IV antibiotics, prolonged hospitalization, removal of implant and re-do after prolonged delay.
- The prevalence of SSI is 1-4.5%. US averages are 1.35% for TKA, 0.5% for hand surgery, 4.5% in foot surgery (11% in diabetic patients).
- The cause of SSI is multifactorial. However, quite **often the kind of bacteria that grow in cultures from SSI are the same as those found on re-used pneumatic tourniquets.**
- Using sterile tourniquets, shortening surgery time, reducing blood loss and blood transfusion and preventing tourniquet skin injury are all facilitated by using HemaClear. This explains why SSI with HemaClear is much less than with pneumatic tourniquet as shown in multiple peer-reviewed articles.