Prevalence of Virulent Microorganisms in Musculoskeletal Tissue Swabs

Jace Allen[1], Melanie Hansen[1], Lee Brandenburg[1], Brenden O'Neale[1], Kimberly Elliott[1] and Sara Dionne[1]

[1]Eurofins Donor and Product Testing, Inc., Centennial, CO

Background

Microbial testing for tissue donation is widely described under the American Association of Tissue Banking Standards. 7-day and 14-day recovery swab testing is commonly used to evaluate the presence of microorganisms. The standards have identified two categories of organisms (*Clostridium* and *Streptococcus pyogenes*) as exhibiting significant virulence and pathogenicity which may lead to tissue rejection for musculoskeletal tissues if not treated with a validated sterilization process (E2.800). We performed a retrospective analysis and examined the results of over 868,000 musculoskeletal tissue swabs.

Hypothesis

There is a relatively low number of donors in which virulent organisms are detected.

Methods

Swabs were cultured in TSB and FTM broth and incubated at 35°C and 37°C, respectively, for 7-14 days. Cultures that were turbid (Growth) were gram stained and plated on various types of solid media to support organism identification. Identification methods included MADLI-TOF and an API biochemical test strip system. Source data used for this analysis was taken from our Laboratory Information Management System and analyzed using Python and Microsoft Excel. Of the 868,260 separate recovery site swabs tested, a total of 117,323 donor samples that exhibited Growth were analyzed for this study (timespan 2019-2024). Analysis of the data was preformed using a chi square goodness of fit test.

Results

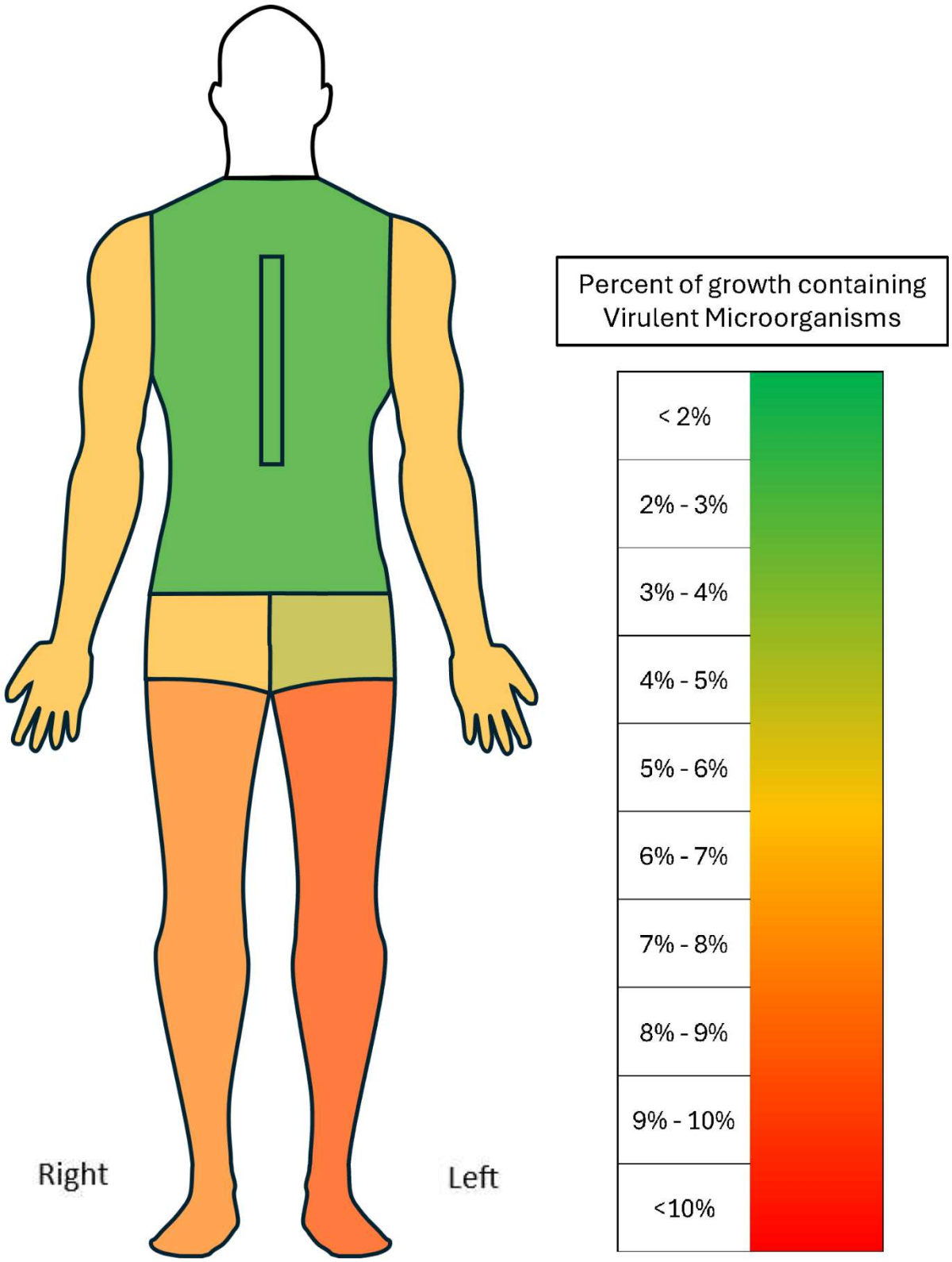
868,260 swabs were analyzed and 11.9% demonstrated microorganism Growth. Of the swabs that demonstrated Growth, 93.1% were shown to have bacterial growth and in 6.9% fungi were identified. However, only 7.0% of swabs with Growth had microorganisms cultured with the potential to disqualify musculoskeletal tissue, per AATB standards.

Data was further analyzed by reviewing Growth specific to different zones of the body. These zones are categorized in Table 1. The prevalence of potentially impactful organisms identified within each recovery zone are shown in Figure 1 as a heat map of the body. The most common potentially impactful organisms identified were members of the *Clostridium* family, with the most frequent member being *C. perfringens*. The lower left and right extremity zones had the highest probability of having potentially impactful organisms identified whereas the vertebrae/spine and thoracic zones had the lowest percentage (Table 2). In addition to *Clostridium* and *Streptococcus* spp., numerous organisms were also identified that can be considered normal floral for the zones (with the exception of vertebrae/spine).

Conclusion

The microbiological contamination of retrieved tissues is a critical aspect in Tissue product safety. Our retrospective analysis of testing swab specimens from musculoskeletal tissue donors indicates that there is a 1% chance that a swab will have a virulent organism detected. Results strongly indicate that the proportion of samples with microorganism Growth identified to have either *Clostridium* spp. or *Streptococcus pyogenes* differ significantly between the collection zones investigated ($P<0.001$).

Figure 1.


Right
Left
Percent of growth containing Virulent Microorganisms
< 2%
2% - 3%
3% - 4%
4% - 5%
5% - 6%
6% - 7%
7% - 8%
8% - 9%
9% - 10%
<10%

Collection Zones	
Zone	**Sites included**
Hemi-pelvis/ilium	Hemi Pelvis, Iliac Crest, Ilium
Upper extremity	Humerus, Radius, Ulna
Lower extremity	Achielles Tendon w/ Calc, Anterior Tibialis, Anterior/ Posterior Tibialis, Fibula, Peroneus Longus/Brevis, Tibia, Talus, Patellar Tendon, Fascia, Femur
Vertebrae/spine	Spine, Vertebral bodies
Thoracic	Scapula, Costal Cartilage, Rib, Sternum

Table 1.

Zone	# of samples	% growth	% Potential Virulent Organism	% *Clostridium sp.*	% *S. pyogenes*	Other organisms commonly identified
Left hemi-pelvis/ilium	41,158	31.9%	5.9%	5.3%	0.6%	*E. coli, S. epidermidis, E. faecalis*
Lower extremity left	314,526	10.0%	8.2%	7.0%	1.2%	*S. epidermidis*
Upper extremity left	70,954	15.3%	6.5%	5.5%	1.0%	*C. acnes, S. epidermidis*
Right hemi-pelvis/ilium	41,161	30.9%	6.0%	5.4%	0.6%	*E. coli, S. epidermidis, E. faecalis*
Upper extremity right	70,417	15.4%	6.2%	5.1%	1.1%	*C. acnes*
Lower extremity right	314,835	10.2%	7.9%	6.6%	1.3%	*S. epidermidis*
Vertebrae/spine	5,166	45.4%	3.4%	2.9%	0.5%	*Streptococcus mitis/oralis/peroris/ Pseudopneumoniae, C. acnes*
Thoracic	10,043	40.4%	3.9%	2.9%	1.0%	*C. acnes*

Table 2.

Prevalence of Virulent Microorganisms In Musculoskeletal Tissue Swabs

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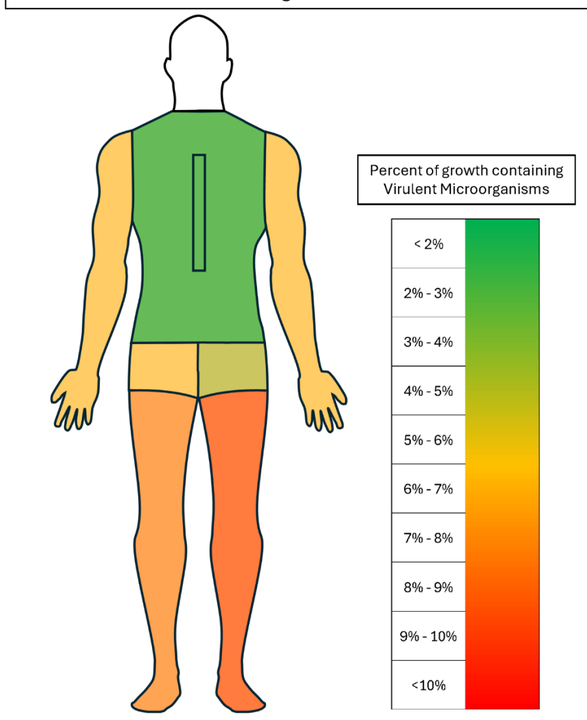

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