

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Hot Tubs and Hydrotherapy – Infection Soup?



ALPHA Teleclass Series

March 2004

Presented by Jim Gauthier, MLT, CIC

Providence Continuing Care Centre

Kingston, ON

Hosted by Paul Webber: paul@webbertraining.com

Objectives

- ▲ *Look at infections associated with:*
 - ▲ *Hot tubs*
 - ▲ *Foot spas*
 - ▲ *Hydrotherapy tubs*
- ▲ *Discuss biofilms and cleaning*
- ▲ *Try to be objective enough that you may use these tubs again in the future!*

Is There a Safe Tub?



Hot Tubs

- ▲ *Referring to large, multi-person, jetted tubs, commonly found in homes, backyards, hotels, health spas or gyms.*
- ▲ *Quite an increase in the last couple of decades*
 - ▲ *1977 – 55,000 in the US*
 - ▲ *1985 - >2,000,000*
 - ▲ *1998 - >340,000 new tubs sold in US*
- ▲ *Rental units available*
 - ▲ *Just park, fill, and tub!*

Ontario Ministry of Health

▲ *Section A, 13.*

▲ *Spa:..contains water...designed for recreational and / or therapeutic use which is not drained after each user...may include...hydro massage jet circulation, hot water, cold water, mineral baths, air induction bubbles, or some combination thereof.*

Ontario Ministry of Health

▲ *Section C, 4 and 6*

▲ *Exempt:*

- ▲ *hydrotherapy pools which are drained, cleaned and sanitized after each user,*
- ▲ *known as floatation / deprivation tanks containing brine and are for use by individual occupants*

Hosted by Paul Webber paul@webbertraining.com

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Ontario Ministry of Health

- ▲ *Section F 4*
- ▲ *The operator should*
 - ▲ *...ensure that the filtration system and the chemical feeders are in continuous operation throughout the entire 24 hours of each day without regard to the duration of actual use of the spa.*

Ontario Ministry of Health

- ▲ *Section Z 5*
- ▲ *The number of days of operation before all the spa water is drained to waste should be determined using the following formula:*
 - ▲ *Vol. of tank in litres/ 10 x maximum number of users = # of days between drainings per day*

Possible Problems

- ▲ *Burns**
- ▲ *Folliculitis*
- ▲ *Inhalational injuries from chemicals**
- ▲ *Humidifier lung*
- ▲ *Hot water fever*
- ▲ *Legionellosis*
- ▲ *Hot tub lung*

Hot Tub Folliculitis

- ▲ *“Hot tub buns”*
- ▲ *Most commonly caused by Pseudomonas aeruginosa*
- ▲ *Pruritic erythematous papule which can progress to erythematous macules or pustules.*
- ▲ *Typically appears in 48 hours*
 - ▲ *Range of 6 hours to 5 days*
 - ▲ *One report of 14 days post exposure*

Hot Tub Folliculitis

- ▲ *Typically distributed over axilla, abdomen and buttocks area.*
- ▲ *Has been confused with: insect bites, hives, allergy, staphylococcal infection, chicken pox, contact dermatitis, and herpes*
- ▲ *Resolve spontaneously within a period of seven to 10 days.*

Hot Tub Folliculitis

- ▲ *Attack rate of 7 to 100%*
- ▲ *Risk factors: crowding, frequent and long hours in tubs (superhydration of skin), snug one piece bathing suits*
- ▲ *Even seen in people who don't wear suits*
- ▲ *Showering may not be protective*
- ▲ *Seasonal – winter months higher*

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Hot Tub Folliculitis

- ▲ *Mild fever and malaise may occur*
- ▲ *Other associated symptoms include: earache, sore throat, sore eyes, conjunctivitis, lymphadenopathy, rhinitis, swollen and painful breasts, nausea, vomiting, abdominal cramps, malaise, fatigue, headache, chills*

Tubs have a Capacity!



Bacterial Loads¹

Water Sample	Tap (n=34)	Tub (n=43) ²
Average cfu/ml	1.38×10^2	2.17×10^6
Low Sample cfu/ml	0 (68% of samples)	700
High Sample cfu/ml	3500	1.48×10^7 (10% of samples $>10^7$)

¹ Moyes, RB unpublished data

² Private n = 22, hotel n = 21)

Bacterial Analysis of Whirlpool Tub Water Samples

	% of positive samples
Enterics ¹	95% (41 of 43)
Fungi	81% (25 of 31)
<i>Staphylococcus aureus</i>	34% (13 of 38)
<i>Pseudomonas aeruginosa</i>	16% (7 of 43)
Other <i>Pseudomonas</i> sp.	56% (24 of 43)
<i>Legionella</i> sp.	36% (8 of 22)

¹ includes *E. coli*, *P. mirabilis*, *Y. pseudotuberculosis*, *Shigella* sp, *Serratia* sp, *Klebsiella* sp.

Nosocomial Whirlpool Tub Infections

- ▲ *Hematology and Oncology unit*
- ▲ *Infections include sepsis, line infections, wound infections – not folliculitis*
- ▲ *Epidemic strain found in drain – was contiguous with tub, closing 2.5 cm below tub level*
- ▲ *Significant risk of infection from tub use*

Nosocomial Whirlpool Tub Infections

- ▲ *Contact time was acceptable*
- ▲ *Could not scrub area – biofilm or slime layer was protecting organism*
- ▲ *New water became colonized with organism*
- ▲ *Outbreak stopped when tubs removed*

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Aerosol-related Infections

- ▲ *Legionella pneumophila*
 - ▲ Pontiac fever – milder illness with flu-like symptoms
 - ▲ 20 persons who used both a whirlpool and swimming pool at a hotel.
 - ▲ *L. pneumophila* isolated from whirlpool water only, not pool.

Legionella

- ▲ Factors that enhance colonization and amplification in man-made water environments include:
 - ▲ Temperatures of 25° – 42°C
 - ▲ Stagnation
 - ▲ Scale and sediment
 - ▲ Presence of certain free living amoeba
 - ▲ Support intracellular growth of legionellae

Hypersensitivity Pneumonitis

- ▲ Associated with *Mycobacterium avium* complex
- ▲ Considered a hypersensitivity reaction as opposed to an infection
- ▲ Misdiagnosed as atypical pneumonia, acute asthma with pneumonia, sarcoidosis, eosinophilic bronchiolitis

Hypersensitivity Pneumonitis

- ▲ Predominate symptom is dyspnea
- ▲ Will include fever (38°C), chills, malaise, headaches, weight loss, dry cough and rhinorrhea
- ▲ Hot tub water not changed frequently enough (8 months in one case)
- ▲ *Mycobacteria* isolated from several of the tubs

Hypersensitivity Pneumonitis

- ▲ X-ray – bilateral infiltrates; bilateral patchy nodular infiltrates; widespread military nodular changes; worsening diffuse bilateral alveolar infiltrates
- ▲ Biopsy – well-formed non-necrotizing and focally necrotizing granulomatous inflammation with virtually all the granulomas centered on the small airways, with focal intrabronchiolar localization, obliterating the lumens

Hypersensitivity Pneumonitis

- ▲ Previous treatment history was prednisone and / or antibiotics
- ▲ Many cases kept using hot tub to help relieve symptoms!
- ▲ Once tub use stopped (sold, converted to indoor garden) symptoms resolved usually on their own

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Hypersensitivity Pneumonitis

- ▲ *Organisms recovered in one tub included:*
 - ▲ *M. avium complex, Pseudomonas sp. Penicillium sp, and Scopulariopsis sp.*
- ▲ *M. avium complex is resistant to chlorination and can be found in domestic water*

Humidifier Lung

- ▲ *Hypersensitivity pneumonitis associated with the inhalation of contaminated water from air-conditioning systems, and domestic, office, and industrial humidifiers.*
- ▲ *Has been reported in showers, at a swimming pool, and in a sauna*

Humidifier Lung

- ▲ *Organisms implicated:*
 - ▲ *Thermophilic Actinomyces, Sphaerolesidales, Penicillium sp, protozoa, Pullularia and Klebsiella oxytoca*

How to Protect Ourselves from Aerosols?



Unknown Etiology

- ▲ *12 persons in Texas guest ranch*
- ▲ *Symptoms included exhaustion, sore muscles, headache, chills, and fever*
- ▲ *One lady reported a miscarriage during her illness*
- ▲ *Clinical specimens negative for L. pneumophila, influenza, parainfluenza, adenovirus.*
- ▲ *Hot tub had been drained, refilled and hyperchlorinated before culture could be done.*

Amoebae

- ▲ *Finnish study found 7 of 11 whirlpools contained amoebae.*
- ▲ *Microbiological quality of water was good in 71% of tubs with amoebae*
- ▲ *Both samples with P. aeruginosa had amoebae*
- ▲ *Filtering and chlorination is unable to destroy cysts.*

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Amoebae

- ▲ *Amoebae proliferate in filter*
 - ▲ *Need to wash regularly by reverse flux*
- ▲ *Conclusion was that contact lenses should not be worn when swimming or bathing in public pools, because of theoretical risk of keratitis.*

Hydrotherapy Tubs



Hydrotherapy tubs

- ▲ *Generally one person at a time*
- ▲ *Need to be drained, cleaned and disinfected between patients*
- ▲ *If jetted, must circulate disinfectant through jets*
- ▲ *Important to ensure proper contact time and dilution of disinfectant*

Birthing Tanks

- ▲ *Recent addition to obstetrical practice.*
- ▲ *Have seen *P. aeruginosa* infections in neonate from tank water*
- ▲ *Water and walls will be contaminated with skin flora and blood during labor and delivery.*
- ▲ *Follow manufacturer's instructions for selection of disinfection method and agent*

Footbaths/Foot Spas



Footbaths/Foot Spas

- ▲ *Outbreaks have been seen*
 - ▲ *Texas, California*
- ▲ *Mycobacterium fortuitum and other related mycobacteria*
- ▲ *Look like spider bites that eventually grow, produces pus, can scar*
- ▲ *Don't shave before your pedicure*

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Footbaths/Foot Spas

- ▲ *California Department of Consumer Affairs*
- ▲ *Between customers: drain, wash and disinfect*
- ▲ *End of each day, remove filter screen, wash system, disinfect*
- ▲ *Every other week clean with bleach solution, then soak for 6 hours*

Disinfectants

- ▲ *Calcium, lithium and sodium hypochlorite, chloroisocyanurates and chlorine gas*
- ▲ *Chlorine – activity is shortened by:*
 - ▲ *Aeration,*
 - ▲ *Agitation*
 - ▲ *High temperatures*
 - ▲ *High numbers of bathers*

Disinfectants

- ▲ *Bromine*
 - ▲ *Forms bactericidal bromamines*
 - ▲ *Some problems with contact dermatitis*
- ▲ *Iodine*
 - ▲ *Does not bleach hair, swim suits or cause eye irritation*
 - ▲ *Gives water a greenish-yellowish cast*

Culturing Frequency

- ▲ *Depends on state of tub, can look only for Pseudomonas, or total and fecal organisms*
- ▲ *Rapid method described using adenosine triphosphate (ATP) which showed good correlation to standard plate counts, but also detected non-coliform bacteria*

A Quick Word on Biofilms

- ▲ *Biofilms are a substance composed of cells embedded in a matrix of extracellularly-produced polymers and associated abiotic particles*
- ▲ *Can contain algae, protozoa, and fungi, but predominating organisms are gram-negative bacteria*

Biofilms

- ▲ *Organisms within biofilms behave quite differently than planktonic (free floating) bacteria*
 - ▲ *More resistant to antibiotics and disinfectants*
 - ▲ *Chlorine less effective against biofilms*
 - ▲ *Requires high concentration*
 - ▲ *Monochloramine can penetrate better, but only used in municipal systems, not as a supplemental water treatment approach*

Hot Tubs & Hydrotherapy – Infection Soup

Jim Gauthier

A Webber Training Teleclass

Biofilms

- ▲ Accelerated or stabilized hydrogen peroxide does penetrate and remove biofilms
- ▲ Can be corrosive on some plumbing fittings

Summary

- ▲ Keep it clean!
 - ▲ Must use elbow grease to clean before disinfecting
- ▲ Risk of problems seem to be directly related to sanitization and cleaning of unit
- ▲ Need to keep educating the public on the importance of cleaning their tubs, and to beware of large, public use tubs.

References

- ▲ Lorber B. Hot tubs, sex, sushi, and infectious diseases. *Pharmacotherapy* 1991;11:56S-63S
- ▲ Vesaluoma M, et al. Microbiological quality in Finnish public swimming pools and whirlpools with special reference to free living amoebae: a risk factor for contact lens wearers? *Br J Ophthalmol* 1995;79:178-181
- ▲ Stulberg DL. Common Bacterial Skin Infections. *Am Fam Physician* 2002;66:119-24

References

- ▲ CDC. Surveillance for waterborne disease outbreaks – United States, 1999-2000. *MMWR* 2002;51:SS-8
- ▲ Ratnam S. et al. Whirlpool-associated folliculitis caused by *Pseudomonas aeruginosa*: report of an outbreak and review. *J Clin Microbiol* 1986;23:655-659
- ▲ California Department of Consumer Affairs, Board of Barbering and Cosmetology. Whirlpool footspa safety fact sheet. 2002 May www.dca.ca.gov/barber

References

- ▲ www.click2houston.com/print/2624450/detail.html?use=print
- ▲ CDC. Guidelines for environmental infection control in health-care facilities. 2003. pp40-54, 67-69, 220-222.
- ▲ Embil J et al. Pulmonary illness associated with exposure to *Mycobacterium-avium* complex in hot tub water. *Chest* 1997;111:813-816
- ▲ Rickman OB et al. Hypersensitivity pneumonitis associated with *Mycobacterium avium* complex and hot tub use. *May Clin Proc* 2002;77:1233-1237

References

- ▲ Berrouane YF et al. Outbreak of severe *Pseudomonas aeruginosa* infections caused by a contaminated drain in a whirlpool bathtub. *Clin Infect Dis* 2000;31:1331-7
- ▲ MOH. Recommended standards for the operation of public spas. 1989
- ▲ Lee JY et al. Rapid determination of bacteria in pools. *J Environ Health* 2001;64:9-13