RECLASSIFIED GRAM NEGATIVE OPPORTUNISTIC PATHOGENS
FUTURE WORRY FOR HOSPITALS
THE OZONE EFFECT

Most of these happen to be opportunistic gram negative bacteria and many of them are recent classifications of potent future pathogens. We provide below some extracts that have been reported on these bacteria .Many of them have been reported now and then in Hospital infections in water system, instruments and also in patient's body fluids and blood.

1) Sphingomonas paucimobilis Gram Negative

Pseudomonas variety renamed now. Found in environment especially soil Susceptible but contact time not known. Ability of *S. paucimobilis* to pass through the 0.2 µm filters. In one Japanese hospital, water obtained from a reverse osmosis system, as well as from an ultra-filtration unit tested positive for *S. paucimobilis*, and the level of contamination was higher than that in tap water from the same hospital (indicating that it passes thorgh UF and RO and proliferates in system loops). Further studies showed a correlation between the chlorine level in the water and the amount of growth of this organism, suggesting that chlorination of the water may have some inhibitory effect on its growth. It is implicated in microbial influenced corrosion of water pipes suggesting that it can exist and proliferate in bio fouling material . Heating the water to 64°C decreases these reactions and microbial growth

2) ***Cupriavidus pauculus Gram negative***

Strains have been isolated from pool water, ground water, and bottled mineral water. It passes through Ultra filtration system . Found in soils . Not much is known about this

3) ***Methylobacterium*** **species : Gram Negative**

They include bacteria previously grouped in the *Pseudomonas* genus. The ability to form biofilms and to develop tolerance to disinfecting agents, high temperatures, and drying may explain the frequent occurrence and colonization of *Methylobacterium . Opportunistic bacteria also found in biofilms and likely to resist disinfection hiding within biofilms*

4) Elizabethkingia meningoseptica**, Gram Negative**

It has been isolated in the hospital environment in water supplies, disinfectants, and medical devices. Isolation of this organism in handwash sink and water is a significant finding as they have been reported to survive in chlorinated water. Environmental studies have revealed that the organism can survive in chlorine-treated municipal water supplies, often colonizing sink basins and taps, intubation tubes, humidifiers, incubators for newborns, ice chests and syringes, and has become a potential reservoir for infections in the hospital environment. Active infection control measures like regularly inspecting the hospital water tanks, water surveillance, and hyper chlorinating the water might be required for controlling infection with this challenging bacteria.

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5) ***Delftia acidovorans*** *Gram Negative*

Earlier known as ***Pseudomonas acidovorans***, is found in soil, water and the hospital environment.

6) **Oligella ureolytica**

is a commensal of the GU tract, and most clinical isolates are from the urine, predominantly from men. From origin the source in water could be contamination of municipal water through sewage

7) Stenotrophomonas (Xanthomonas) maltophilia Gram Negative

Stenotrophomonas (Xanthomonas) maltophilia is an aerobic bacillus that is found in various aquatic environments. .Not much has been reported about this bacteria and its susceptibility to ozone

8) ***Aeromonas salmonicida Gram Negative***

In the past, Aeromonas species were placed alongside Vibrio species and Plesiomonas shigelloides in the family Vibrionaceae .The major route of contamination is poor water quality. The bacterium's optimal growth temperature is between 22 and 25°C. The maximum temperature that it can grow at is 34.5°C. it is widely distributed in aquatic environments since their genus is made up of psychrophiles and mesophiles from soil and aquatic environments. Aeromonas species have the inherent capability to grow in water distribution systems, especially in biofilms, where they may be resistant to chlorination

9) Acinetobacter ursingii & Acinetobacter lowffii

The species belonging to the *Acinetobacter* genus are widely distributed in nature since they are found frequently in soil, water, and dry environments Due to their ability for long-term survival on inanimate surfaces, they are commonly isolated from the hospital environment
Since they are they are regularly recovered from urinary tract, their presence in water could be contamination through sewage or soil

10) Roseomonas gilardii Gram Negative

The natural reservoir for *Roseomonas* infection is unknown although it has been isolated from water supplies. it may also exist as a commensal in humans. Not much has been reported about the disinfection of these species

We have studied the information, including the likely source, the habitat that would provide us some idea on ozone's effects on them. Not many studies have been reported on the effects of Chlorine/ozone on these bacteria. Our inference will be based on the species and its susceptibility on ozone and its actions

Our Inference:

1) Most of them /all are Gram Negative
2) Many of them were previously classified s pseudomonas species but now reclassified
3) Most of them find their way into water through soil contamination/sewage contamination
4) Most of them hide behind bio fouling material to escape disinfectant action
5) All pseudomonas species are chlorine resistant
6) All are opportunistic bacteria
7) All are causative organisms of hospital infection.

Likely ozone actions on these bacteria

Construction of Bacteria

Bacteria are microscopically small single-cell creatures and take up foodstuffs and release metabolic products, and multiply by division. The bacteria body is sealed by a relatively solid cell membrane. Their vital processes are controlled by a complex enzymatic system.

Action of ozone on Bacteria

Ozone interferes with the metabolism of bacterium cells, most likely through inhibiting and blocking the operation of the enzymatic control system. A sufficient amount of ozone breaks through the cell membrane, and this leads to the destruction of the bacteria

Gram Negative Bacteria are more susceptible to ozone

Gram negative bacteria are more susceptible to ozone than gram positive organism's .Gram negative organisms, fatty acid alkyl chains and helical lipoproteins are present. In acid-fast bacteria, such as Mycobacterium tuberculosis, one third to one half of the capsule is formed of complex lipids and glycolipids. The high lipid content of the cell walls of these bacteria may explain their sensitivity, and eventual demise, subsequent to ozone exposure. Ozone may also penetrate the cellular envelope, directly affecting cytoplasmic integrity, disrupting any one of numerous levels of its metabolic complexities.

Solutions to Obtain pathogen free water

The inference, points 3, 4, 5 suggest that ozone is a good solution for eradicating these bacteria because

1) Ozone is very effective against gram negative bacteria because of its mode of action
2) Ozone is very effective against pseudomonas strain unlike chlorine
3) Ozone destroys bio-fouling material on the inner surfaces of the pipes and tanks , hence prevents subsequent proliferation of these bacteria and exposes them to ozone action

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