

# CO<sub>2</sub> Dependent *Staphylococcus aureus*

Implications for Clinical Microbiology  
Laboratories and Infection Control

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- First described by Hale in 1951
- Atypical biochemical characteristics described by Mair in 1955
- Sometimes described as small colony variants (SCV's)
- Unusual phenomenon and the least common auxotroph of SCV's

## Case Study

- A 3 ½ year old female with transverse myelitis presented in late January with pyrexia
- *Staph aureus* was isolated from her peg site
- Automated susceptibility testing was performed on the Vitek2 Compact instrument
- All antibiotic tests terminated and there was no growth on purity plates
- Further investigations established this isolate to be CO<sub>2</sub> dependent

# Biochemical Characteristics and Morphology

Atmosphere	Growth	Colony Size	Catalase	Latex Agglutination	Tube Coagulase
CO <sub>2</sub> at 37°C	Good growth	1-2mm	Positive	Positive	Positive at 4 hrs



<b>Atmosphere</b>	<b>Growth</b>	<b>Colony Size</b>	<b>Catalase</b>	<b>Latex Agglutination</b>	<b>Tube Coagulase</b>
Air at 37°C	Hazy growth	Pinpoint colonies	Positive	Negative	Negative at 4 hrs, Very loose clot at 24hrs



## Molecular Studies

- Whole genome sequencing has been performed on many isolates in different studies
- No significant differences found between CO<sub>2</sub> and non-CO<sub>2</sub> dependent isolates
- Exhibition of the phenotype is governed at the level of gene expression
- Colonies can convert to CO<sub>2</sub> dependency, and revert back, at will

## Implication for Clinical Microbiology

- Due to unusual morphology these colonies may not be selected for further investigations
- If they are they may be misidentified as CNS
- Most *MRSA* chromogenic agars must be incubated in  $O_2$
- Implications for susceptibility testing

# Examples in Literature

- Valour, F. et al, 2014. Rapid detection of *Staphylococcus aureus* and Methicillin resistance in bone and joint infection samples: evaluation of the GeneXpert MRSA/SA SSTI assay, *Diagnostic Microbiology and Infectious Disease*, **78**, 313-315
- 3 false positives detected by Xpert MRSA/SA SSTI assay. No growth on culture
- All plates incubated AEROBICALLY

- Wolk et al, 2009. Rapid detection of *Staphylococcus aureus* and MRSA in Wound Specimens and Blood Cultures: Multicentre Preclinical Evaluation of the Cepheid Xpert MRSA/SA Skin and Soft Tissue and Blood Culture Assays, *Journal of Clinical Microbiology*, 47, 823-826
- 3 false positive results detected by Xpert MRSA/SA SSTI assay. No growth on culture.
- All plates incubated AEROBICALLY

# Conclusions

- All clinical microbiologists should be made aware of the possibility of CO<sub>2</sub> dependent *Staph aureus* in clinical samples
- If suspected culture plates should be incubated in CO<sub>2</sub> for 18-24 hours prior to any identification or susceptibility testing
- Chromogenic agars which must be incubated aerobically pose a significant problem, particularly for MRSA screening