Streptococcus dysgalactiae a potential source of zoonotic infection in the kitchen

Koh Tse Hsien1,2, Nurdyana Binte Abdul Rahman1 and October Sessions2
1Department of Microbiology, Singapore General Hospital; 2Duke-NUS Graduate Medical School, Emerging Infectious Diseases Programme, Singapore

INTRODUCTION

• Streptococcus dysgalactiae is comprised of two subspecies
  ➢ S. dysgalactiae subspecies equisimilis (SDSE)
  ➢ S. dysgalactiae subspecies dysgalactiae (SDSD)

• Traditionally S. dysgalactiae have been separated into β-haemolytic SDSE which infect humans and α-haemolytic SDSD that are animal pathogens

• Interestingly, a suspected zoonotic fish-associated SDSD infection (DB49998-05) was first described in Singapore in 2008

• We have since isolated a few more suspected zoonotic S. dysgalactiae from humans and from fish meat being sold at a market

• Here, we performed a comparative genomics analysis of
  • Five local S. dysgalactiae genomes
  • 15 publically available complete S. dysgalactiae genome

METHODS

• Five samples were collected from patients and fish meat from 2005 to 2017.

Identification

DNA extraction & Library prep

WGS

Sequencing

Paclio * RSI

Illumina Hisoeq4000

Data analysis

Genome characterization

Phylogenetic analysis

• Sequence type (ST)
  • NAD-glycohydrolase
  • Streptokinase
  • Streptodornase

• Antiphagocytic M protein

• Virulence genes

• Antimicrobial resistance genes

• Virulence genes

• eptA

• sodA

RESULTS

1. Both SDSD and SDSE were recovered from fish meat.
2. A total of 34 isolates were sequenced.
3. The NAD-glycohydrolase gene was absent in all SDSD isolates.

Figure 1 Virulence factors of publically available SDSE and SDSD. (Human clinical isolates/gene included in Wang et al., 2015; *isolates included in Rats et al., 2011). Isolates included in this study. Numbers included in Luther et al., 2017. *UniProt accession number. The presence of virulence factor is indicated using cutoff value ≥90% coverage and ≥75% sequence identity. Genes that are absent in all genomes are removed from figure.

Figure 2 Phylogenetic tree based on 747 bp portion of nuf gene sequences from S. dysgalactiae isolates in this study and selected strains included in Wang et al. (2016), Abdelsalam et al. (2011), Suzuki et al. (2011) and Picard et al. (2006). The value on each branch represents the percentage of bootstrap replications supporting the branch. Bootstrap values lower than 50% are not shown.

Figure 3 Phylogenetic tree based on 920 bp portion of mna gene sequences from S. dysgalactiae isolates in this study and selected strains included in Abdelsalam et al. (2012), Okumura et al. (2012), Suzuki et al. (2011), and Fujino et al. (2007). The value on each branch represents the percentage of bootstrap replications supporting the branch. Bootstrap values lower than 50% are not shown. The source corresponding to each S. dysgalactiae isolate is indicated on the far left. Scale bar are nucleotide substitutions per site.

CLINICAL DETAILS

1. DB49998-05* was a clear case of fish exposure from patient who had mastectomy [Group C α-hemolytic]
2. DB31752-13 was from a patient who had cellulitis at the mastectomy site [non-hemolytic]
3. SDSE060705-15 was from a patient with breast cancer and right arm lymphedema [Group G α-hemolytic]
4. STREP97-13 was from Red Tilapia purchased from a local supermarket [Group G α-hemolytic]
5. SDSE39993-17 was from a food stall operator selling chicken [β-hemolytic]

• Clinical histories of all 3 patients were strikingly similar (ascending cellulitis in an upper limb of a breast cancer patient)
• STREP97-15 and DBSE993-17 were β rather than α-hemolytic

CONCLUSION

• It appears that zoonotic infections of SDSD may be acquired as a result of handling meat.
• SDSD infection is likely to be rare given that the opportunity to acquire zoonotic infection with this species is uncommon.
• It may also be under-recognized because the variability of haemolysis on blood agar may result in failure to distinguish SDSD from SDSE in the routine lab.
• The possibility of zoonotic SDSD should be suspected in patient with bacteraemia and ascending cellulitis of the upper limb with a history of handling meat.
• Hence, confirmation of the identity of SDSD can only be made with a multi- gene approach.