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Short report

Mass prophylaxis in an outbreak of invasive group A streptococcal disease in a residential aged care facility

Bhakti R Vasant, Kari A J Jarvinen, Ning-Xia Fang, Helen V Smith and Amy V Jennison

Abstract

In September 2016, an invasive group A streptococcal disease outbreak occurred among residents of a residential aged care facility. An expert advisory group recommended mass prophylaxis for residents and staff in addition to strict infection control practices to prevent further spread. Whole genome sequencing confirmed the cases were related.

Background and methods

Group A streptococci (GAS) can cause serious diseases including necrotising fasciitis and toxic shock syndrome. Invasive GAS (iGAS) outbreaks in residential aged care facilities (RACF) are associated with high case fatality (25%–60%).[1,2] Prompt outbreaks control is therefore important. Targeted prophylaxis for GAS carriers or mass prophylaxis for staff and residents may have a role.[3] Variations are noted in guideline recommendations for prophylaxis (Table 1).

In Queensland, iGAS (GAS isolation from a sterile site) is a notifiable condition.[4] Notifications of iGAS in a RACF in 2016 resulted in public health investigations of a suspected iGAS outbreak. Laboratory investigations were undertaken to confirm whether the RACF iGAS cases were related.

Ethics approval was not required because outbreak identification, characterisation and control are covered under the Public Health Act 2005, Queensland.[5]

Description of outbreak

In September 2016, a large metropolitan Public Health Unit (PHU) in Queensland was notified of two iGAS cases in elderly residents in the same wing of a RACF (wing A). The first case was hospitalised for cellulitis and GAS bacteraemia. The PHU provided a fact sheet to the RACF following notification of the first case and requested notification of additional cases.

The second wing A resident case of iGAS was notified two weeks later. As two epidemiologically linked iGAS cases were identified within three months, the criteria for a suspected iGAS

Table 1: Recommendations for targeted or mass prophylaxis to control iGAS outbreaks in RACFs [4,6–9]

Guideline	Type of prophylaxis recommended (targeted or mass)
Queensland	Mass*
Northern Territory	Mass
Canada	Targeted
UK	Targeted or mass prophylaxis to be considered

* Queensland iGAS guidelines were in development at the time of the outbreak.

outbreak were met.[4] As Queensland's guidelines for public health management of iGAS were in development during the outbreak, an expert advisory group (EAG) was convened to ascertain whether prophylaxis should be recommended for wing A residents and staff. Options included recommending no prophylaxis, recommending targeted prophylaxis or recommending mass prophylaxis to wing A residents and staff. The latter was recommended and carried out.

In November 2016, the PHU was notified of a case of GAS bacteraemia in another resident from wing A. The likely nidus of infection was a chronic ulcer.

Laboratory investigations

GAS isolates from the three cases were submitted to the Queensland Forensic and Scientific Services (FSS, the Queensland Health Public Health Reference Laboratory) for Whole Genome Sequencing through their in-house NexteraXT library preparation and Illumina NextSeq500 sequencing workflow. Fastq sequences are located in ENA project PRJEB23078. The *emm* type, *spe* exotoxin gene detection, multi-locus sequence types (MLST) and *emm* locus arrangement were determined from de novo assembled sequences using Ridom SeqSphere+ with alleles from the CDC MLST scheme (https://pubmlst.org/spyogenes/) and CDC *emm* data base (https://www2a.cdc.gov/ncidod/biotech/strep-blast.asp). Sequences were mapped to the reference genome *Streptococcus pyogenes* M1 strain (Genbank accession NC_002737) and core single nucleotide polymorphism (SNP)s identified using the Snippy pipeline (https://github.com/tseemann/snippy). A Maximum Likelihood tree was generated from the SNP alignment, using the Fast Tree plugin in Geneious R7 software (figure 1).

Isolates from cases 1 and 2 showed limited genetic variation to each other (17 SNP differences) and were more genetically related to each other than other *emm* 12 isolates isolated from Queensland in the 12 months prior to these cases (n= 9, SNP distance >251 SNPs) (Figure 1). The isolates from cases 2 and 3 showed even less genetic distance (6 SNP differences). This limited genetic variation and plausible epidemiological link between cases support the hypothesis that the three iGAS cases in wing A were related (Table 2).

Public Health Response

The EAG recommended mass prophylaxis for residents and staff of wing A after case 2 to ensure that individuals with asymptomatic carriage were treated and to reduce the risk of GAS transmission to non-carriers. Staff who opted not to receive antibiotics were recommended to undergo screening for nasopharyngeal GAS carriage. Carriers were recommended to be excluded from work until completing 48 hours of a suitable antibiotic (phenoxymethylpenicillin, cephalexin or azithromycin). All wing A staff opted to receive antibiotics.

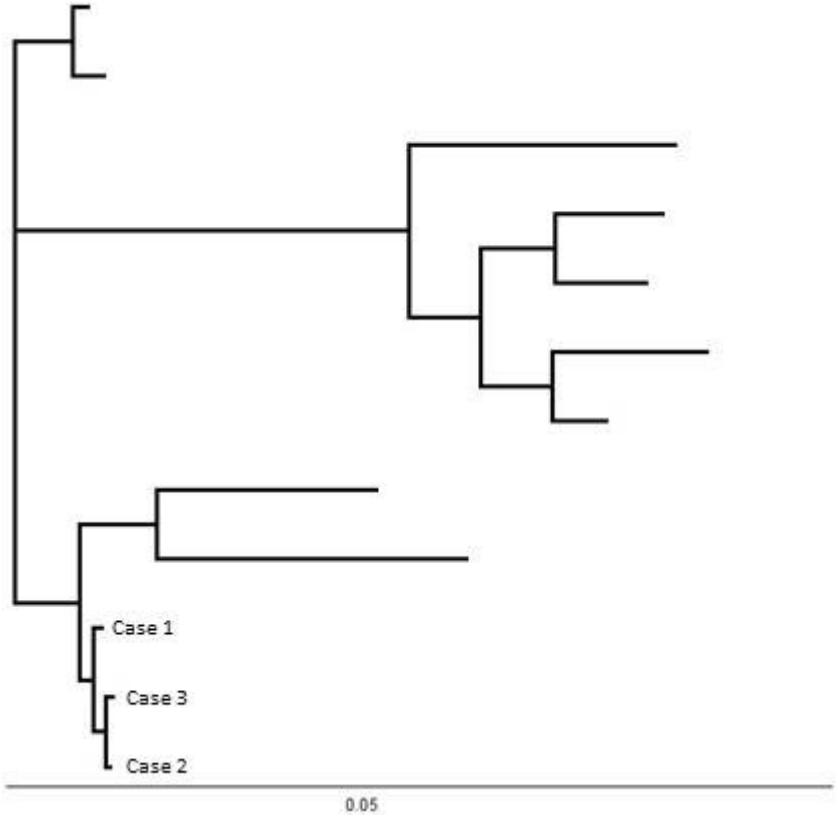
Facility management, staff and visiting medical practitioners were advised that staff cohorting and strict infection control practices (including hand hygiene and environmental cleaning) were required to prevent further spread of iGAS.

All wing A residents and staff, including case 3, commenced chemoprophylaxis by early October

Table 2: Group A streptococcal isolates from residents with iGAS in a residential aged care facility outbreak, 2016

Case	*emm* sequence type	*spe* genes detected	*spe* genes not detected	MLST ST	*emm* locus				
					mga	*mrp*	*emm*	*enn*	*scpA*
Case 1	12	B, C, Z, F, G, H	J, ssa	36	+	-	+	-	+
Case 2	12	B,C, Z, F, G, H	J, ssa	36	+	-	+	-	+
Case 3	12	B,C, Z, F, G, H	J, ssa	36	+	-	+	-	+

Figure 1. Phylogenetic Maximum Likelihood Tree showing SNP differences between *emm12* isolates isolated in a 12 month period up to and including the case cluster.



2016. When case 3 was notified more than one month after outbreak identification, the PHU recommended increased vigilance for additional cases and reinforced the importance of infection control practices. No further iGAS cases were notified from the RACF.

Discussion

Due to the severity of iGAS infection, preventing transmission is important in institutional settings such as RACFs.[10,11] Prevention and control strategies include: (1) early identification of iGAS infection through surveillance and communication to the RACF, (2) infection prevention and control strategies (particularly hand hygiene and wound management) and (3) targeted or mass antibiotic prophylaxis.[11]

A review by Cummins and colleagues reported no clear advantage to either targeted or mass antibiotic prophylaxis in controlling iGAS outbreaks in RACFs.[3] Smith and colleagues reported using mass prophylaxis to control a rapidly evolving RACF outbreak with a high case fatality rate after targeted prophylaxis was unsuccessful. In this outbreak, strain persistence was associated with poor infection control practices.[12] Marsden and colleagues also reported that infection control deficiencies may lead to poor outbreak control, despite the implementation of antibiotic prophylaxis.[11]

To ensure judicious antibiotic use, facility and outbreak characteristics should be considered before recommending targeted or mass prophylaxis. In this outbreak, iGAS cases were confined to one wing and all residents and staff received antibiotic prophylaxis. Facility staff were also advised about the importance of infection control. Although additional prophylaxis was not recommended following the third iGAS case, the importance of infection control was highlighted. Further iGAS cases were not detected.

Controlling iGAS outbreaks in RACFs requires a multi-faceted approach involving staff aware-

ness, early identification of cases, scrupulous infection control practices and situation-specific consideration of antibiotic prophylaxis.

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