Spectrum of Group A streptococcus soft tissue infection in a community hospital

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Abstract:
Introduction: The most common form of group A streptococcal (GAS) infection is soft tissue infection. We reviewed our experience in a community hospital in the Bronx, NY to determine the spectrum and frequency of GAS infection
Method: Soft tissue infections with GAS were retrospectively identified by reviewing cultures results from the microbiology laboratory. Patients' charts were reviewed to ensure that the cultures were taken from purulent material and to obtain information on the patient's diagnosis and risk factors.
Results: During the 14 month period, 8 children and 13 adults had GAS isolated from exudate or blood cultures. Initiating event was trauma to the skin. Seventy-nine percent of the soft tissue cultures were polymicrobial of which 68% were co-infected with Staphylococcus aureus (SA).

Conclusion: GAS soft tissue infection was not a frequent occurrence in this study. Surprisingly 68% of the soft tissue cultures were co-infected with SA. It remains unclear if there is a synergistic interaction between these two pathogens. Further studies are needed to determine if the presence of GAS with SA represents co-infection or a co-incidence.

Introduction:

The most common form of group A streptococcal (GAS) infection is soft tissue infection. Infections can involve deeper structures causing myonecrosis, or elaborate toxins causing systemic manifestations like toxic shock syndrome. Mortality in these entities are high. In a 1996 Canadian study, soft tissue infection accounted for 48% of GAS infections, followed by bacteremia without a source 14%, pneumonia 11%, toxic shock 13% and necrotizing fasciitis 6%. Overall mortality was 15%, but increased to 67% in patients with toxic shock.[1] The Center for Disease Control estimates that in the United States, there are 9,000-11,500 cases of invasive GAS disease per year and over 10 million non-invasive GAS infections (throat and skin infections) occur annually.[2]

GAS is a gram positive cocci that lives in the respiratory tract and the skin. GAS strains can undergo serologic typing of the M protein that is present on the bacterial cell surface, or by nucleotide sequence analysis of the M protein gene.[3] Certain M strains have been implicated in GAS bacteremia (increase prevalence of M-1 strain in patients with GAS bacteremia in Ireland in 2012-13[4]). In the United States, the increase in invasive GAS infections in the 1980's and 1990's was due to the M1-3 strains.[2] However these observations cannot fully explain the range of pathology exhibited by GAS.

Method:

Retrospective chart review of all abscess cultures and blood cultures for GAS from January 2015 to February 2016. Cultures were sent from our outpatient clinics, emergency room or from admitted patients. Charts were reviewed to ensure that the cultures were taken from purulent material and to obtain information on patient's diagnosis and risk factors. The study was IRB approved.

Results:

During the 14 month period, 8 children from 1 month to 11 years (average age 8 years) and 13 adults aged 18 to 57 years (average age 36 years) had GAS isolated from exudate or from their blood. These cases are summarized in tables 1 and 2. All cases had trauma to the skin: rash, burn, foreign object, piercing, blunt trauma, and ulcers. Two patients, who did not have wound cultures (cellulitis and infected burn site) had positive blood cultures.

Blood cultures were not drawn in any of the pediatric cases. In adults 11/13 patients had blood cultures, one had a contaminant (Corynebacterium) and three were positive for GAS.

In the 19 patients who had wound cultures, 15 cultures were polymicrobial (79%). Staphylococcus aureus (SA) was present in 13 of 19 wound cultures (68%).

Many of the infections were not accompanied by systemic symptoms (fever, hypotension, organ damage). Only two children were hospitalized with a hospital stay of two days or less. The two most severe cases were in a patient with necrotizing fasciitis and in a patient with fascial trauma complicated by an abscess (case described below).

Below are examples of three cases:

Case #1:

An 11-year-old female with no past medical history presented to the emergency room with swelling of the 3rd digit of the right hand after the door slammed on her hand. The swelling and pain increased over the course of two days. The patient did not have any fever. The lesion was drained and cultures were positive for MSSA and GAS

Case #2:

A 29-year-old Ethiopian male with history of latent tuberculosis, paraplegia s/p GSW and skin graft for sacral osteomyelitis secondary to decubiti who was admitted to the for sepsis secondary to sacral decubiti abscess. Patient had an incision and drainage procedure performed. Cultures were positive for MRSA and GAS.

Case #3:

A 51-year-old female with medical history significant for alcohol use presented to the emergency room with altered mental status and tactile fever. She was found to have a left eye periorbital lesion resulting from hitting her head on a train door. The lesion was erythematous with warmth, swelling with purulent secretions. The patient had no history of alcohol or drug use. The patient was started on antibiotics, intubated and transferred to the intensive care unit with the impression of sepsis. Wound culture from secretions of the eye lesion was positive for methicillin sensitive SA, staphylococcus epidermidis and GAS. Blood cultures were positive for GAS. On day 7 she was found to have severe erythema in the left face, neck, scalp and peri-auricular area, with an indurated lesion in

the submandibular area. Neck, orbit and CT brain showed abscess formation in the left orbit and formation in the left submandibular area with extension to the zone I-II of the neck and all the way up to the scalp. The patient was transferred to a tertiary referral hospital for extensive oral maxillofacial surgery and lost to follow up.

Discussion:

This study was initiated to determine the frequency of GAS infection in a community hospital in the Bronx, New York. Internal medicine and pediatric account for approximately 30,000 outpatient visits per year, and 8,300 yearly inpatient admissions. Only 21 soft tissue infections were identified, three of which were complicated by sepsis. Not surprisingly, many of the infections had trauma as the initiating event.

The cultures from soft tissue exudate were all positive for GAS, however only four cultures grew GAS alone. SA was present in 68% of the GAS positive cultures. Although GAS and SA are known skin colonizers, in this study they were both isolated from purulent material suggesting that they are both pathogens. This co-existence could be a chance occurrence as our sample size is small.

Review of the literature revealed an article published in 1955 by Parker[5] where he discusses the organisms involved in "impetigo contagiosa." Of the 298 patients, 45% were co-infected with SA and an alpha streptococcus (of which 86% was believed to be due to GAS). He goes on to discuss that the majority of SA were of phage type 71, and three quarters of GAS belonged to two closely related serologic types. The study was done in England. A more recent study of impetigo in children from northern Australia found that GAS and SA co-existed in 58% of sores[6]. The presence of scabies was associated with GAS, whereas the SA nasal carriage did not predict recovery of SA from the lesions. The severity of the impetigo was not associated with either pathogen. As noted in the article[6], the organism isolated seem to change with the region and time. This could be due to environmental factors or to the presence of specific clones of SA or GAS. In our study we were unable to type or to further categories either the SA or GAS.

The presence of both GAS and SA could be the end results of factors that promote bacterial presence on skin. For example Radek et al[7] describe activation of cholinergic stimulation via nicotinic receptors (which can be triggered by trauma) by applying a topical agonist. This caused reduction of an antimicrobial peptide activity found in skin and increased adherence of both SA and GAS. It is also possible that the presence of either bacteria can protect or promote the pathogenicity of either organism.

Our study found 21 cases of GAS soft tissue infection over a 14 month period. Sixty-eight percent of cultures grew both GAS and SA. Although the presence of both pathogens could be an artifact of the small sample size, previous studies in patients with impetigo confirm the co-existence of these pathogens and suggest that specific clones of SA or GAS may be involved. Further studies are needed to confirm these observations.

Table 1: Pediatric patients with GAS soft tissue infection

Age (years)	Gender	Site	Wound culture
1	M	Infected "diaper rash" - Perianal culture	GAS + MSSA + E. COLI
10	F	Infected vesicular rash	GAS + MSSA
6	F	Hand: 2nd digit; bites fingers, developed redness and pus around nail	GAS + MSSA
7	F	Hand: 1st digit pustule drained with a pencil	GAS
10	M	Hand: 2nd digit nail bed infection	GAS + MSSA
10	F	Hand: tip of pencil found in palm, removed, developed pustule and drainage	GAS + MSSA
11	F	Infected nodule on ear lobe at a piercing site, patient also with pharyngitis and a positive strep throat culture	GAS
11	F	Hand: 3rd digit abscess after door slammed on finger	GAS + MSSA

MSSA: methicillin sensitive SA

Table 2 Adult patients with GAS soft tissue infection:

Age (years)	Gender	Site	Wound culture	Blood Culture
51	F	Trauma to eye and facial skin	GAS + MSSA + S. Epiderminitis + Corynebacterium	GAS
51	M	Left forearm infected burn site	ND	GAS
57	F	B/L LE cellulitis in a non-diabetic patient with neuropathy	ND	GAS
18	F	Superinfected hand blister	GAS + MSSA	No growth
36	M	Hand: septic thrombophlebitis in an intravenous drug user	GAS + MSSA	Corynebacterium
20	M	Hand : infected burn site	GAS + MSSA	No growth
19	F	Breast abscess following nipple piercing one year prior	GAS	Not done
23	M	Foot: 5th digit cellulitis around nail bed	GAS + MSSA	Not done
29	M	Gluteal abscess in a paraplegic	GAS + MRSA	No growth
31	M	Infected leg stasis ulcer	GAS + Proteus mirabilus + Corynebacterium	No growth
38	M	Below the knee amputation stump infection in a diabetic patient	GAS + MSSA	No growth
43	M	Infected Hallux ulcer in a diabetic patient	GAS + Provotella + Klebsiella + Enterococcus	No growth
50	M	Fasciitis of the hand after blunt trauma	GAS	No growth

MSSA: methicillin sensitive SA; MRSA: methicillin resistant SA

References:

1. Davies DH, McGeer A, Schwartz B, Green K, Cann D, Simor AE, et al. Invasive group A streptococcal infections in Ontario, Canada. Ontario Group A Streptococcal Study Group. N Engl J Med 1996;335:547-54
2. Group A Streptococcal (GAS) Disease. http://www.cdc.gov/groupastrep/clinicians.html
3. Johansson L, Thulin P, Low DE, Norrby-Teglund A. Getting under the Skin: The Immunopathogenesis of Streptococcus pyogenes Deep Tissue Infections. Clin Inf Dis. 2010:51:58-65
4. Meehan M, Murchan S. Bergin S, O'Flanagan D, Cunney R. Increased incidence of invasive group A streptococcal disease in Ireland, 2012 to 2013. Euro Surveill 2013:18:20556.
5. Parker MT, Tomlinson AJ, Williams RE. Impetigo contagiosa; the association of certain types of Staphylococcus aureus and of Streptococcus pyogenes with superficial skin infections. J Hyg (Lond) 1955;53:458-73.
6. Bowen AC, Tong SY, Chatfield MD, and Carapetis JR. The microbiology of impetigo in Indigenous children: associations between Streptococcus pyogenes, Staphylococcus aureus, scabies, and nasal carriage. BMC Infect Dis. 2014;14:727. Published online 2014 Dec 31.
7. Radek KA, Elias PM, Taupenot L, Mahata SK, O'Connor DT, Gallo RL. Neuroendocrine nicotinic receptor activation increases susceptibility to bacterial infections by suppressing antimicrobial peptide production. Cell Host and Microbe 2010;22:7:277-89.