Vascular complications among children and adolescents with acute complicated sinusitis

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BACKGROUND/OBJECTIVES

The burden of vascular complications in children with acute complicated sinusitis is not well defined.

Study objectives:
- Describe the vascular complications in children with acute bacterial sinusitis, as well as associated pathogens
- Identify the differences in complications due to *S. anginosus* versus other pathogens

METHODS

- Study design: Retrospective chart review
- Population setting: Academic quaternary care center, serving Colorado and surrounding states
- Inclusion criteria: Children aged 6 months to 25 years admitted from 2010-2016 for acute complicated sinusitis, defined using ICD9/10 codes for acute sinusitis (461 or J01) and concomitant diagnosis of bacterial meningitis, intracranial abscess or empyema, encephalitis, vascular abnormality, orbital cellulitis or abscess, periosteal abscess, or pre-septal cellulitis based on clinical or imaging findings
- Exclusion criteria: immunodeficiency, cystic fibrosis, craniofacial abnormality, or culture positive fungal disease
- Primary outcome: Presence of an intracranial vascular abnormality
- Secondary outcomes: Type of vascular abnormality and proportion of patients with *S. anginosus* infections, as well as various covariates as shown in Table 2
- Analyses: Descriptive statistics (Chi square/Fisher's exact tests, Wilcoxon rank sum tests), quantile and logistic regression using SAS v 9.4

RESULTS

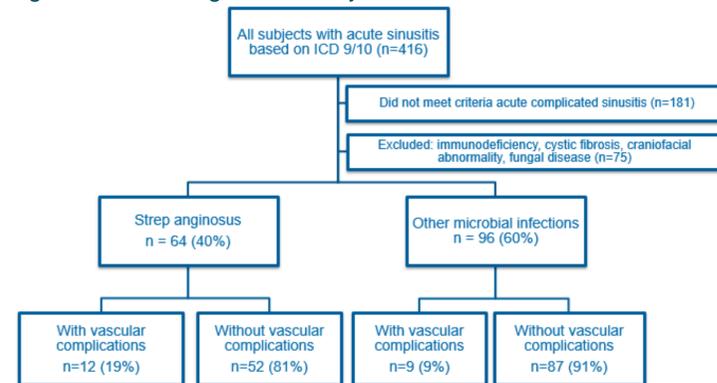Figure 1: Flow diagram of study cohort selection

Table 1: Socio-demographic and clinical characteristics and outcomes of children with acute complicated sinusitis

Variable	160 Total	S. anginosus 64 (40%)	Other microbial infections 96 (60%)	P value
SOCIODEMOGRAPHIC AND CLINICAL CHARACTERISTICS				
Male Sex (n%)	111 (69.4%)	42 (65.6%)	69 (71.9%)	0.4
Age in years, median (IQR)	9.3 (5.1, 12.8)	11.8 (9.3, 13.6)	7.2 (3.8, 10.9)	<0.0001
Race (White)	116 (72.5%)	46 (71.9%)	70 (72.9%)	0.89
Ethnicity (Hispanic)	27 (16.9%)	5 (7.8%)	22 (22.9%)	0.01
Insurance (Medicaid)	45 (28.1%)	18 (28.1%)	27 (28.1%)	1
Year of Diagnosis (2015-2016)	56 (35.0%)	27 (42.2%)	29 (30.2%)	0.12
Underlying medical condition	63 (39.38%)	24 (37.50%)	39 (40.63%)	0.69
Duration of illness prior to admission, days (IQR)	6.0 (3.0, 10.0)	6.0 (3.0, 12.5)	6.0 (3.0, 10.0)	0.56
CSF white cell count, n = 24	67.5 (13.0, 517.0)	84.00 (16.0, 504.5)	32.50 (7.5, 686.0)	0.73
Abnormal MRI, n = 58	51 (87.93%)	38 (97.44%)	13 (68.42%)	0.0037

Variable	Total 160	S. anginosus 64 (40%)	Other microbial infections 96 (60%)	P value
CLINICAL OUTCOMES				
Neurological deficits	70 (43.8%)	36 (56.3%)	34 (35.4%)	0.01
Surgery	97 (60.6%)	63 (98.4%)	34 (35.4%)	<0.0001
Sinus/ENT	94 (58.8%)	61 (95.3%)	33 (34.4%)	<0.0001
Neurosurgical	21 (13.1%)	18 (28.1%)	3 (3.1%)	<0.0001
Eye	39 (24.4%)	24 (37.5%)	15 (15.6%)	0.002
Complications				
Vascular	21 (13.1%)	12 (18.8%)	9 (9.4%)	0.09
Orbital	87 (54.4%)	32 (50%)	55 (57.3%)	0.36
CNS	56 (35%)	39 (60.9%)	17 (17.7%)	<0.0001
Duration of IV antibiotics in days, median, (IQR)	5 (3, 27)	23 (6, 46)	4 (2, 5.5)	<0.0001
Planned duration of antibiotics in days, median (IQR)	24 (14, 42)	42 (28, 42)	16 (14, 28)	<0.0001
Length of stay in days, median (IQR)	4 (3, 7)	7 (5, 10)	3 (2, 5)	<0.0001
ICU admission	33 (20.6%)	22 (34.4%)	11 (11.45%)	0.0004

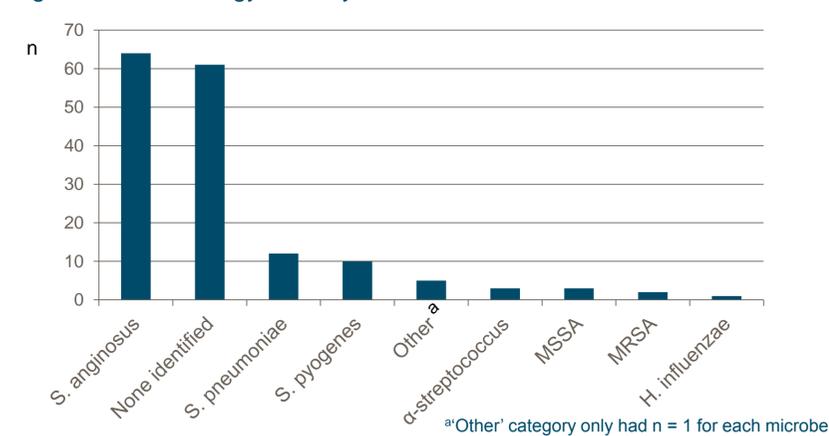Figure 2: Microbiology of study cohort

[a]'Other' category only had n = 1 for each microbe

Figure 3: Types of vascular complications with associated microbiology

DVST: dural venous sinus thrombosis; ICA: internal carotid artery; CST: cavernous sinus thrombosis; SOV: superior ophthalmic vein; A1: anterior cerebral artery, division 1; M1: middle cerebral artery, division 1
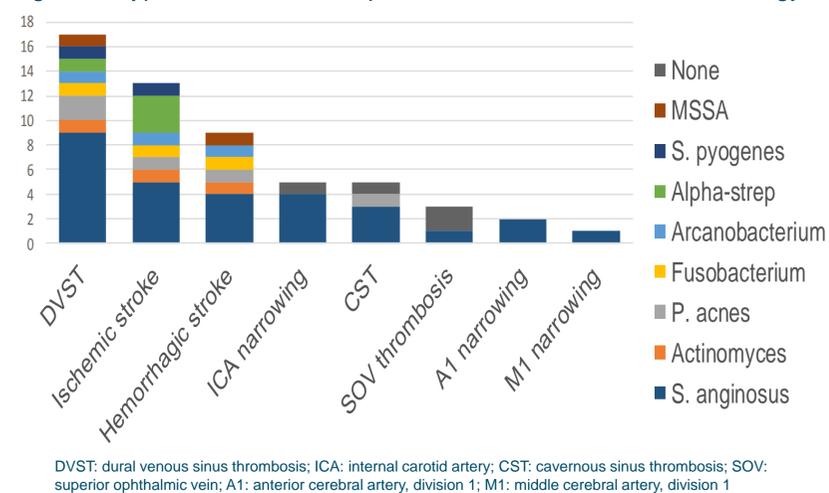
Table 2: Adjusted[a] analyses showing A) Difference in median days and B) Odds ratios for clinical outcomes of interest between children with S. anginosus infection compared with those without S. anginosus infection

| Outcome	Estimated Difference in Median	95% Confidence Interval	P value
Duration of IV Antibiotics (days)	15.4	8.77, 22.03	<0.0001
Planned Duration of IV Antibiotics (days)	21	16.03, 25.97	<0.0001
Length of Stay (days)	3	1.76, 4.24	<0.0001

Outcome	Estimated Odds Ratio	95% Confidence Interval	P value
Vascular complication	1.15	0.41, 3.27	0.790
ICU admission	2.75	1.10, 6.83	0.027

[a]Adjusted for age, race, ethnicity, admission year and presence of neurological deficits on admission

Figure 4: Proportion of acute complicated sinusitis infections associated with S. *anginosus* per year

Estimated ratio increase per year= 1.1193, 95% CI: (1.0220, 1.2300), p value = 0.0147
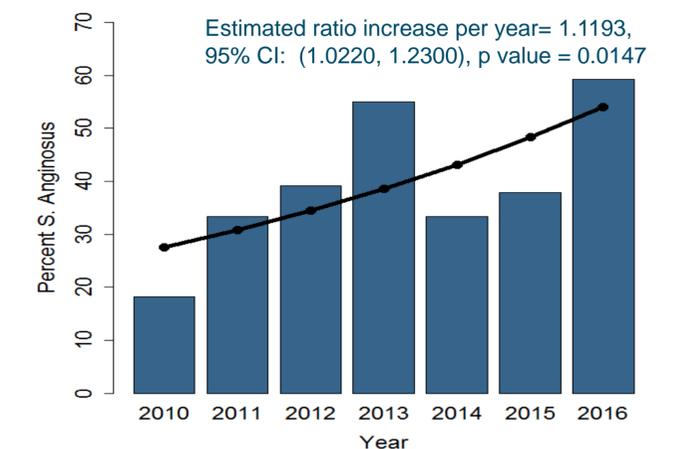
CONCLUSIONS

- 21/160 (13%) children had a vascular complication.
- Dural venous sinus thrombosis was the most common vascular abnormality (14/46; 30.4%).
- *S. anginosus* was the most common microbe seen in children with vascular disease (57%).
- Increased morbidity was seen with *S. anginosus* disease.
- When controlling for age, race, ethnicity, admission year, and neurological deficits, children with *S. anginosus* had longer duration of antibiotics, length of stay, and need for ICU admission.
- Proportion of all complicated sinusitis infections associated with *S. anginosus* is increasing by an estimated 12% per year.

IMPLICATIONS

- Consider vascular imaging early in the disease course of complicated sinusitis.
- Recognize the increased morbidity between *S. anginosus* and other pathogens.
- Be cognizant of rise in prevalence of *S. anginosus* complicated sinusitis and its associated increased morbidity.