neurosurgical conditions. We assessed bias using published tools specific to study type. A meta-analysis was not conducted due to insufficient data on outcomes by duration of therapy. PROSPERO registration: CRD42020201667.

Results. A total of 2195 studies were identified; 280 were selected for full text review and 32 were included for narrative synthesis. There was 1 randomized-controlled trial (RCT), 25 cohort studies, and 6 case series. The RCT found no difference in treatment failure rates between 10 and 14 days of therapy, but only included 2 cerebrospinal fluid (CSF) culture-positive cases. A single cohort study including only CSF culture-negative cases presented outcomes by duration of therapy and concluded that courses >21 days had no impact on prognosis. Twenty-one studies had data on duration of therapy and outcomes by patient, most with small samples (median 4 patients). No conclusions on efficacy of shortened antibiotic courses could be drawn due to small sample sizes and lack of stratification of outcomes by short versus long courses.

Conclusion. Data on parenteral treatment duration in bacterial meningitis in infants < 3 months are primarily observational, and larger studies rarely report outcomes by duration of therapy. Given the associated risks and costs of prolonged parenteral therapy, there is a pressing need for comparative effectiveness research to determine the optimal parenteral treatment duration.

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1149. Application of a Multiplex Polymerase Chain Reaction Test for Diagnosing Bacterial Enteritis in Children in a Real-Life Clinical Setting

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Session: P-64. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Although a bacterial multiplex polymerase chain reaction (mPCR) test should be performed selectively in patients with gastrointestinal symptoms consistent with bacterial enteritis, its usefulness has been evaluated upon stool samples as requested by clinicians, without considering the patients' gastrointestinal symptoms or clinical diagnoses. This study aimed to determine the subjects to bacterial mPCR testing and to interpret the mPCR test results with considering patients' clinical symptoms and diagnoses.

Methods. Medical records of 710 pediatric patients for whom a bacterial mPCR test was performed were retrospectively reviewed. Clinical characteristics and mPCR test results were compared between patients with positive mPCR test results (n = 199) and those with negative mPCR test results (n = 511) and between patients in whom inflammatory pathogens (*Campylobacter* spp. and *Salmonella* spp.) were identified (n = 95) and those in whom toxigenic pathogens (*Clostridium* spp.) were identified (n = 70).

Results. A positive mPCR test result was significantly associated with an older age (p < 0.001), diagnosis of acute gastroenteritis (p = 0.021), presence of hematochezia (p < 0.001), and absence of cough (p = 0.004). The diagnosis of acute gastroenteritis (p = 0.003), presence of fever (p = 0.027) and diarrhea (p = 0.043), and a higher C-reactive protein level (p = 0.025) were significantly associated with the identification of inflammatory pathogens rather than toxigenic pathogens in patients with positive mPCR test results.

Conclusion. Bacterial mPCR testing should be performed selectively based on patients' clinical symptoms and diagnoses, and its results should be interpreted with considering identified pathogens.

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1150. Pediatric Osteoarticular Infections Caused by Mycobacteria Tuberculosis Complex: A Twenty-Six Year Review of Cases in San Diego, California

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Session: P-64. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Osteoarticular infections (OAI) account for 10-20% of extrapulmonary *Mycobacteria tuberculosis* (MTB) complex infections in children. Given the rarity of MTB OAI, the epidemiology, disease manifestations, and treatment are poorly characterized. We describe 21 children treated for MTB complex OAI over a 26-year period at a tertiary pediatric center in southern California.

Methods. We conducted a retrospective review of children diagnosed with MTB complex OAI and cared for between 31 Dec 1992 to 31 Dec 2018 at a single tertiary care pediatric hospital with close proximity to the United States-Mexico border.

Results. We identified 21 children with MTB complex OAI during the study period (Table 1). Concurrent pulmonary disease (4.8%), meningitis (9.5%), and intra-abdominal involvement (14.3%) were all observed. MTB complex was identified by culture from operative samples in 15/21 children (71.4%); 8/15 (51.3%) cultures were positive for *Mycobacterium bovis.* Of the eight cases of vertebral OAI (the most common site), one was culture-positive for *M. bovis.* Open bone biopsy was the most common procedure for procurement of a tissue sample and had the highest culture yield (Table 2). The median duration of antimicrobial therapy was 52 weeks (IQR 52-58). Successful completion of therapy was documented in 15 children (71.4%). Seven children (33.3%) experienced long term sequelae related to their infection.

Table 1. Twenty-one children with Mycobacteria tuberculosis complex osteoarticular infections.

Subject*	Age (years)	Sex	Presenting symptom (Duration)	CRP (mg/dL)	ESR (mm/hr)	OAI sites	Sites other than OAI	PPD, IGRA	**Pathology	**Culture data, Source of culture	†Resistance	‡Discharge regimen	Duration of therapy (weeks)	Complication
1	3.8	F	Elbow swelling, decreased ROM, pain (2 days)	3.7	50	Elbow	N/A	Positive, N/A	OBB, AFB+	*M. tuberculosis*/OBB, JA & OBB	None	Unknown	Unknown	Unknown
2	2.8	F	Limp, decreased ROM, pain (5 days)	2.7	54	Pelvis	N/A	Positive, N/A	None	*M. bovis*/JA	P	RIF	Unknown	Unknown
3	2.3	M	Knee swelling, limp, decreased ROM, fever (3 months)	1	39	Femur	N/A	N/A, N/A	OBB, AFB+	*M. bovis*/OBB	P	RIF	52	None
4	7.4	F	Limp (4 weeks)	<0.4	19	Pelvis	N/A	Positive, N/A	OBB, AFB+	*M. bovis*/JA & OBB	P	RIF	68	None
5	2.9	M	Limp, erythema (4 months)	1.5	42	Femur	N/A	Positive, N/A	OBB, AFB+	*M. bovis*/OBB	P	RIF	60	None
6	1.9	M	Pain, limp (2 weeks)	0.75	60	Vertebra	N/A	Anergic, N/A	CT BB, reactive changes	No organism isolated	N/A	RIF	36	None
7	18.7	F	Pain, fatigue (unknown)	0.5	76	Vertebra	N/A	Negative, N/A	OBB, pus	*M. tuberculosis*/OBB	S	RIF	52	None
8	9.8	M	Scoliosis (unknown)	1.1	42	Vertebra	N/A	Positive, N/A	I&D, lymphocytic and neutrophilic infiltration	No organism isolated	N/A	RIE	60	None
9	14.5	F	Pain, weakness, paraplegia, weight loss, malaise (4 months)	Not available	Not available	Vertebra	N/A	Positive, N/A	OBB, AFB+	*M. tuberculosis*/OBB	None	RIPS	52	None
10	18.5	M	Abdominal pain, chest pain, weight loss, fatigue (1 month)	Not available	42	Vertebra	Liver, spleen, left lobun	Positive, N/A	CT BB, AFB+	No organism isolated	N/A	RIPE	Unknown	Unknown
11	12.2	M	Fever, cough, anorexia (3 weeks)	4.4	Not available	Vertebra	N/A	Negative, Negative	CT BB, granulomas	*M. bovis*/CTBB	P	RIPS	52	Scoliosis
12	1.0	F	Somnolence, emesis (5 weeks)	4	Not available	Sacrum, osseys	Meningitis	Negative, N/A	OBB, AFB+	*M. tuberculosis*/OBB	None	RIPE	Unknown	Seizures
13	3.4	M	Abdominal mass, anorexia (5 days)	Not available	59	Vertebra	Intestine	N/A, N/A	I&D, AFB+	*M. tuberculosis*/epidural abscess	I	RIPE	60	††See below
14	3.7	F	Limp, fever (2 weeks)	Not available	44	Hip, femur	N/A	Positive, N/A	OBB, AFB+	*M. bovis*/OBB	None	RIF	44	None
15	1.6	F	Knee swelling, limp (4 weeks)	Not available	53	Knee	N/A	Positive, N/A	BA, AFB+ SB, AFB+	No organism isolated	N/A	RIF	30	None
16	6.3	M	Limp, back swelling and pain (4 months)	Not available	96	Vertebra	N/A	Positive, N/A	I&D, AFB+	*M. tuberculosis*/epidural abscess	None	RIPS	52	Scoliosis
17	13.6	M	Pain, limp (6 months)	Not available	Not available	Hip	N/A	Positive, N/A	SB, AFB+	No organism isolated	N/A	RIF	52	Decreased ROM
18	10.6	F	Elbow swelling, pain, erythema (3 months)	Not available	35	Elbow	N/A	Positive, N/A	OBB, sustaining necrosis SB, AFB+	*M. bovis*/OBB	I	RI	Unknown	Decreased ROM
19	4.2	F	Pain, limp (6 months)	Not available	18	Hip	N/A	Positive, N/A	SB, granulomas	No organism isolated	N/A	RIF	Unknown	Decreased ROM
20	7.1	M	Cervical neck pain, fever, weight loss (unknown duration)	5.03	112	Pelvis, skull base	Spleen, lymph nodes	N/A, N/A	Lymph node, biopsy, AFB+	*M. bovis*/lymph node	P	RIPE	52	None
21	5.4	F	Pain, decreased ROM (12 months)	7.3	67	Hip, femur	Meningitis	Negative, Positive	BA AFB+ SB, AFB+	MTB complex/SB & BA	None	RIPS	Unknown	Limb length discrepancy
Summary	median 5.4 (IQR 2.8, 10.6)	48% male		median 2.1 (IQR 0.9-3.8)	median 50.0 (IQR 42-60)								median 52 (IQR 52-58)	

*Subjects are listed in random order.
** For Pathology and Culture data:
I&D= incision and drainage, JA= joint aspirate, SB= synovial biopsy, BA= bone aspirate, CT BB= CT guided bone biopsy, OBB= open bone biopsy
†R= For R and Discharge Treatment:
R= Rifampin, I= Isoniazid, P= Pyrazinamide, E= Ethambutol, S= Streptomycin
††Repeat admission one month after initial admission for CT guided abscess drainage

Table 2. Surgical sample type and percent positivity.

Sample Type	Culture positive (%)
Incision and drainage of abscess	4/6 (66.7)
Pelvis	1/1 (100)
Retroauricular	0/1(0)
Sacrum	1/1 (100)
Psoas	2/2 (100)
Forearm	0/1 (0)
Joint aspirate	3/5 (60)
Elbow	1/1 (100)
Hip	2/3 (66.7)
Knee	0/1 (0)
Synovial Biopsy	2/6 (33.3)
Knee	0/1 (0)
Hip	2/4 (50)
Elbow	0/1 (0)
Bone aspirate	1/2 (50)
Femur	1/2 (50)
Bone biopsy (CT-guided)	1/3 (33.3)
Vertebra	1/3 (33.3)
Bone biopsy (open)	8/8 (100)
Olecranon	2/2 (100)
Femur	1/1 (100)
Hip	2/2 (100)
Vertebra	2/2 (100)
Sacrum	1/1 (100)
Total	19/30 (63.3)

Conclusion. Among the 21 children with MTB complex OAI assessed, 8 of 15 (53.3%) children with a positive tissue culture had *M. bovis* (intrinsically resistant to

pyrazinamide), representing a higher percentage than in previous reports and potentially reflecting its presence in unpasteurized dairy products in the California-Baja region. Local epidemiological trends in endemic MTB complex species should be considered when evaluating and managing MTB complex OAI. Bone biopsy produced the highest culture yield in this study. Given the rarity of this disease, multicenter collaborative studies are needed to improve our understanding of the presentation and management of pediatric MTB complex OAI.

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1151. Clinical Characteristics of Persistent Staph Aureus Bacteremia in Children

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Session: P-64. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Persistent *Staphylococcus aureus* bacteremia (pSAB) is a poorly defined entity, but associated with significant morbidity and mortality in children. We aim to better describe the epidemiological features of this clinical entity.

Methods. We performed a retrospective case series analysis of pediatric patients with pSAB at a single center children's hospital using electronic medical data from 2016 – 2020. Bacterial persistence was defined as culture growth > 72 hours after first blood culture.

Results. Twenty-two patients with pSAB were included in the analysis. Sources of persistent infection were endovascular infection (n=11, 50%), osteoarticular infection (n=6, 27%,), isolated central line associated blood stream (n=4, 18%), isolated skin and soft tissue infection (n=2, 9%), and no known primary infectious site (n=1). Methicillin resistance occurred in 41% (n=9) of cases of pSAB. Total duration of therapy varied, with a median of 4 weeks from negative cultures (range of 2 – 8 weeks). Total days of positive cultures in pSAB were not significantly associated with methicillin susceptibility of the bacterial isolate, use of double gram-positive coverage, nor presence of a central venous catheter. Use of double gram-positive coverage occurred in 50% of cases with a mean duration of therapy of 11 days, most frequently in cases of septic thrombophlebitis (Table 1). Rifampin and gentamicin were the most commonly used agents.

Table 1. Clinical Characteristics of Children Treated with Double Gram-Positive Coverage

Age	Primary Agent	Secondary Agent	Source of Infection	MSSA/MRSA	Days of Positive Cultures	Duration of Double Coverage (days)	Central Venous Access Present	Hospital Unit
6 weeks	Oxacillin	Vancomycin, Rifampin, Gentamicin,	Septic Thrombophlebitis	MSSA	9	13	Yes	NICU
7 weeks	Vancomycin	Gentamicin	Septic Thrombophlebitis	MRSA	5	4	Yes	PICU
2 years	Vancomycin	Ceftaroline, Gentamicin	Septic Thrombophlebitis, Anterior mediastinal infection	MRSA	6	12	No	PICU
9 years	Oxacillin, Cefazolin	Gentamicin, Rifampin	Osteomyelitis (presumed endovascular infection)	MSSA	7	16	No	General Pediatrics
5 months	Vancomycin	Rifampin	Septic thrombophlebitis	MRSA	7	16	No	PICU
3 years	Oxacillin	Rifampin	Osteomyelitis, septic thrombophlebitis	MSSA	7	14	No	PICU
11 months	Vancomycin	Rifampin	Septic arthritis	MRSA	5	3	Yes	General Pediatrics
8 months	Vancomycin	Clindamycin, Rifampin	Septic Thrombophlebitis	MRSA	5	18	No	PICU
10 years	Oxacillin	Gentamicin	Endocarditis	MSSA	7	7	No	General Pediatrics
2 weeks	Oxacillin	Rifampin	Endocarditis	MSSA	4	19	No	NICU
2 years	Vancomycin	Rifampin	CLABSI	MRSA	5	7	Yes	General Pediatrics

Conclusion. Children presenting with persistent S. aureus bacteremia present with a heterogenous group of underlying conditions and epidemiological features. While pediatric recommendations for double gram-positive coverage for synergy have not been established, their use for pSAB is common, especially in endovascular infections where culture persistence is often an expected outcome. Further research should examine risk factors for pSAB and define optimal treatment modalities and duration.

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1152. Microbiology of Pediatric Neck Infections Based on Age and Anatomic Location

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Session: P-64. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Studies of pediatric neck infections demonstrate an increase in methicillin resistant *Staphylococcus aureus* (MRSA), and predominance of *Staphylococcus aureus* (S. aureus) in infants, and commonly polymicrobial infections. Thus, some providers treat acute neck infections with empiric broad spectrum antibiotics, often with two drugs. Our institution often uses clindamycin plus ampicillin-sulbactam as empiric therapy for hospitalized children with acute neck infection. We aimed to identify the microbiology of acute neck abscesses at our institution to determine if stratifying by age and abscess location would allow for single agent therapy.

Table 1. Causative organism based on anatomic location of neck infection.

ORGANISM	MEDIAL	LATERAL	BOTH	TOTAL
Staphylococcus aureus	11	31	2	44
Group A Streptococcus	16	6	0	22
Streptococcus anginosus	16	2	1	19
Fusobacterium	6	1	0	7
Prevotella	7	0	0	7
Haemophilus influenzae	4	1	0	5
Streptococcus viridans	4	0	0	4
Peptostreptococcus	3	0	0	3
Eikenella	3	0	0	3
Group C Streptococcus	1	0	0	1
Other β-hemolytic Streptococcus	0	1	0	1
Streptococcus pneumoniae	1	0	0	1
Gemella	1	0	0	1
Escherichia Coli	1	0	0	1

Methods. Diagnosis codes identified patients hospitalized with acute neck infections. Cases with underlying malignancy, cervicofacial malformations, or lymphatic malformations were excluded. Patients with surgical cultures were categorized into two groups based on anatomic location of infection: medial (retropharyngeal, parapharyngeal, and peritonsillar), lateral (other locations), or both. Within each group, causative pathogen(s) were explored and further categorized by age (infants: < 1 year old; non-infants: ≥1 year old).

Results. 412 patients were hospitalized for acute neck infection of which 132 had surgical cultures. 110 had growth of one or more pathogens (20 infants, 90 non-infants). 53 infections were located medially, 54 laterally, and 3 had both locations involved. S. aureus was most commonly identified, with lateral infections accounting for the majority (Table 1). 40/44 S. aureus isolates were susceptible to clindamycin. Among medial infections, *Streptococcus Anginosus* and Group A Streptococcus were most common followed by S. aureus (Table 1). 17/20 (85%) positive cultures in infants grew S. aureus with 8/17 (47%) MRSA. No polymicrobial infections were identified in infants. Among non-infants, 0/39 lateral infections had polymicrobial growth but 23/50 (46%) of medial infections did.

Conclusion. Local epidemiology based on anatomic location and patient age suggests a single agent (clindamycin for lateral and penicillin with beta-lactamase inhibitor for medial) may be reasonable for non-infants with uncomplicated neck infections. For infants, coverage of MRSA, regardless of anatomic location, is advisable.

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1153. ESBL Producing *E. coli* Urinary Tract Infections in Children: Is Carbapenem Always Necessary?

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Session: P-64. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Urinary tract infections (UTI) are common in children with a prevalence of 5% in infants. UTI are the main reason for beginning antibiotics in children's hospitals and *E. coli* is approximate 80% of urinary pathogens.