low oxygen saturation noted in our analysis may be related to this being an initial sign of convalescence. However, the absence of a longer follow-up period for this measurement (48 hours versus 14 days for respiratory rate and temperature) precludes our ability to demonstrate a true plateau, indicating a return to baseline values.

Despite its relatively low prevalence among subjects, the persistence of low oxygen saturations at 48 hours underscores the importance of supplemental oxygen in the treatment of patients with pneumonia. This is consistent with recently published guidelines for management of Community Acquired Pneumonia by the Infectious Diseases Society of America and The British Thoracic Society, which integrate oxygen saturation measurement and supplemental oxygen treatment into decisions regarding patient care and disposition.\textsuperscript{9,20}

Our study demonstrated similar trajectories in resolution of tachypnea regardless of age. The specific timing for correction from an abnormal range however was different between the 2 age groups. This finding may be due to the crude nature of identifying a single cutoff for an age range over which there is significant difference in baseline respiratory rate. A systematic review of observational studies measuring normal respiratory rate proposed rates as high as 64 and as low as 29 serving as the 99th percentile for ages 2 and 59 months, respectively.\textsuperscript{1} In general, however, the subjects aged >12 months took longer to return to reported norms as their degree of tachypnea was relatively higher than age-adjusted norms on enrollment.

Among the vital signs studied, temperature had the most reliable stabilization and plateau at 36.7°C. The relatively rapid decline of temperature in response to antibiotic treatment among febrile subjects supports the use of persistent fever as a sign of treatment failure among similar patients.

Overall, our analysis demonstrated low rates of vital sign abnormalities. Even among children with vital signs defined as abnormal, there was a relatively rapid return to normal ranges with the initiation of hospitalization and treatment. Furthermore, the rate of return to normal values was found to be relatively parallel within a narrow time frame. This is not surprising as it is well-known that vital signs are closely interrelated and often have similar trajectories in convalescence.\textsuperscript{5,6} Specifically, fever and hypoxia in response to pneumonia can both increase the respiratory drive and lead to tachypnea. Conversely, resolution of tachypnea may require the initial resolution of hypoxia and fever as demonstrated in the attached figure.

The relatively low baseline prevalence of vital sign abnormalities in our study likely reflects the poor specificity of WHO-defined severe pneumonia and may have been improved if children with WHO-defined very severe pneumonia were also included.\textsuperscript{3} In addition, the relatively rapid return to normal values within our study may reflect the high efficacy of beta-lactam antibiotics in the treatment of acute lower respiratory tract infection, assuming that subjects with fever, hypoxia and tachypnea were more likely to be true cases of bacterial pneumonia. Unfortunately, our study did not investigate the etiology of pneumonia in each patient, and we are thus unable to comment on vital sign trajectories in patients with bacterial causes when compared with those with viral or mixed causes of pneumonia. Further studies of vital sign abnormalities particularly among children with a more specific and microbiological diagnosis of pneumonia are needed to understand the true trajectory of disease and convalescence.

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PEDIATRIC SUPPURATIVE PAROTITIS IN CAMBODIA BETWEEN 2007 AND 2011

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Abstract: The causes of suppurative parotitis in Cambodian children are not known. We describe 39 cases at the Angkor Hospital for Children, Siem Reap, between January 2007 and July 2011 (0.07/1000 hospital
Pediatric suppurative parotitis (PSP) is uncommon, and details relating to presentation, etiology and management are reported to a few case series and multiple case reports.\(^1\)\(^2\) Mortality was once substantial but has greatly improved as a result of antimicrobial treatment. Fever, facial swelling, erythema, pain, lymphadenopathy, trismus, purulent aural discharge and facial palsy are all described with PSP, and the presence of pus at the opening of the parotid (Stensen’s) duct is considered pathognomonic. Common microbiological pathogens identified include *Staphylococcus aureus*, viridans streptococci and anaerobes in acute cases; *Streptococcus pneumoniae* and *Haemophilus influenzae* in recurrent parotitis;\(^3\) and *Burkholderia pseudomallei* where melioidosis is endemic, such as South-East Asia,\(^4\) although cases of *B. pseudomallei* parotitis occur rarely in endemic areas of Australia.\(^5\)

Treatment typically involves antimicrobials, with surgical management indicated for abscesses or if there is a poor response to medical therapy. Optimum duration and regimen of antimicrobial treatment is unclear and is likely to vary depending on causative pathogen, particularly with respect to *B. pseudomallei*. Complications include systemic dissemination and septicaemia, extension of infection to involve the adjacent bones or parapharyngeal space and facial nerve palsy or fistula formation.

Descriptions of PSP in Asia are limited to studies investigating melioidosis.\(^4\)\(^5\) Melioidosis has been described as a clinical entity in Cambodia in several studies,\(^5\)\(^9\) but there is no study to date investigating PSP in Cambodian children. This study aimed to characterize the clinical presentation, microbiology, management and outcome of cases of PSP at a pediatric hospital in north-western Cambodia between 2007 and 2011.

**METHODS**

All potential cases of PSP presenting to the Angkor Hospital for Children in Siem Reap, Cambodia, from January 1, 2007 to July 31, 2011, inclusive were identified retrospectively by 1 of the 2 methods: (1) from the hospital electronic database through the relevant International Classification of Diseases, 10th revision code used by the hospital for encoding parotitis (K11.3) and/or (2) by reviewing laboratory records for microbiological specimens submitted. Hospital notes for patients with relevant pus specimens were reviewed; if these were consistent with a clinical diagnosis of parotitis, then the case was included.

Details relating to each case were collected on a standardized case report form and included the following: demographic features, clinical presentation, blood test and microbiology results, radiological investigations, medical and surgical management and clinical outcomes.

Standard operating procedures for laboratory investigations were in place. For microbiology, sample processing, identification and antimicrobial susceptibility testing were undertaken in accordance with Clinical and Laboratory Standards Institute guidelines with some local adaptations as previously described.\(^6\) *B. pseudomallei* was identified on the basis of typical colonial morphology on Ashdown’s agar, resistance to gentamicin and colistin, and latex-based antigen detection. Disk diffusion–based susceptibility testing for *B. pseudomallei* was carried out for co-amoxiclav, cefazidime, imipenem, doxycycline and co-trimoxazole; for co-trimoxazole, isolates that were nonsusceptible by disk diffusion (zone diameter ≤10 mm) had confirmatory minimal inhibitory concentration–based testing using an Etest (bioMérieux, Marcy-l’Etoile, France). Isolates with a co-trimoxazole minimal inhibitory concentration of ≤2 mg/L by Etest were deemed susceptible.

Data were analyzed using Stata 11.1 (StataCorp, College Station, Texas). Ethical approval for the study was obtained from the Angkor Hospital for Children Institutional Review Board and the Oxford Tropical Research Ethics Committee (UK).

**RESULTS**

Thirty-nine cases were identified, equating to a crude incidence of 0.07 cases/1000 hospital attendances or 9.9/1000 surgical ward admissions. Twenty-two (56%) patients were male. The median age of children with parotitis was 5.7 years (interquartile range 3.7–9.6 years; range 0.7–14.6 years), and no neonatal cases were observed. The median duration of symptoms before admission was 7 days (interquartile range 3–10 days; range 4–30 days), and most (n = 38; 97%) patients presented with fever, facial swelling and localized pain/tenderness of the parotid region. Presenting symptoms occurring in >5% of cases are listed in Table 1; other symptoms included aural pain/discharge, cough/coryza, seizures, gastrointestinal symptoms, rigors and 1 case presented with widespread erythema (later confirmed as a disseminated staphylococcal infection).

Prehospital treatment was common. At least 6 cases had taken antimicrobials (1 or more of amoxicillin, ceftriaxone, gentamicin, amoxicillin-clavulanate, erythromycin and cephalixin), 5 had visited a “Krou Khmer” (traditional healer) and 14 had been given an unknown medication, typically from the market, pharmacy or a private practitioner. Nineteen percent of children had been seen in a private healthcare clinic and 2 had prior incision and drainage procedures.

Mean admission temperature was 38.1°C; there was a significant difference in mean admission temperature for *B. pseudomallei* culture-positive cases and non-*B. pseudomallei* cases (38.5 versus 37.1; t test; \(P = 0.006\)). Of 24 patients who had blood tests taken, all but 2 had a leukocytosis (91%); all of these cases presented with a neutrophilia (mean % neutrophils 76%; range 37%–92%) except the child with the disseminated staphylococcal infection, who had lymphocytosis. Twenty-five (64%) children had an ultrasound scan at presentation; of the 24 who had results reported, all had parotid enlargement and 13 (54%) had a visible collection of fluid.

Culture from parotid specimens was positive in 34 (87%) cases: 29 (85%) of culture-positive cases; 74% of all cases) with *B. pseudomallei*, 4 (12% of culture-positives; 10% of all cases) with...
TABLE 1. Prevalence of Symptoms in Cases of PSP Presenting to the Angkor Hospital for Children, Siem Reap, Cambodia, Between 2007 and 2011

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Number of Cases Presenting With Symptom (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>39 (100)</td>
</tr>
<tr>
<td>Facial swelling</td>
<td>39 (100)</td>
</tr>
<tr>
<td>Left</td>
<td>22 (56)</td>
</tr>
<tr>
<td>Right</td>
<td>15 (39)</td>
</tr>
<tr>
<td>Bilateral</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Pain</td>
<td>38 (97)</td>
</tr>
<tr>
<td>Erythema</td>
<td>31 (79)</td>
</tr>
<tr>
<td>Decreased appetite</td>
<td>12 (31)</td>
</tr>
<tr>
<td>Warmth over gland</td>
<td>5 (13)</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>4 (10)</td>
</tr>
<tr>
<td>Purulent discharge from the parotid duct</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Trismus</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Dental problems</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Palpable fluctuate over parotid gland</td>
<td>3 (8)</td>
</tr>
</tbody>
</table>

S. aureus and 1 with coagulase-negative Staphylococci, which may have been a contaminant. No methicillin-resistant Staphylococcus aureus infections were detected. Susceptibility testing was variably recorded on B. pseudomallei isolates, but 5 of 28 (18%) were resistant to co-trimoxazole, 1 of 23 (4%) to cefazidime and 0 of 21 to doxycycline; 1 of 29 (3%) isolates showed intermediate susceptibility to amoxicillin-clavulanate. Six patients had a blood culture taken; all were negative.

All patients were treated with antimicrobials, but for cases where clear pathogens were cultured (S. aureus or B. pseudomallei), only 16 of 33 (48%) were initially treated with antimicrobials that provided appropriate activity for the subsequently isolated organism (all B. pseudomallei cases). All patients received at least 1 surgical incision and drainage procedure; requirement for >1 surgical intervention was significantly associated with a culture positive for B. pseudomallei (Fisher exact test, \( P < 0.001 \)).

No deaths were observed in any of the PSP cases in this series. A lower motor neuron facial palsy was observed in 1 child, and weight loss at follow-up in another. Median duration of follow-up postdischarge was 33 days (interquartile range 1–81 days; range 0–1577 days).

DISCUSSION

Localized melioidosis was by far the commonest cause of PSP at our institution, followed by S. aureus. We may have missed cases of anaerobic/mixed-anaerobic parotitis, given the lack of anaerobic culture. No deaths and a low rate of complications were observed, which concurs with other published cases of nonsepticemic PSP caused by B. pseudomallei.\(^4\) This was despite initial inappropriate antimicrobial cover in 52% of cases, a phenomenon also described in Thailand.\(^4\)

The optimum antimicrobial regimen and duration for localized pediatric melioidosis has not been defined, although recommendations support the use of either cefazidime or amoxicillin-clavulanate as acute parenteral therapy, and co-trimoxazole or amoxicillin-clavulanate as consolidation/eradication therapy in children.\(^4\) In our setting, 18% of B. pseudomallei isolates were resistant to co-trimoxazole (compared with 13%–16% in Thailand and 2.5% in Australia) and so this should not be used without confirmation of susceptibilities. Coamoxiclav was used for consolidation/eradication therapy in children who require admission be treated empirically with cefazidime and cloxacillin (intravenous preparations of amoxicillin-clavulanate are very expensive locally) pending culture results, as this would treat both B. pseudomallei and S. aureus. For confirmed parotid melioidosis, amoxicillin-clavulanate 500/125 mg 3 times/day for those >12 kg and 20/5 mg/kg for those <12 kg could be used as consolidation/eradication therapy for 12 weeks when clinical improvement is observed and no further surgical intervention is anticipated. Children managed as outpatients could be treated with oral amoxicillin-clavulanate dosed as above from the outset.\(^4\)

The difficulties of undertaking a trial to characterize the optimum dose and duration of therapy relate to the limited numbers of cases reviewed at any one institution, especially those with the capacity to undertake diagnostic microbiology. High rates of surgical intervention were seen in our series and just over a quarter of patients required multiple surgical procedures—all of these cases had culture-confirmed parotid melioidosis.

Suppurative parotitis is typically thought to be attributable to the ascending colonization of the parotid duct with oral bacteria. The ingestion of B. pseudomallei in water is therefore the most likely explanation for the parotid form of melioidosis, given that for the rural Cambodian population the drinking water supply is often taken from boresholes, surface water, rainwater and other unprotected water sources. The observation that parotid melioidosis appears to be mostly a disease of childhood may relate either to types of exposure or perhaps to the impact of changing oral microbiota and mucosal immunity with increasing age.

No neonatal cases of suppurative parotitis were seen, although this may be due to ascertainment bias. Siem Reap has a second pediatric hospital that also provides maternity services, and more neonates are seen there. In a recent survey of febrile illness requiring admission at Angkor Hospital for Children, only 2.6% of admissions were <28 days old (Emary K, unpublished data).

PSP in Cambodia (excluding neonates) is predominantly caused by B. pseudomallei, and generally has a favorable prognosis, although it requires high rates of surgical intervention. A pragmatic antimicrobial treatment strategy has been proposed for our setting, given local antimicrobial availability and difficulty of ensuring adequate follow-up.

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Ear discharge, or otorrhea, is a common problem during childhood. It is usually a symptom of otitis media (OM), when middle ear secretions drain through a perforation in the tympanic membrane or through a tympanostomy tube into the ear canal.\(^1\)

Treatment of otorrhea includes local and systemic antibiotics. In day-to-day practice, follow-up after treatment is often done over the phone. Ear, nose and throat physicians or family physicians then rely on parental observation of resolution or persistence of ear discharge. It is not known however, how well this parental assessment agrees with an actual clinical examination by a physician. Parents base their judgment merely on symptoms and signs, while physicians have an otoscope or otomicroscope at their disposal.

The objective of this study was to determine the interobserver agreement between parents and physicians regarding the presence of otorrhea in children, during follow-up after an initial diagnosis of acute or chronic otorrhea.

**MATERIALS AND METHODS**

**Study Population**

For this study, datasets of 2 randomized trials were used. The first is based on an ongoing trial of treatment of acute tympanostomy tube otorrhea (ATTO). Children aged 1–9 years with tympanostomy tube otorrhea present for no more than 7 days, and symptoms having started at least 2 weeks after placement of the tube are included. They are randomized into treatment by oral antibiotics (amoxicillin/clavulanate), ototopical antibiotic-steroid drops (bacitracin/colistin/hydrocortisone) or watchful waiting strategy. The second dataset is based on a completed trial on the treatment of active chronic mucosal otitis media (COM).\(^2\) Children aged 1–12 years with a documented history of >12 weeks of continuous otorrhea through either a tympanic membrane perforation or a tympanostomy tube were included. They were randomized into treatment by either oral antibiotics (trimethoprim/sulfamethoxazole) or placebo.

**Data Sources**

Ears of children with unilateral or bilateral ATTO or COM with oto(micro)scopic signs of otorrhea at baseline were included. For the ATTO study, otoscopic observation of otorrhea by the study physician at 2 weeks and 6 months follow-up was compared with parental report of ear discharge as documented in a daily diary. Using otomicroscopy rather than otoscopy, the same comparisons were made for the COM study at 6 and 12 weeks follow-up. For both studies, we included assessments by parents and physicians performed on the same day or with a 1-day difference (parents’ assessments always preceded the physician’s).

**Statistical Analysis**

We determined the “chance-corrected agreement” between physicians and parents for otorrhea versus no otorrhea. The \(K\) coefficient expresses the degree of agreement exceeding chance.\(^1\) A \(K\) value of 1 indicates full agreement, whereas a value of 0 indicates merely chance. We used the ranges for agreement as suggested by Landis and Koch,\(^3\) with values between 0.41 and 0.60 indicating moderate agreement, 0.61 and 0.80 indicating substantial agreement and 0.81 and 1.00 indicating almost perfect agreement. \(K\) coefficients were calculated for each follow-up visit for the ATTO and COM trials. Using the physician’s observation of otorrhea as the reference standard, we also calculated the positive predictive value and negative predictive value of the parents’ assessments. All statistical analyses were performed with SPSS 17 (SPSS Inc., Chicago, IL).