Tuboovarian Abscess and Peritonitis Caused by *Streptococcus pneumoniae* Serotype 1 in Young Girls

Andrew P. Sirotnak, Stephen C. Eppes, and Joel D. Klein

*S. pneumoniae* is a frequent bacterial cause of pneumonia, bacteremia, meningitis, and otitis media in infants and children. Primary pneumococcal peritonitis, however, is rare in children and is usually associated with an underlying medical condition (such as nephrotic syndrome) or with upper genital tract disease in females. Pneumococcal upper genital tract infections in the premenarchal child are extremely unusual. Epidemiologic reviews of pneumococcal serotypes causing infection in children have indicated that serotype 1 is an uncommon pathogen of pelvic disease in children. We describe three children who presented with abdominal pain and a toxic appearance; appendicitis was initially suspected in all three children, but peritonitis due to *S. pneumoniae* serotype 1 was subsequently diagnosed in all three. Each child had a tuboovarian abscess that was demonstrated radiographically. Two children had complicated courses, but all ultimately recovered. The epidemiology and possible tropism of serotype 1 isolates for the female upper genital tract are discussed.

*Streptococcus pneumoniae* causes bacterial pneumonia and is also the most common cause of bacteremia, otitis media, and meningitis in infants and children. It can also cause primary peritonitis in children and adults; this infection is usually associated with underlying medical conditions such as sickle-cell disease, nephrotic syndrome, cirrhosis, and immunocompromised states [1].

The prevalence of pneumococcal serotypes that are associated with a given infection varies over time with the age of the patient and with geographic location; however, certain serotypes have been more consistently associated with bacteremia and meningitis in children. This association has been noted in recent reviews of the epidemiology of clinically significant pneumococcal serotypes in several locations during different periods in the United States [2–8] (table 1). A review of published data on the epidemiology of *S. pneumoniae* revealed that no cases of peritonitis caused by *S. pneumoniae* serotype 1 in prepubertal children have been previously reported. We describe three cases of peritonitis associated with salpingitis caused by *S. pneumoniae* serotype 1 in three young girls who presented to our institution within a 13-month period.

Case Reports

**Case 1.** A previously healthy premenarchal 8-year-old girl presented to the emergency department with a 3-day history of abdominal pain, nausea, emesis, and fever. She had a toxic appearance and was febrile, tachycardic, and hypotensive. She had a diffusely tender abdomen with guarding, rebound, and rectal tenderness. Vaginal examination was not performed. After rehydration, blood specimens for cultures were obtained, and standard antibiotic therapy for peritonitis was administered. Laboratory evaluation revealed a WBC count of 21,100/mm$^3$, with 88% neutrophils, 9% band forms, and 3% lymphocytes. The child was admitted to the hospital with the diagnosis of probable appendicitis. Laparotomy revealed an inflamed but intact appendix, purulent fluid in the right adnexa uteri, and a grossly inflamed right fallopian tube and ovary. Blood and peritoneal fluid specimens were taken, and aerobic and anaerobic cultures yielded *S. pneumoniae* serotype 1 that was susceptible to penicillin. Microscopic examination of the appendix revealed only serosal inflammation.

Her fever and abdominal pain abated following administration of 250,000 U of penicillin G/(kg·d) for 8 days. On the sixth postoperative day, an abdominal ultrasonogram showed a right ovarian mass measuring 3.4 × 2.5 cm. Her medications at the time of discharge were oral penicillin VK and probenecid. Findings on a physical examination 3 weeks after the initial presentation were unremarkable, and an ultrasonogram obtained at that time revealed complete resolution of the adnexal fluid collection.

**Case 2.** A previously healthy premenarchal 12-year-old girl presented to an emergency department with a 2-day history of abdominal pain that had progressed to severe right lower quadrant pain associated with emesis. She denied sexual activity. She appeared pale and was in moderate distress. Obstruction studies showed multiple loops of distended bowel.

Laboratory evaluation revealed a WBC count of 23,000/mm$^3$, with 60% neutrophils, 29% band forms, 6% lymphocytes,
and 5% metamyelocytes. Laparotomy for treatment of a presumed ruptured appendix revealed an intact appendix and purulent fluid in the peritoneal cavity with a thick cecal exudate adherent to the abdominal wall. She was initially treated with cefotaxime, gentamicin, and metronidazole. Aerobic and anaerobic cultures of blood and peritoneal fluid yielded *S. pneumoniae* serotype 1 that was susceptible to penicillin.

On the second postoperative day, auscultation was performed, and marked cracks were heard bilaterally. CT of the chest revealed a loculated right pleural effusion, which subsequently required drainage of purulent fluid via a chest tube for 1 week. An abdominal ultrasonogram obtained at the same time showed a right-sided tuboovarian abscess measuring 6.3 × 3.8 cm. The patient was treated with 250,000 U of penicillin G/(kg·d) for 14 days. The pleural effusion and adnexal disease completely resolved. Pathological examination of the appendix demonstrated acute serositis with normal mucosal and muscular layers. Physical examination and chest radiographs were unremarkable 1 week after discharge. Results of abdominal ultrasound examinations were normal 2 and 3 months after her initial presentation.

**Case 3.** A previously healthy 12-year-old girl presented to the emergency department with a chief complaint of crampy abdominal pain for 2 days and acutely difficult breathing. Her second menstrual period had started 3 days prior to this episode. She denied sexual activity and use of tampons. Physical examination revealed a toxic-appearing girl who had a markedly tender abdomen with bilateral lower quadrant rebound and guarding. Pelvic examination demonstrated blood in the vaginal os. Obstruction studies showed only air-fluid levels. Chest radiographs revealed indistinct costovertebral angles.

Initial laboratory evaluation disclosed a WBC count of 26,700/mm³, with 81% neutrophils, 11% band forms, 5% lymphocytes, and 3% monocytes, and a serum pregnancy test was negative. She underwent emergent laparotomy that demonstrated 200 mL of free pus in the pelvis, inflammation of both fallopian tubes without abscesses, an enlarged left ovary, a thick fibrinous exudate coating the small bowel, and a normal-appearing appendix. Cytological examination of peritoneal fluid did not show any malignant cells. Cultures of peritoneal fluid were negative for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* but were positive for *S. pneumoniae* serotype 1 that was susceptible to penicillin.

Her postoperative course was complicated by spiking temperatures and persistent abdominal pain. An ultrasonogram demonstrated a 4-cm left-sided adnexal fluid collection with a tuboovarian abscess. Bilateral pleural effusions developed; thoracentesis was performed, and eventually, a purulent exudate was drained via a chest tube during the third postoperative week. Cultures of pleural fluid did not yield any aerobic or anaerobic organisms. She was treated initially with ampicillin/sulbactam, gentamicin, and metronidazole, and her temperature gradually abated; she was subsequently discharged 32 days after her initial presentation.

**Discussion**

Previously healthy children who present with peritonitis, a toxic appearance, diffuse abdominal pain, fever, and leukocytosis often are initially considered to have appendicitis. Such was the case with our three patients. Laparotomy of all three patients revealed an intact appendix with evidence of only serosal inflammation and an exudate. Furthermore, pathological examination of the appendiceal specimens showed serosal inflammation without the characteristic inflammatory changes of acute appendicitis.

In other reviews of cases of primary peritonitis in children and adults who were initially believed to have appendicitis, similarly histologically normal appendixes have been reported [9]. It seems unlikely, therefore, that our patients had peritonitis secondary to primary pneumococcal appendicitis. However, the latter entity has been described in both healthy [10] and immunocompromised [11] hosts.

Primary peritonitis accounts for <2% of all acute abdomens in children [1], although in the preantibiotic era primary peritonitis accounted for 10% of all abdominal emergencies in children. The decrease in this incidence has been attributed to the use of antibiotic therapy for respiratory tract infections [1]. A

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**Table 1.** Summary of data from studies reviewing *Streptococcus pneumoniae* serotypes causing disease in children during selected periods (1957-1984).

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study period, location</th>
<th>Source of isolate</th>
<th>No. of isolates</th>
<th>No. (%) of <em>S. pneumoniae</em> serotype 1 isolates</th>
<th>Overall rank of serotype 1 isolates among all serotypes recovered in study</th>
</tr>
</thead>
<tbody>
<tr>
<td>[8]</td>
<td>1967-1976, Chicago</td>
<td>Blood</td>
<td>293</td>
<td>13 (4.4)</td>
<td>8</td>
</tr>
</tbody>
</table>

* Data are for 271 combined isolates from adults and children.
review of a 22-year period of clinical experience [12] revealed that five of seven cases of primary peritonitis in previously healthy children occurred in girls 3–10 years of age. In this review, *S. pneumoniae* was isolated from three of these female patients, but the specimens were not serotyped. This finding is consistent with those of other series, thus indicating that nearly all reported cases occur in girls [13].

The route of infection in pneumococcal peritonitis may be hematogenous, may involve lymphatic spread, may result from transmural migration through an intact intestinal wall from the gut lumen, or may ascend from the vagina via the fallopian tubes [13]. This latter source of infection has been recently described in a previously healthy 31-year-old woman [14] and would seem to apply in our cases, since each patient had salpingitis. Because *S. pneumoniae* does not normally reside in the vagina, ascending infection may result when the organism becomes part of the transient vaginal flora [15]. This colonization can occur postpartum, following an abortion, or after gynecologic procedures.

In children, colonization of the vagina with *S. pneumoniae* may occur when organisms are transferred from the upper respiratory tract through inadequate hygiene. Orogenital sexual contact, which has been suggested as a cause of vaginal colonization in women [15], can occur in children as a result of sexual abuse. It is important to note that in the present report, the initial medical history did not fully address the possibility of abuse, and only the two older girls were asked about sexual activity. Furthermore, only the postmenarchal patient underwent a comprehensive examination of the vagina and hymen. In the absence of a careful evaluation, sexual abuse, as well as the possibilities of poor hygiene or vaginal colonization secondary to masturbation, must remain a potential source of infection in our patients.

Lower genital tract colonization may allow organisms to ascend the endometrium, giving rise to endometritis, salpingitis, and peritonitis. In the otherwise healthy premenarchal child, pelvic inflammatory disease due to any etiology is rare. Gonococcal salpingitis has been described in an 8-year-old premenarchal child who was sexually assaulted [16]. Salpingitis and perappendicitis due to *N. gonorrhoeae* have also occurred in a prepubertal child with no history of sexual abuse [17]. Acute salpingitis caused by *Escherichia coli* in a 6-year-old girl with severe vulvovaginitis has been described [18].

The first reported case of pneumococcal salpingitis or pyosalpinx in a young child involved a 4-year-old girl who presented with a presumed clinical picture of appendicitis and who had previously been evaluated for a vaginal discharge [19]. In this case, in which there was no history of sexual abuse, pneumococcus was not recovered from the vagina, and the peritoneal isolate was not serotyped. A more recent case report [20] described a 4-year-old Dutch girl with pyosalpinx caused by *S. pneumoniae* serotype 11, which was also isolated from the vagina, following abdominal trauma and a retroperitoneal hematoma. Tuboovarian abscesses caused by *S. pneumoniae* are reported to be exceedingly rare [21], although these abscesses occurred in each of our young patients.

Westh et al. [15] reviewed 36 cases of pneumococcal genital tract infections in postpubertal females in Denmark; they found that 11 of 18 pneumococci that were serotyped were serotype 1 or 3. The median age of their patients was 35 years (range, 14–77 years). Two cases of pneumococcal peritonitis in adolescent girls from Australia that were reported in 1979 were caused by *S. pneumoniae* serotype 1 [22].

The prevalence of pneumococcal serotypes associated with various infections depends on the patient's age, time surveyed, and geographic area (table 1). In Boston between 1935 and 1955, serotype 1 was the most common pneumococcus causing disease in patients of all ages, but between 1979 and 1982, it had fallen to 14 in the rank of serotypes causing all disease [2]. Serotype 1 also caused a large percentage of bacterial pneumonia in Boston between 1929 and 1936, but none of the genital tract and peritoneal isolates from females of all ages between 1935 and 1974 were this serotype [23].

In the United States, surveillance of the distribution of pneumococcal serotypes by the Boston City Hospital and the Centers for Disease Control and Prevention has shown that serotype 1 is not among the higher ranked serotypes causing disease [3, 7, 24]. The most recent data show that for all ages and sites of isolation, serotype 1 was cultured from only 151 (2.8%) of 5,469 total isolates [25].

The occurrence of three cases of primary peritonitis secondary to infection with *S. pneumoniae* serotype 1 in young children may simply reflect the prevalence of this serotype in our catchment area during that period. However, our case series and other reports in the literature suggest that, under certain conditions, serotype 1 may have a unique predilection for the female genital tract and/or may have the ability to infect the female genital tract and produce tuboovarian abscesses. Future serotyping of these isolates may indicate whether serotype 1 is indeed overrepresented as a cause of this infection. Although the pathogenesis of infection in our patients was not conclusively determined, this report should reinforce the need for a careful, thorough evaluation to rule out the possibility of sexual abuse. An appropriate pelvic examination and cultures for pathogens of sexually transmitted diseases as well as other potential pathogens should be performed when the diagnosis of a tuboovarian abscess is made.

References


