Clinical Infections and Nonsurgical Treatment of Parapharyngeal Space Infections Complicating Throat Infection

Simon de Marie,* Richenel T. O. Tjon A Tham,
Andel G. L. van der Mey, Geert Meerdink,
Ralph van Furth, and Jos W. M. van der Meer

The clinical features and management of eight patients with parapharyngeal space infection who presented with swelling of the neck subsequent to sore throat are described. In four patients the interval between the initial throat symptoms and swelling was 2 days or less, and the disease was rapidly progressive with stridor or a descending mediastinitis. In the other four cases, this interval was longer (4 to 14 days) and the infection was fairly localized. Computed tomography was useful for making the diagnosis, establishing that the infection had spread into other deep neck spaces and the mediastinum, distinguishing abscesses from diffuse cellulitis, guiding drainage aspiration, and assessing the response to therapy. None of the patients underwent extensive surgical drainage of the deep neck spaces. A nonsurgical approach with antibiotics, including high doses of benzylpenicillin, and computed tomography-guided selective needle aspirations proved successful. Even patients with distinct abscesses were completely cured.

An infection in the parapharyngeal space is a rare complication of a throat infection [1]. Life-threatening consequences of a parapharyngeal space infection include acute upper airway obstruction, aspiration pneumonia, descending suppurative mediastinitis, jugular thrombophlebitis with septic pulmonary foci, and hemorrhage from the carotid artery [2-5].

Although the frequency of parapharyngeal space infections has decreased since the introduction of antibiotics, mortality is still high, partly because the diagnosis is often not established until late in the course of disease. Early recognition is sometimes hampered by the mild nature of the preceding throat infection or the length of time between occurrence of the initial throat symptoms and development of the complications.

In this article, we describe the clinical features of eight cases of parapharyngeal space infection that were treated nonsurgically. We will focus on the importance of computed tomography (CT) for the establishment of an early diagnosis and as a guide for treatment.

Case Histories

Between 1980 and 1987 eight patients with a parapharyngeal space infection were admitted to our hospital. The clinical and laboratory data are summarized in tables 1 and 2.

Symptoms. All eight patients recently had had a sore throat, and all presented with a swelling in the neck. All patients had pain on swallowing. Two patients (patient 6 and patient 8) exhibited torticollis (table 1). No foreign bodies or lesions were found in the oropharynx. Odontogenic infectious foci were not detected, although patient 3 had moderate periodontitis. Except for a radical mastoidectomy after repeated otitis in patient 7, there were no preexisting abnormalities in the head and neck areas.

The infections of patients 1, 3, 4, and 7 were rapidly progressive, the interval between the initial throat symptoms and the subsequent deep neck infection being 2 days or less (table 1). These patients were seriously ill, presenting with severe dyspnea and high fever. The association with the sore throat was clear. In two cases (patients 3 and 4), endotracheal intubation was necessary. For patients 2, 5, 6, and 8, the interval between the mild sore throat and the subsequent swelling was longer (range, 4-14 days). In three
Table 1. Clinical features and CT findings of eight patients with parapharyngeal space infection.

<table>
<thead>
<tr>
<th>Feature or CT finding</th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex/age</td>
<td>M/49 y</td>
<td>F/17 y</td>
<td>M/63 y</td>
</tr>
<tr>
<td>Year of admission</td>
<td>1980</td>
<td>1985</td>
<td>1986</td>
</tr>
<tr>
<td>Time (sore throat to swelling in neck)</td>
<td>1 d</td>
<td>4 d</td>
<td>&lt;1 d</td>
</tr>
<tr>
<td>Symptoms at admission:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>40.0°C</td>
<td>38.6°C</td>
<td>39.0°C</td>
</tr>
<tr>
<td>Stridor</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Trismus</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Torticollis</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pharyngeal abnormality</td>
<td>Peritonsillar abscess</td>
<td>Absent</td>
<td>Swelling</td>
</tr>
<tr>
<td>Swelling in the neck</td>
<td>Right</td>
<td>Right &gt; left</td>
<td>Right</td>
</tr>
<tr>
<td>Initial diagnosis</td>
<td>Retropharyngeal abscess</td>
<td>Subacute thyroiditis</td>
<td>Parapharyngeal abscess</td>
</tr>
<tr>
<td>Time (swelling to correct diagnosis)</td>
<td>3 d</td>
<td>9 d</td>
<td>1 d</td>
</tr>
<tr>
<td>Localization at admission (CT)</td>
<td>Not done</td>
<td>Not done</td>
<td>+</td>
</tr>
<tr>
<td>Parapharyngeal</td>
<td>Not done</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Submandibular</td>
<td>Not done</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Retropharyngeal</td>
<td>Not done</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Pretracheal</td>
<td>Not done</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Mediastinal</td>
<td>Not done</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Complications (hospital day)</td>
<td>+ (d 2)</td>
<td>+ (d 1)</td>
<td>+ (d 3)</td>
</tr>
<tr>
<td>Mediastinitis</td>
<td>+ (d 2)</td>
<td>-</td>
<td>+ (d 3)</td>
</tr>
<tr>
<td>Pleuritis</td>
<td>+ (d 23)</td>
<td>-</td>
<td>+ (d 13)</td>
</tr>
</tbody>
</table>

NOTE. + = present; - = absent.

cases (patients 2, 5, and 6), incorrect diagnoses of subacute thyroiditis, otitis after radical mastoidectomy, and cervical lymphadenitis, respectively, were made initially and led to delays in the institution of adequate therapy to 9, 5, and 14 days, respectively, after swelling occurred. The course of the disease in patients 5–8 was milder than in patients 1–4.

CT findings. CT of the neck was combined with CT of the upper mediastinum in seven of the eight cases. Whenever signs of mediastinitis were found, the whole thorax was scanned. In six patients CT examination disclosed parapharyngeal space infection (both anterior and posterior compartments) on the first or second day of hospitalization (table 1). CT scans of patient 3 revealed involvement of the pretracheal space; the parapharyngeal space was not scanned despite clinical suspicion of its involvement. In patient 1, who was not seen until the later phase of a descending mediastinitis, scanning was confined to the thorax. CT disclosed an infectious process in the retropharyngeal space in five patients, the pretracheal space in four, and the submandibular space in two patients. In patients 1 and 3, a descending upper and lower mediastinitis developed in the course of the disease, associated with pleuritis (patients 1 and 3) and pericarditis (patient 1). The transient upper mediastinitis in patients 2 and 4 was only revealed by CT (table 1).

Bacteriologic examinations. Blood cultures were performed for each patient. Patients 1 and 5 had been transferred from other hospitals, where blood cultures were found to be negative. At admission to our hospital, cultures were repeated. Patients 5, 6, and 7 had received prior antibiotic therapy (doxycycline). At least two blood samples 30 minutes apart were taken at admission and were incubated in bottles containing standard media for aerobic and anaerobic cultures for 7 days at 37°C. The bottle for anaerobic culture contained tryptone soya broth (Oxoid, Haarlem, The Netherlands) 30 g/L, agar (1 g/L), Liquoid (Roche, Mydrecht, The Netherlands) 0.5 g/L, and cysteine 0.5 g/L at pH 7.3. The medium for aerobic culture included brain-heart infusion (Oxoid) 37 g/L, proteose peptone (Oxoid) 5 g/L, Liquoid (Roche) 0.5 g/L, gelatin 12 g/L, hemin 8 mg/L, and nicotinamide-adenine dinucleotide 5 mg/L at pH 7.4. The bottles were subcultured blindly after 2 and 7 days. All blood cultures remained negative.

Pus or exudate obtained by needle aspiration was collected in sterile syringes closed with a plastic cap, avoiding the addition of air. These materials were plated within 2 hours after collection on sheep blood
Table 1. (continued)

<table>
<thead>
<tr>
<th>Patient 4</th>
<th>Patient 5</th>
<th>Patient 6</th>
<th>Patient 7</th>
<th>Patient 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/65 y</td>
<td>F/30 y</td>
<td>F/31 y</td>
<td>M/70 y</td>
<td>F/10 y</td>
</tr>
<tr>
<td>1 d</td>
<td>8 d</td>
<td>14 d</td>
<td>2 d</td>
<td>5 d</td>
</tr>
<tr>
<td>39.9°C</td>
<td>38.2°C</td>
<td>38.8°C</td>
<td>38.7°C</td>
<td>38.7°C-40.0°C</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Swelling right</td>
<td>Swollen right tonsil</td>
<td>Absent</td>
<td>Swelling</td>
<td>Swelling</td>
</tr>
<tr>
<td>Parapharyngeal abscess</td>
<td>Otitis after radical mastoidectomy</td>
<td>Cervical lymphadenitis</td>
<td>Parapharyngeal infection</td>
<td>Parapharyngeal abscess</td>
</tr>
<tr>
<td>Right &gt; left</td>
<td>Right</td>
<td>1 d</td>
<td>Right &gt; right</td>
<td>1 d</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
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<td>+</td>
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<tr>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>+ (d 1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

agar base no. 2 (Oxoid), and chocolate agar (sheep blood agar incubated at 80°C for 20 minutes) plates were aerobically incubated for 5 days at 37°C (chocolate agar in 6% CO₂) and observed daily for growth. Anaerobic cultures were performed using sheep blood agar plates incubated at 37°C in an anaerobic jar containing 80% N₂, 10% CO₂, and 10% H₂ and checked for growth after 2 and 5 days. For the detection of Actinomyces species, a separate blood agar plate was incubated at 37°C in an anaerobic jar and not inspected until after 5 days of incubation.

The results of the bacteriologic examinations were as follows.

Patient 1: pleural fluid aspiration during stay in another hospital; gram stain, not available; culture, β-hemolytic Streptococcus group G (Lancefield) and three different anaerobic bacilli (not specified).

Patient 2: pus obtained by needle aspiration from neck abscess; gram stain, 20–50 polymorphonuclear leukocytes (PMNs) and 20–50 gram-positive cocci in chains; culture, nonhemolytic Streptococcus pyogenes group A (Lancefield), no anaerobic bacteria.

Patient 3: foul, odorous pus aspirated via nasotracheal tube (spontaneous drainage of neck abscess); gram stain, 5–10 PMNs, 20–30 gram-negative rods, 10–20 gram-positive rods, and 0–20 gram-positive cocci; culture, mixed oropharyngeal flora (not further specified).

Patient 4: material obtained by hypopharyngeal incision; gram-stain, 0–3 PMNs, 100 gram-negative rods, 5–10 gram-positive rods, 20–50 gram-positive cocci in chains; culture, mixed aerobic-anaerobic oropharyngeal flora containing at least 10 different species (not further specified); no β-hemolytic streptococci.

Patient 5: pus obtained by peritonsillar incision in another hospital; gram stain, not available; culture, no β-hemolytic streptococci.

Patient 6: pus obtained by needle aspiration from parapharyngeal abscess; gram stain, 20–50 PMNs, 0–2 erythrocytes, 20–50 gram-positive cocci (chains), 0–1 gram-negative rod; culture, negative.

Patient 7: throat swab: culture, β-hemolytic streptococci group C (Lancefield); material obtained by needle aspiration from the left tonsillar region: gram stain, 0–5 PMNs, 0–5 gram-positive cocci, 0–5 gram-negative rods, 0–10 yeasts; culture, β-hemolytic streptococci group C (Lancefield), Candida albicans, no anaerobes.

Patient 8: throat swab: culture, β-hemolytic streptococci group A (Lancefield); pus obtained by needle aspiration from parapharyngeal abscess; gram...
Table 2. Isolated microorganisms and treatment of eight patients with parapharyngeal space infection.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Organism(s)</th>
<th>Treatment</th>
<th>Surgical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>β-Hemolytic Streptococcus group G; anaerobes, three species</td>
<td>Penicillin (1-4), streptomycin (1-4), metronidazole (5-17), clindamycin (5-30), rifampin (18-30), penicillin (30-78)</td>
<td>Incision, peritonsillar abscess; pleural punctures</td>
</tr>
<tr>
<td>2</td>
<td>S. pyogenes</td>
<td>Penicillin (5-21)</td>
<td>Percutaneous cervical punctures</td>
</tr>
<tr>
<td>3</td>
<td>“Mixed oropharyngeal flora”</td>
<td>Metronidazole (1-4), gentamicin (1-11), penicillin (2-11), clindamycin (4-16), cotrimoxazole (TMP-SMZ) (11-16)</td>
<td>Pleural and pericardial punctures</td>
</tr>
</tbody>
</table>

* Gram stain of cervical puncture: 20-50 PMN, 20-50 gram-positive cocci, 0-1 gram-negative rods, 0-1 fine-shaped gram-negative rods. All cultures negative. Aerobic culture: no gram-negative microorganisms. Anaerobic culture: negative.

† Phenethicillin potassium.

Stain 2–3 PMNs, 100 erythrocytes, 5–20 gram-positive cocci in chains, 0–3 gram-negative rods; culture, Streptococcus sanguis, Streptococcus salivarius, Staphylococcus aureus, Micrococcus species, no anaerobes.

**Antibiotic therapy.** Antibiotic treatment is shown in table 2. In all eight cases, benzylpenicillin was administered in high intravenous dosages (12–24 million IU/24 h). Patient 1 had already received various antibiotics in the course of 30 days before referral to our hospital; his remaining mediastinal abscesses were successfully treated by continuous infusion of 24 million IU of benzylpenicillin/24 h. Patient 8 received benzylpenicillin in a continuous infusion, because of extensive deep neck abscesses (figure 1).

**Drainage procedures.** The initial and follow-up CT allowed us to establish and follow the development of deep neck and mediastinal abscesses. Drainage could therefore be restricted to guided needle aspiration or small incisions (table 2). In patient 1, surgical incision of a peritonsillar abscess was performed before the diagnosis of a parapharyngeal space infection was made. In patient 4, two small cervical incisions were made, guided by CT. The large abscesses in patient 8 (figure 1) could not easily be reached by puncture and were not drained at all. Not only the phlegmonous mediastinitis in patient 3 but also the distinct mediastinal abscesses in patient 1 responded well to antibiotic therapy alone; aspiration was only performed because of pleuritis and pericarditis (table 2).

**Prognosis.** Hospitalization varied from 14 to 89 days, with a median of 30 days. All patients survived and were discharged from hospital in good health, without sequelae.

**Discussion**

The most important primary foci for a parapharyngeal space infection (PSI) are the teeth (via the submandibular space), the pharynx, and the tonsils (via the lymphatics). Parotitis and otitis media are rare primary sources (figure 2, left) [2, 6, 7]. Since the introduction of antibiotics, PSI has been presumed to arise more often from odontogenic foci than from a throat infection [3, 4, 8]. Our data do not confirm this view, because all eight of our patients appeared to have a primary throat infection.

Early recognition of PSI is of great importance because of the risk of rapid airway obstruction—due to swelling of pretracheal or retropharyngeal tissues—and descending mediastinitis. The latter complication was seen in four of the eight patients. For understanding of these acute developments, knowledge of the anatomic relationships of the deep neck spaces is essential (figure 2). PSI can spread rapidly into the mediastinum along the fascias of the spaces, which run the entire length of the neck, in-
including the “danger space,” and the retropharyngeal, prevertebral, and carotid sheath spaces. The so-called danger space is filled with areolar tissue and offers little resistance to further spread of infections [6, 7]. Another route to the mediastinum is through the pretracheal space (figure 2, center and right) [1, 4, 9-11]. Carotid hemorrhage and jugular thrombophlebitis [12-14] did not occur in our patients, despite the frequent involvement of the posterior compartment (figure 2, left). The local signs, i.e., stridor, trismus, torticollis, and pharyngeal swelling, varied in our patients, which hampered early recognition of PSI. However, in all cases a nonfluctuant painful erythematous swelling below the angle of the

Figure 1. Left, Patient 8, CT before treatment at the level of the floor of the mouth. Soft tissue mass with a large abscess in the parapharyngeal and retropharyngeal (white arrows) spaces. The oropharynx is compressed and displaced (black arrow). Right, Patient 8, follow-up CT after a 4-week course of benzylpenicillin via an intravenous infusion, at the same level as left panel. Parapharyngeal and retropharyngeal spaces show no abnormalities.
Figure 2. Anatomic relations of deep neck spaces. Left, Oblique section of the neck. The multiple deep neck spaces are separated by layers of the cervical fascia. The parapharyngeal space (A) lies behind the peritonsillar space (B) and is adjacent to the parotid (C) and masticator (D) spaces. The base of this cone-shaped space is part of the base of the skull and its apex is the hyoid bone (I). The anterior compartment (A1) lies in close relation to the submandibular (E) and retropharyngeal (F) spaces. The posterior compartment (A2) contains the carotid sheath with the internal carotid artery and the jugular vein and communicates with the “danger space” (G) and the prevertebral space (H). Center, Sagittal section of the neck and the thorax. Infections can descend rapidly into the mediastinum along the cervical fascia of the longitudinal neck spaces (F, G, H, I) or the pretracheal space (J). Right, Cross-section at the level of C6. Infections can easily spread from one neck space to the other. A1 = anterior compartment of the parapharyngeal space; A2 = posterior compartment of the parapharyngeal space; B = peritonsillar space; C = parotid space; D = masticator space; E = submandibular space; F = retropharyngeal space; G = “danger space”; H = prevertebral space; I = carotid sheath space; J = pretracheal space; 1 = hyoid bone; 2 = trachea; 3 = esophagus; 4 = thyroid gland.

mandible was evident. Another problem of the recognition of the disease is apparent from our series: the interval between the initial sore throat and subsequent signs of PSI may vary from a few hours to several weeks [2]. In four of our eight patients, this interval was long (4–14 days); all four were young women (10–31 years) with less fulminant and more localized PSI than the four older patients (49–70 years), who had rapid development of the disease (0–2 days). Lower mediastinitis was only found among the latter.

Although both appropriate physical examination of the oropharyngeal region and laryngoscopy are important, physicians often cannot reliably make the diagnosis of PSI [12]. Cross-sectional imaging is indispensable in the evaluation of PSI and other deep neck infections [15, 16]. Conventional X-ray findings usually provide insufficient information. CT depicts the various deep neck spaces more clearly than sonography. The value of sonography is more limited to the superficial anatomic regions and is therefore not primarily indicated for analyzing deep neck infections. Spread of the infection into the retropharyngeal and pretracheal spaces could be established by CT in a high proportion of our cases. CT allowed early detection of airway obstruction and descending mediastinitis. This was useful for prophylactic intubation. Magnetic resonance imaging (MRI) seems to be a promising new method for analyzing pathology in the deep spaces of the neck [17]. Its major advantages over CT are the excellent soft tissue contrast and the ability to demonstrate vascular anatomy without the use of intravascular contrast. Initial studies with MRI of the neck mainly concern the analysis of neoplasms. No major studies have been published so far on the use of MRI in deep neck infections.

Diagnostic punctures may yield important infor-
mation on the causative agents, even in diffuse cellulitis. Blood cultures are usually sterile, as they were in our patients, except in the case of jugular thrombophlebitis [5]. The type of causative microorganism varies with the focus from which the PSI originated. In the case of primary pharyngitis or tonsillitis, the flora is usually mixed: β-hemolytic streptococci (mostly of group A, but sometimes of groups C or G, as shown in our series), nonhemolytic streptococci, and various species of anaerobes, including Fusobacterium species, Bacteroides species (including Bacteroides melaninogenicus and rarely Bacteroides fragilis), peptococci, and peptostreptococci [18-20]. β-Hemolytic streptococci and anaerobes are the causative agents of life-threatening synergistic necrotizing infections in other parts of the body as well [21, 22]. Sometimes S. aureus can be isolated, mainly as part of a mixed culture [2]. Coliforms are uncommon in this type of PSI [19, 23].

Benzylpenicillin administered in frequent high dosages or as a continuous infusion (approximately 200,000 IU/[kg·24h]), was the cornerstone of antibiotic treatment in our series. In our opinion, continuous infusion is preferable for the treatment of abscesses since this mode ensures continuous effective concentrations in the deep tissues [24]. No β-lactamase-producing anaerobes were found in our cases. However, recent studies point to the increasing frequency of β-lactamase producers among B. melaninogenicus and other Bacteroides species [25-27]; therefore, the addition of metronidazole deserves consideration. Clindamycin can be used as an alternative if the patient is allergic to penicillin. Antibiotics covering gram-negative rods and staphylococci should only be used when indicated by gram stain and culture results.

Blind treatment of a PSI that originates from other primary foci has to be directed to causative agents associated with those foci. Odontogenic infections may be due to B. fragilis, which is usually penicillin-resistant, and Actinomyces species [23, 28]. In chronic otitis media or mastoiditis, anaerobes—including B. fragilis—and coliforms, Pseudomonas aeruginosa, and S. aureus may play a role [18, 29]. The main causative agent of purulent parotitis is S. aureus [19].

Surgical drainage of the deep neck spaces has been widely recommended as an essential part of effective treatment of PSI. According to most authors, antibiotics cure only 10%-15% of patients and therefore cannot replace surgery [3, 30-32]. However, our results demonstrate the efficacy of a nonsurgical regimen that included drainage by CT-guided aspiration or, in three cases, small incisions. Assessment of the response to therapy was based on the follow-up CT. Radical surgical drainage was not performed in any of our eight cases. Intensive antibiotic treatment, usually with selective aspiration, proved very successful. All patients, including those with extensive deep neck and mediastinal abscesses, achieved complete cure with no sequelae.

On the basis of our data, we can recommend a nonsurgical approach consisting of intensive antibiotic therapy combined with CT-guided needle aspiration as an effective strategy for treatment of PSI in many or most patients. Patients should be followed closely clinically and with CT. The surgical approach would then be reserved for cases of jugular phlebitis, carotid hemorrhage, and abscesses that do not respond to conservative treatment.

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