Bacterial Meningitis Following Pantopaque Myelography
A Case Report and Literature Review

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ABSTRACT: A case of acute bacterial meningitis following Pantopaque myelography is reported, and the literature reviewed pertaining to this uncommon but potentially fatal complication. A positive Gram's stain is most helpful in differentiating bacterial from chemical meningitis. Treatment of the meningitis before and after determination of its cause is described. Preventive steps include removal of Pantopaque from the subarachnoid space immediately at the conclusion of fluoroscopy, and observance of strict sterile technique during myelography, including use of face masks.

Introduction
Acute bacterial meningitis following lumbar puncture for contrast myelography is a rare occurrence. Clinically the presentation of acute bacterial meningitis following injection of contrast media may be indistinguishable from acute chemical meningitis. A positive Gram's stain, found in about 70% of cases of acute bacterial meningitis, is helpful in differentiating acute bacterial meningitis from aseptic meningitis. In those cases where the Gram's stain is negative, prompt initiation of antimicrobial therapy prior to the return of bacterial cultures is imperative to eliminate the sequelae of untreated bacterial meningitis.

Case Report
A 32-year-old white man was admitted to the Portsmouth Naval Hospital for evaluation of left sided neck, shoulder and arm pain of seven months' duration. Associated symptoms included left triceps weakness and diminished triceps reflex, as compared to the right, and subjectively decreased sensitivity over the left middle three fingers. The initial clinical evaluation was consistent with left C7 radiculopathy. EMGs and nerve conduction velocity studies confirmed the clinical impression. The initial CBC, chest radiograph, urinalysis, and coagulation studies were within the limits of normal. Cervical spine radiographs were interpreted as normal. The patient underwent a Pantopaque cervical myelogram, which revealed an anterior extradural defect at the C6-7 interspace. The procedure was technically difficult, necessitating two lumbar punctures for removal of the dye, with only a small amount remaining in the dural sac. Sterile technique was maintained and total time for the procedure was 60 minutes. Laboratory studies on the initial spinal fluid revealed a clear, colorless fluid with a protein of 49 milligrams per deciliter (mg/dl) and glucose of 74 mg/dl. Gram's stain revealed no cells or bacteria, and cultures were sterile.

Forty-eight hours following the procedure, the patient developed a bifrontal headache, nausea, vomiting, oral temperature of 39° C, and meningismus. Repeat lumbar puncture revealed cloudy fluid with a total white blood cell count of 9,860 per cubic millimeter, with 93% neutrophils, 7% mononuclear cells, 540 red blood cells, protein of 179 mg/dl, and glucose of 37 mg/dl. Gram's stain of the fluid revealed many neutrophils, but no organisms. The patient was started on intravenous methylprednisolone for presumptive acute chemical meningitis, and intravenous oxacillin and cefotaxime to cover the possibility of bacterial meningitis. The following day, the spinal fluid cultures revealed gram positive cocci in chains later speciated as Staphylococcus aureus and Streptococcus viridans. Cefotaxime, oxacillin and methylprednisolone were discontinued, and intravenous penicillin G, 24 million units per day was begun. The patient's symptoms resolved rapidly with defervescence in sixty hours with only a mild headache persisting for ten days. Penicillin was continued for seven days. Lumbar puncture 48 hours later was sterile. Seven days later an uncomplicated anterior cervical diskectomy and interbody fusion was performed with an uneventful postoperative course. The patient was discharged from the hospital on the tenth postoperative day.

Discussion
The inflammatory reaction of the meninges following contrast myelography may be a result of either acute bacterial meningitis or aseptic meningitis, the latter due to either a chemical reaction
TABLE 1
SPINAL FLUID PROFILE OF REPORTED CASES OF (CHEMICAL) ASEPTIC MENINGITIS FOLLOWING CONTRAST MEDIA

<table>
<thead>
<tr>
<th>Report</th>
<th>#</th>
<th>Culture</th>
<th>Gram's Stain</th>
<th>SF WBC</th>
<th>% PMN</th>
<th>Prot</th>
<th>Glucose</th>
<th>Simult</th>
<th>Ser Gluc</th>
<th>Study</th>
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<tbody>
<tr>
<td>Worthington 1983</td>
<td>1</td>
<td>Sterile</td>
<td>Neg</td>
<td>2,300</td>
<td>94</td>
<td>253</td>
<td>8</td>
<td>75</td>
<td>Metrizamide</td>
<td></td>
</tr>
<tr>
<td>Hurd 1982</td>
<td>2</td>
<td>Sterile</td>
<td>Neg</td>
<td>3,850</td>
<td>96</td>
<td>90</td>
<td>63</td>
<td>153</td>
<td>Metrizamide</td>
<td></td>
</tr>
<tr>
<td>Kelley 1980</td>
<td>3</td>
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<td>Neg</td>
<td>4,600</td>
<td>87</td>
<td>960</td>
<td>17</td>
<td>—</td>
<td>Metrizamide</td>
<td></td>
</tr>
<tr>
<td>Mayher 1971</td>
<td>4</td>
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<td>—</td>
<td>12,400</td>
<td>99</td>
<td>500</td>
<td>—</td>
<td>—</td>
<td>Pantopaque</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sterile</td>
<td>Neg</td>
<td>536</td>
<td>94</td>
<td>55</td>
<td>—</td>
<td>—</td>
<td>Pantopaque</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taren 1960</td>
<td>6</td>
<td>Sterile</td>
<td>Neg</td>
<td>5,800</td>
<td>—</td>
<td>160</td>
<td>Normal</td>
<td>—</td>
<td>Pantopaque</td>
<td></td>
</tr>
<tr>
<td>Luca 1951</td>
<td>7</td>
<td>—</td>
<td>Neg</td>
<td>707</td>
<td>71</td>
<td>113</td>
<td>—</td>
<td>—</td>
<td>Pantopaque</td>
<td></td>
</tr>
</tbody>
</table>

or hypersensitivity to the contrast medium.3.17-24

The chemical meningitis produced by radiographic contrast media may be manifested as a mild delayed onset headache, nausea, and vomiting that resolves rapidly without sequelae. Cytologically, the spinal fluid picture at this time would show a mild leukocytosis with a negative Gram's stain and culture.29

In most cases the symptoms are mild, self-limiting, and attributable to a postmyelographic headache, and they resolve spontaneously without sequela, requiring only symptomatic treatment. Occasionally, a more extensive inflammatory reaction may produce more severe meningeal symptoms, including fever, photophobia and nuchal rigidity. It is this acute chemical meningitis that clinically may be indistinguishable from acute bacterial meningitis.28

Oil base contrast media such as Pantopaque are known to be some of the most irritating of all contrast media, and may produce a more severe and longer lasting inflammatory reaction. In addition, the presence of bloody spinal fluid and retained Pantopaque has been suggested as a link between acute and chronic arachnoiditis.10,22 Histologically, this type of meningitis produces the outpouring of a fibrinous exudate around the meningeal tissue that results in consolidation into a fibrin mesh-work known as adhesive arachnoiditis. Clinically, this may be responsible for the clinical symptoms of chronic low back pain, and may even produce an objective neurologcal deficit. This may be implicated in the “Failed Back Surgery Syndrome.”29 Chronic arachnoiditis may progress to obstructive arachnoiditis with progressive hydrocephalus and eventual death.

The noninfectious reactions to radiographic contrast media are well documented in the literature, and range from mild acute aseptic meningitis to chronic arachnoiditis.4.7.15.22.24.26.30-34 Approximately 500,000 Pantopaque myelograms are performed in the United States annually.25 In spite of the large number of studies performed each year, the documented cases of inflammatory reactions due to the contrast media are few (Table I). The incidence of aseptic meningitis reactions to contrast media range from 0.5% to 3%.4.15,18,35 The meningeal reactions following subarachnoid injection of Pantopaque are more common when larger amounts of Pantopaque are used, after incomplete removal of the contrast media, after repeat myelograms, and when the myelogram is performed in the face of a traumatic lumbar puncture with blood in the spinal fluid.6.15,18,19,36-39 The current recommendation, therefore, is that the contrast material be removed completely from the spinal fluid immediately at the end of fluoroscopy.6,19,22,39

The use of systemic steroids remains controversial, and recommendations vary from use only with acute chemical meningitis to routine use for 72 hours following the procedure to alleviate the inflammatory response.3.5.24.27,29,34.35 While steroids may be beneficial to alleviate the symptoms of chemical meningitis, they may mask symptoms and could delay the diagnosis and treatment of bacterial meningitis. In the case of meningitis of undetermined origin in this setting, the use of both steroids and appropriately chosen antibiotics would cover for both causes of meningitis while awaiting culture results. There is no conclusive evidence to suggest that the simultaneous administration of steroids and antibiotics would significantly reduce the outcome of bacterial meningitis.

The true incidence of acute bacterial meningitis following contrast myelography is not known, although most authors feel it is much less common than aseptic meningitis.38,40,41 In a series of 6,000 patients over ten years, no cases of bacterial meningitis were reported following Pantopaque myelography.35 If we include cases of lumbar puncture for spinal anesthesia, only two cases of bacterial meningitis were reported in 52,000 anesthetics,40,41 In fact, there are few well documented reports of bacterial meningitis following Pantopaque myelography (Table 2).1-3 It is significant that most of these cases were due to Streptococcus species, especially the viridans streptococci.2,3 When all cases of bacterial meningitis secondary to spinal manipulation (i.e. diagnostic lumbar puncture, myelography, and spinal anesthesia) are considered, several authors have indicated that Pseudomonas aeruginosa, Staphylococcus aureus, and coliform bacterial pathogens are the most common causes.1.12,13,16,39,42-45 Several authors have inferred that the source of infection was contamination of the lumbar puncture during preparation or handling during the procedure,12,45-47 The majority of reports of pseudomomas and staphylococcal meningitis antedate the general availability of prepackaged, sterile, disposable lumbar puncture trays,9,12,44,45 This method of preparation and handling possibly predisposed the patients to a higher risk of contamination. On the other hand, the reports of staphylococcal meningitis are all recent, yet the source of the pathogen is not readily apparent.1,3,11,21

To investigate the effect that Pantopaque dye exerts on the commonly related organisms, we inoculated separate pure cultures of 103 and 105 organisms per milliliter of a viridans streptococcus, Staphylococcus aureus, and Pseudomonas aeruginosa into 1 ml aliquots of Pantopaque. The contrast medium by itself was bactericidal to the organisms. When we added organisms plus sterile spinal fluid to Pantopaque, in an amount that represented the average ratio of spinal fluid (1:40) to Pantopaque during a myelogram, the organisms grew and multiplied. Random cultures of Pantopaque samples from the same lot number
used in our patient were sterile. Pantopaque appears by itself to be bactericidal to the organisms tested in this report. In the setting of Pantopaque-induced meningeal inflammation coupled with spinal fluid as a favorable culture medium, a small bacterial inoculum introduced during myelography has the apparent potential for rapid growth. In light of this infectious potential during myelography, the use of facial masks and adherence to absolute sterile technique appears to be indicated.

The viridans streptococci are infrequent invaders of the meninges, responsible for 0.3% to 2.4% of all types of purulent meningitis. In approximately 44% of these cases, a concomitant infection such as bacterial endocarditis, or ear or sinus infection was thought to be the source. Our patient had none of these infections. Since these organisms colonize the human upper respiratory tract and the operator, as in our case, wore no mask, the infection may have been transmitted through droplet or oropharyngeal spread during the procedure. This mode of spread has been suggested by others.

Regardless of the type of meningitis, the inflammatory response of the meninges is a nonspecific reaction to an irritant. Consequently, the cerebrospinal fluid findings in either case may be identical and of limited value in differentiating the etiology of the meningitis.

In six of the 14 cases of bacterial meningitis in Table 2, the Gram's stain was negative while the final culture confirmed the bacterial nature of the meningitis. Reliable interpretation of cerebrospinal fluid Gram's stain requires a certain amount of expertise that comes with experience and time. When the spinal fluid protein is elevated, staining characteristics of bacteria can be misleading. Considering the fact that in the reported cases of bacterial meningitis, 42% will have a negative Gram's stain, the patient should be given the benefit of the doubt and treated for bacterial meningitis until the culture results are known.

From this review, we conclude the following: 1) Bacterial meningitis following Pantopaque myelography is a rare and potentially fatal complication. 2) The clinical presentation and spinal fluid findings in bacterial meningitis may be indistinguishable from the acute aseptic (chemical) meningitis that is more frequently seen. 3) Gram's stain of the spinal fluid, when positive, may be helpful in differentiating the two and directing initial antibiotic therapy. 4) In cases where the Gram's stain is negative, antibiotic therapy should be directed toward the most frequently isolated organisms, which include streptococci, staphylococci, and gram negative bacteria until the culture results are known; these would include a penicillin-resistant synthetic penicillin, aminoglycoside, and third generation cephalosporin. 5) Positive cultures may necessitate a change in treatment to a more specific antibiotic. 6) Negative cultures suggest a chemical meningitis and favor discontinuation of antibiotics. 7) Parenteral steroids may be beneficial for chemical meningitis. 8) Pantopaque should be removed from the subarachnoid space immediately at the conclusion of fluoroscopy. 9) Strict sterile technique should be followed during the myelogram, including the use of a face mask.

References