**ABSTRACT**

Intraparenchymal brain abscesses are rare but serious brain infections with a very high morbidity and mortality. One-half of these abscesses originate from otogenic and rhinogenic sources. The purpose of this paper is to review all relevant studies on cerebral abscesses from otogenic and rhinogenic sources, identify possible patterns in pathogen frequency, and streamline antimicrobial therapy based on this information. Extensive meshterm searches on Medline were performed. Data was compiled and analyzed. *Proteus spps.* were commonly associated with otogenic abscesses; *S. milleri* was commonly associated with rhinogenic abscesses. Limitations to the study exist. Future research should include investigation of virulence factors contributing to these common intraparenchymal pathogens as well as obtaining culture results from both the ear or sinus as well as the intraparenchymal abscess for further correlation.

**INTRODUCTION**

Intraparenchymal brain abscesses are rare but serious infectious infections with a mortality of 25% and an even higher associated morbidity. Studies demonstrate one half of these abscesses are secondary to otogenic and rhinogenic infections. During the past 50 years, numerous case series and case reports have been published contributing data to the limited fund of knowledge available on this subject. Brain abscesses can be evaluated based on location and pathogens. The review papers can be categorized on date of publication and geographic location of the publishing hospitals. The purpose of this review is to analyze the case series and reports of rhinogenic and otogenic intracranial abscesses with an intention to investigate for possible relationships between particular pathogens, locations, time periods, and intracranial sites. Such information could prove valuable in the selection of antimicrobial therapy.

**METHODS AND MATERIALS**

Medline searches were performed. The meshterms “otitis media” and “brain abscess” limited to English resulted in 190 hits. A meshterm search for “sinusitis” and “brain abscess” yielded 157 articles. Articles were reviewed. Total case numbers of intracerebral abscesses and culture results were collected. Articles that did not include cultures of intracerebral abscesses were excluded. Articles that grouped all intracranial complications were distillation into intracerebral abscesses.

The otogenic abscess search was narrowed to 29 articles were relevant and available for complete review. 18 case series with a total of 421 patients with 437 abscesses were identified. 11 case reports were identified.

The 157 rhinogenic abscesses articles were narrowed to 8 case series with 67 patients and 8 case reports were available and relevant for review.

Dates ranged from 1962 to 2007 for the otogenic papers while dates ranged from 1983 to 2004 for the rhinogenic abscesses. Locations included the US, the UK, and developing nations.

**RESULTS**

437 otogenic abscesses with 562 pathogens and 75 rhinogenic abscesses with 163 pathogens were identified. Otogenic locations included temporal 45% (197), cerebellar 24% (106), frontal <0.5% (2), unknown 13% (56), and other 5% (21). Rhinogenic locations included frontal 36%, (n=27) and unknown 35%, (n=26).

Otogenic culture results in decreasing order of frequency these included sterile 25%, n=134; *Proteus spps.* 24%, n=128; *Bacteroides spps.* 7%, n=36; anaerobic 6%, n=31; *E. coli* 5%, n=25; and streptococcus (species not noted) 5%, n=24.

Rhinogenic culture results in decreasing order of frequency these yielded enteric gram negative rods 31%, n=169; sterile 25%, n=134; streptococcus 12%, n=65; non-enteric gram negative rods 8%, n=44.

Distilled into broad subgroups in decreasing order of frequency these included sterile 25%, n=134; *Proteus spps.* 24%, n=128; *Bacteroides spps.* 7%, n=36; anaerobic 6%, n=31; *E. coli* 5%, n=25; and streptococcus (species not noted) 5%, n=24.

Rhinogenic culture results in decreasing order of frequency included *S. milleri* 33%, n=54; sterile 13%, n=21; *Streptococcus spps.* 9%, n=15; and *Bacteroides spps.* 7%, n=11. Broadly distill into subgroups, *Streptococcus spps.* accounted for 48%, n=76 followed by sterile 13%, n=21, enteric gram negative rods 11%, n=18, and *Staphylococcus spps.* 10%, n=16.

The 532 separate otogenic culture results from 437 abscesses and the 163 culture results from 75 total rhinogenic abscesses suggest polymicrobial etiologies for a significant portion of abscesses.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Otogenic Abscess</th>
<th>Rhinogenic Abscess</th>
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</thead>
<tbody>
<tr>
<td>Sterile</td>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td><em>Proteus spps.</em></td>
<td>197</td>
<td>0</td>
</tr>
<tr>
<td><em>S. milleri</em></td>
<td>106</td>
<td>0</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>77</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>77</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 1. Frequency of Brain Abscess Location

**DISCUSSION**

The results demonstrate a predominance of otogenic *Proteus spps.* and rhinogenic *S. milleri* as pathogens. No difference in pathogens between developed and developing nations was noted; no difference between early and late studies was noted. Few rhinogenic abscess data, however, originated from developing nations.

Limitations to this type of review are inherent. The studies were heterogeneous in data presentation. For example, not all case series had culture results for each patient. Patients had variable antibiotic therapy prior to culture likely altering pathogen yields. Heterogeneity also resulted from the age of the studies and the reclassification of bacterial species over the past 50 years. Not all abscess specimens underwent anaerobic and fungal cultures or evaluation for fastidious organisms—possibly underestimating the contribution of these bacteria.

With the wide variability of pathogens documented in intracranial abscesses and the absence of other strong relationships, recommendations regarding antibiotic choice cannot be made.

**CONCLUSIONS**

Intraparenchymal brain abscesses caused by rhinogenic and otogenic sources are similar in the variability of pathogens without effect from abscess location, geographic location, or time period. *Proteus spps.* is most common in otogenic abscesses; *S. milleri* is most common in rhinogenic abscesses.

Developing research may ultimately yield insight into how particular pathogens’ virulence factors may facilitate intracranial abscess formation.

**REFERENCES**


Bradley PJ, Manning KP, Shaw MDM. Brain abscess secondary to otitis media. The Jounrnal of Laryngology and Otology 1984; 98: 1185-91

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