Leading articles


Treatment of brain abscess

Brain abscess is a serious, life-threatening condition which, until a decade ago, was associated with a mortality of about 40% (Garfield, 1969). Over the last ten to fifteen years the mortality has fallen to less than 10% (Alderson et al., 1981; Maurice-Williams, 1987; Taylor, 1987; Mampalam & Rosenblum, 1988). This reduction has been attributed mainly to the introduction of computerized tomography, allowing earlier diagnosis and more precise localization of the abscess; but partly also to improvements in surgical and bacteriological techniques and the use of more appropriate antimicrobial therapy.

A brain abscess may arise by several routes. A contiguous focus of infection arising in the mastoid or the sinuses is commonly identified, accounting for 54% and 36% of cases in two recent series (Alderson et al., 1981; Chun et al., 1986). Metastatic abscesses secondary to chronic suppurrative lung disease used to be common but are now relatively rare: a fall from 18% in the early 1970s to 2% in the 1980s was shown in a recent review (Mampalam & Rosenblum, 1988). Surgical or accidental trauma accounts for further cases; the numbers are variable but may be as high as 44% (Schlamser, Bäckman & Norrby, 1988). A further 20% of cases may have no infective focus identified (Wispelwey & Scheld, 1987); these cryptogenic abscesses may be due to unrecognized dental sepsis (Ingham et al., 1978). Rarely brain abscess is a complication of bacterial meningitis; this may occur in the neonate, particularly with Gram-negative bacilli (Renier et al., 1988).

The ideal treatment for brain abscess is a combination of surgical removal of pus and a course of appropriate, high dose antibiotics. The surgical management of brain abscess is still a controversial area (Garfield, 1969; Mampalam & Rosenblum, 1988). The two main methods used are burr-hole aspiration of pus and excision at craniotomy, and choice depends on the site of the abscess, the condition of the patient and the surgeon's preference. Recent series show no advantage of one method over the other (Alderson et al., 1981; Yang, 1981; Schlamser et al., 1988); both methods may have complications such as damage to the surrounding brain tissue or dissemination of the infection (Taylor, 1987). Inaccessible or multiple abscesses may be aspirated by a stereotactic method under CT guidance (Dyate et al., 1988). In selected cases, who are in a good neurological state or where surgery may be hazardous, medical treatment with antibiotics alone has been successful (Rosenblum et al., 1980). Careful follow up with CT scan is necessary.

There is a lot of information available on the penetration of antibiotics into CSF, but the problem of penetration into brain tissue and brain abscess pus has been less well studied. The blood brain barrier is altered in proximity to areas of cerebritis and encapsulated abscesses (Britt, Enzmann & Yeager, 1981), and may allow increased penetration of antibiotics. A study by Kramer, Griffith & Campbell (1969) looked at brain tissue and serum from patients undergoing surgery, who had received a 2-g bolus of one of the following antibiotics: chloramphenicol, cephalothin, ampicillin, penicillin G (3-2 mega units—approx. 2 g—given preoperatively) and cephaloridine. Brain-blood ratios for these antibiotics were calculated and it was found that chloramphenicol reached a higher concentration in brain than in blood, with a ratio of 9:1. The worst penetration was of ampicillin, which showed a ratio of 1:56. Chloramphenicol has therefore been a part of the antibiotic regimen for brain abscess for many years. Black, Graybill & Charache (1973) looked at pus from six patients who were initially treated with antibiotics alone. They found detectable levels of meticillin (mean 4.5 mg/l), penicillin (mean > 150 mg/l) and chloramphenicol (7.8 mg/l). However, the patients continued to deteriorate whilst on antibiotics and until needle aspiration of the abscess was carried out. Sensitive
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A larger study was made by de Louvois, Gortvai & Hurley (1977a), in which pus from 32 patients was analysed for a variety of antibiotics. Penicillin concentrations in the pus were widely variable, but generally a concentration of 1.0 mg/l or more was found if the dose exceeded 2.4 g (4 mega units) per day. It was found by de Louvois & Hurley (1977) that penicillin may be inactivated by 90% or more when incubated in pus in vitro, and this may partly explain the variability of the concentrations. Lincomycin and fusidic acid were found to penetrate well, to produce concentrations of 40 and 62 mg/l, respectively. Chloramphenicol concentrations were very erratic, ranging from 0 to 10 mg/l. Cephaloridine, ampicillin, cloxacillin and gentamicin appeared to penetrate very poorly.

The introduction of metronidazole, a highly active anti-anaerobe agent, prompted a study looking specifically at this agent (Ingham, Selkon & Roxby, 1977). The findings were that it reached high concentrations of 34-45 mg/l in brain abscess pus, and the outcome of treatment was highly satisfactory. Other studies using metronidazole instead of chloramphenicol as an anti-anaerobe agent have found that the outcome is favourable (Warner, Perkins & Cordero, 1979; Chun et al., 1981; Alderson et al., 1986).

There is little information available on the penetration of the third generation cephalosporins into brain tissue; the early cephalosporins such as cephalothin and cephaloridine penetrate very poorly (Kramer, Griffith & Campbell, 1969). Cefotaxime has been shown to reach therapeutic concentrations in CSF (Humbert et al., 1984) and is being used successfully in the treatment of Gram-negative bacillary meningitis (Cherubin et al., 1982). There are now reports of its successful use in treating brain abscess, particularly otogenic abscesses (Luengo et al., 1986; Donald & Ispa-hani, 1988); and success with ceftriaxone in a child with a salmonella abscess has been reported (Kinsella et al., 1987). Other agents such as latamoxef and imipenem have been reported to be successful (Levy & Saunders, 1981; Carton et al., 1987).

The choice of antibiotic should be guided initially by the site of the abscess, the predisposing factors, and the Gram film of the pus. Therapy may be amended later when the cultures are available. There may be a wide spectrum of bacteria isolated, and polymicrobial infections are common (de Louvois, Gortvai & Hurley, 1977b). The importance of anaerobes has been emphasized in recent years, and with improved microbiological techniques up to 90% of brain abscesses will grow anaerobic organisms (Heineman & Braude, 1963; Alderson et al., 1981). The site and origin of the brain abscess may be a guide as to the types of bacteria present (Gortvai, de Louvois & Hurley, 1987). Abscesses secondary to paranasal sinusitis are usually frontal, and the commonest organisms found are Streptococcus milleri and anaerobes. Benzylpenicillin, with metronidazole, for its good activity against penicillin-resistant anaerobes, would be appropriate for these abscesses. Temporal lobe and cerebellar abscesses are often otogenic in origin, and may contain enterobacteria, usually Proteus spp., with mixtures of anaerobes. Chloramphenicol or ampicillin has been used for these abscesses, but chloramphenicol is not bactericidal for the Enterobacteriaceae, and there is increasing resistance to ampicillin amongst these organisms. The third generation cephalosporins are increasingly being used in these situations, in combination with metronidazole and an aminoglycoside. In abscesses secondary to trauma, Staphylococcus aureus should be suspected, and a combination of high dose flucloxacillin with fusidic acid or rifampicin should be appropriate. Vancomycin is an alternative if the patient is allergic or the organism is a resistant strain. The $\beta$-lactam antibiotics should be given in maximum doses to allow adequate penetration into the abscess.

The outlook then, for a patient with a brain abscess, is no longer gloomy; with early diagnosis, appropriate surgery and appropriate antibiotics, the chances of survival are much greater.

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References


