Lesson of the Week

Brain abscess presenting as an intracranial gas shadow

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A brain abscess may present as a gas shadow in a plain skull radiograph.¹ Owing to the rarity of this feature its importance may not be recognised,² which may lead to delay in diagnosis of a surgically correctable condition. The following case highlights the problem.

Case report

A previously well 77 year old man was seen by his general practitioner for the sudden onset of confusion; he was found by his wife reading a newspaper upside down. There was no preceding history of deafness or ear discharge.

FIG 1—Lateral skull radiograph of patient presenting with abrupt onset of confusion showing lucent area in temporal region. (Presence of air-fluid interface more evident when radiograph viewed in brow up position (as originally taken).)

No definite abnormality was detected, and it was assumed that he had suffered a cerebrovascular accident. No specific treatment was given. He remained confused and complaining of headaches and one week later was found collapsed at home.

Recognising a gas shadow in a plain radiograph of the skull may lead to early diagnosis of a brain abscess

On admission he was very drowsy but responsive to pain. Axillary temperature was 37.8°C, pulse 80 beats/min, and blood pressure 180/100 mm Hg. There was no neck stiffness, and no localising neurological signs were found. The optic fundi could not be visualised owing to cataracts, and the ears were glued with wax. Basal coarse crackles were heard in the lungs.

Initial investigations showed a haemoglobin concentration of 149 g/l and a total white cell count of $12.9 \times 10^9/l$. Cultures of blood and sputum grew no pathogens. A lateral skull radiograph taken to exclude major fractures showed a lucent area in the temporal region (fig 1), but the importance of this was overlooked. Chest radiography showed inflammatory changes at both lung bases, and in view of his low grade fever and leucocytosis he was treated with intravenous benzylpenicillin and gentamicin.

Over the next five days he failed to improve and developed neck stiffness and variable left sided hemiparesis. Lumbar puncture produced cloudy cerebrospinal fluid at 75 mm H₂O with a protein concentration of 4.2 g/l (normal 0.15-0.45 g/l) and a leucocyte count of $1.12 \times 10^9/l$ (90% polymorphs). Direct Gram stain and culture gave negative results.

In view of the lumbar puncture findings and unusual appearance of the skull radiograph computed tomography of the head was performed. This showed an abscess containing gas in the right temporal lobe (fig 2). Aspiration of the abscess was carried out with antibiotic cover (metronidazole and cefotaxime). Culture of the aspirate showed a dominant growth of *Proteus mirabilis* with some *Bacteroides vulgatus*. Postoperatively he recovered well with no neurological deficit. When the wax was removed from the right ear he was discovered to have a cholesteatoma, for which he subsequently underwent mastoidectomy.

Discussion

The diagnosis of cerebral abscess remains a difficult problem. Most patients have symptoms of raised intracranial pressure, which may be followed by impaired consciousness and papilloedema.³ Focal neurological abnormalities may be detected on admission in up to two thirds of cases,⁴ and epilepsy may occur, especially in children. In only about half of the cases do patients have evidence of infection, such as fever or neck stiffness.⁵ In most cases the abscess develops over one to four weeks,² simulating the course of a rapidly growing neoplasm. It is clearly unusual for a patient to present as ours did with the abrupt onset of confusion and no preceding symptoms, though by the time of admission he was feverish and complaining of headaches.

For years it has been recognised that some brain abscesses are due to gas forming organisms and that plain radiographs may show an air-fluid interface.^{2,6,7} Most of these patients have sustained head wounds in combat,⁶ though a few cases have occurred in civilians after penetrating head wounds.¹⁶ The infecting agent is almost always *Clostridium* spp, and the mortality in patients given prompt diagnosis and drainage is about 25%.¹⁶ Though otitis media is the

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most common single cause of brain abscess formation,⁸ a gas-containing abscess due to ear disease has been described on only three occasions.^{7,9,10} In our patient the cholesteatoma was probably responsible for the abscess, as there was no history of injury. The possibility that the gas in the abscess cavity may have arisen from the middle ear seems unlikely, as both organisms cultured were later shown to be gas producing.

The overall mortality associated with brain abscess is 30-50%¹¹ and has not been reduced by advanced diagnostic techniques such as computed tomography. The lower mortality observed with gas

producing abscesses may be because the presence of injury draws attention to the possibility of infection. When there is no injury, as in our case, a high index of suspicion must be maintained to ensure that patients with a potentially curable condition are referred for definitive investigation. The shadow in the skull radiograph, initially over looked, was in retrospect the clue which might have led to earlier treatment in our patient, though fortunately the outcome was favourable.

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FIG 2—Computed tomogram of head before (above) and after (below) contrast injection. Note enhancement of abscess wall by contrast and presence of dark, round shadow in anterior part of cavity due to gas bubble.

Is the widespread use of underarm deodorants associated with any significant absorption of aluminium salts, bearing in mind the reputed relation between concentrations of aluminium salts in the brain and presenile dementia?

Aluminium in underarm deodorants is present in the form of aluminium chlorhydrate—usually as a 1% solution. One squirt of a typical deodorant will usually deliver 0.1 ml of solution. I do not know if any of this would be absorbed through intact skin, but even if absorption were complete the amount would represent a very small fraction of the normal dietary intake of aluminium.—LINDA BEELEY, consultant clinical pharmacologist, Birmingham.

Some methylcellulose products contain E 127 erythrosine, which is described in "E for Additives" as containing 557 mg of iodine per gram. A possible effect on thyroid function is mentioned. Is there any evidence that regular use of methylcellulose products is attended by any risk because of the colouring?

Although excessive intake of iodine produces both hypothyroidism and hyperthyroidism, I do not know if the amount consumed in preparations of methylcellulose containing erythrosine would have any effect on thyroid function. The recommended daily intake of iodine is 50-150 µg. Celevac tablets (one brand of methylcellulose) contain 0.24 mg erythrosine per tablet. On a daily dose of 12 tablets a patient would consume about 2.88 mg of erythrosine, which is roughly equivalent to 1.6 mg iodine. Capsules of lithium carbonate and of levodopa containing erythrosine have previously been reported as producing a small increase in protein bound iodine and depressing radioactive iodine uptake.¹ These effects occurred, however, in the absence of any change in other measures of thyroid function. Patients in a study of lithium carbonate capsules¹ consumed about 1.2 mg of iodine daily for six weeks. Amiodarone contains 6 mg iodine per 200 mg tablet and it has been suggested that one way in which amiodarone produces thyroid dysfunction is by release of iodine. Amiodarone, however, has other effects on thyroid hormone metabolism which may be more important.² The pathogenesis of iodine induced thyroid dysfunction is not clear but patients with pre-existing thyroid abnormalities, especially those with autoimmune thyroid disease, seem to be at increased risk. This is true also of amiodarone induced thyroid dysfunction.²—LINDA BEELEY, consultant clinical pharmacologist, Birmingham.

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