DIAGNOSIS OF INTRACRANIAL TUBERCULOMA

Ravindra Kumar Garg*

INTRODUCTION

Tuberculomas of the brain account for 20 to 30 per cent of intracranial tumors in India. In pediatric age group, upto 41% of intracranial space occupying lesions (ICSOls) have been found to be tuberculous in nature. Tuberculomas develop in the brain when the initial “Rich focus” does not rupture into the meninges but expands locally within the brain parenchyma. The tuberculoma may also originate in the meninges, and may be found in the superficial cortex. The meningeal form may resemble a meningioma.

Patients with intracranial tuberculoma most often present with seizures (60 to 100%), symptoms and signs of raised intracranial pressure (56-93%), and focal neurological deficits (33-68%). In a magnetic resonance imaging (MRI) based study, Gulati et al found tuberculoma as the commonest cause of chronic seizures, in 64 out of 158 patients. In the brain, there may be multiple caseating granulomas, although most of the patients (66-73%) have single or confluent large granulomas with necrotic centre. Tuberculomas may also be multiple or miliary (Figs. 1, 2).

Although tuberculoma appears avascular when studied angiographically, its appearance on computerised tomographic (CT) scan and MRI varies. It is consistent with the evolving granulomatous nature of the disease. During the initial phase of the disease, oedema and necrosis may appear as a low attenuating area on CT scan. Once the granuloma has begun to organize, there may be high attenuation, contrast enhancement and calcification, as well as ring enhancement and a variable degree of surrounding oedema. The enhancement may be homogenous or there may be a central radiolucent area corresponding to the central zone of necrosis.

MRI is considered to be more sensitive than CT in detecting tuberculomas of the cerebral parenchyma. Tuberculomas are isointense with grey matter on T1-weighted MR images. On T2-weighted images, lesions show central hyperintensity. In some cases, a hypointense ring is present within the wall of the tuberculoma on T2 weighted images. Most tuberculomas are further outlined by a collar of high signal, resulting from oedema, on T2-weighted images. Tuberculomas, typically, “enhance” after the intravenous administration of gadopentetate dimeglumine in a solid or ring pattern.

DIFFERENTIAL DIAGNOSIS

The CT/MRI diagnosis of tuberculoma is largely presumptive in view of its nonspecific appearance. Cysticercus granuloma, pyogenic abscess, metastases, fungal granuloma, and at times, glioma may be indistinguishable from tuberculoma.

* Department of Neurology, King George’s Medical College, Lucknow
Correspondence: Dr. R.K. Garg, Department of Neurology, King George’s Medical College, Lucknow - 226003.
Differentiation from neurocysticercosis

Clinical picture and CT scan in both the diseases are very similar. Several diagnostic points have been suggested from time to time but could not prove useful. In tuberculoma, a central speck of calcification, ‘target sign’, had been considered pathognomonic. Similar punctate calcification may also be seen in cysticercus granuloma: McCormick et al noted it in 55% of their patients.

In patients with partial seizures the cranial CT scans usually show small ring enhancing lesions. Initially, these lesions were considered tuberculomas and were prescribed antituberculosis treatment. Later, Rajeshkhar et al from Vellore unequivocally demonstrated that majority of these lesions were cysticercus in nature; only a few were tuberculomas. In their study, presence of signs of raised intracranial pressure, focal neurological deficits, along with certain CT features of the lesion (>20 mm size, irregular margin, and midline shift) were suggestive of intracranial parenchymatous tuberculoma. However, none of these features are specific enough to start the antituberculosis therapy.

Differentiation from other localised brain lesions

Brain abscesses are usually characterised on CT scan by a central cystic lesion contained within a well defined enhancing ring lesion with a substantial amount of surrounding oedema. A tuberculous abscess may also be clinically and radiologically indistinguishable from pyogenic abscess. The protracted course and presence of calcium inside the intracranial lesion make the diagnosis of tuberculoma likely. A syphilitic gumma may be a solitary circumscribed lesion in the brain, but this lesion would be unusual without evidence of syphilis elsewhere. Nocardia, an aerobic ‘Gram positive’ bacillus that behaves more like a fungus than bacterium, occurs mostly in immunocompromised persons, and produces poorly capsulated, frequently multiloculated, liquefied abscesses in the brain. There is evidence of pulmonary disease in 60 per cent of cases. Actinomycosis, which invades the nervous system in 1 to 3 per cent of patients with systemic infection, produces a well encapsulated pus filled cavity containing characteristic sulphur granules. Evidence of cervicofacial, thoracic or abdominal disease is invariably present.

Protozoal disease may produce focal brain lesions, especially those due to amoebiasis and toxoplasmosis. Acquired toxoplasmosis is predominantly a disease of immunocompromised persons, and usually causes encephalitis, circumscribed microglial nodules, or haemorrhagic and necrotic lesions in brain parenchyma. Certain fungal diseases that may produce intracranial granulomas need to be considered in differential...
DIAGNOSIS OF INTRACRANIAL TUBERCULOMA

DIAGNOSIS OF INTRACRANIAL TUBERCULOMA

Cryptococcus neoformans, which usually causes a chronic meningitis, may result in solitary granuloma. Candida albicans may produce multiple parenchymal brain abscesses or granulomas in an immunocompromised host. It closely resembles tuberculoma, although the Candida granuloma tends to be located predominantly in white matter rather than in the cortex and is usually associated with spinal fluid pleocytosis and poor prognosis. Evidence of candidiasis elsewhere in body should be present. Aspergillosis, which causes bronchopulmonary infection in immunocompromised patients can also result in solitary or multiple brain abscesses which progress to form granuloma that may calcify. Another fungal disease which produces intracerebral granuloma is mucormycosis especially in those with uncontrolled diabetes. Hydatid cysts of brain appear lucent on radiographic studies and may transform into a gelatinous mass very rarely.18,20

Primary brain tumours or the more common localized intracranial lesions are likely to be mistaken for tuberculoma, especially oligodendroglialomas which are more likely to calcify and produce a hyperdense lesion demonstrable on plain CT scan. Tumors metastatic to nervous system are often multiple, and a few appear hyperdense on CT scan like secondaries from lung cancer, melanoma, choriocarcinoma and renal cell carcinoma. Absence of substantial oedema and mass effect on CT scan, the presence of calcification in the lesion and the slow evolution of the lesion exclude this possibility. Primary central nervous system lymphoma is an uncommon lesion of brain. It has a rapid course otherwise indistinguishable, on clinical and radiological grounds, from tuberculoma.18

BIOPSY

Accurate diagnosis of tuberculoma is not possible till brain lesion in question is subjected to histopathological examination. The small single enhancing lesions (in patients of epilepsy), which were earlier considered as tuberculoma, were found to be cysticercus granuloma in the majority, on biopsy.15 In a study by Jaya Kumar et al (1993)21 correct preoperative diagnosis of tuberculoma had been made in only 39 of the 52 (75%) patients. It was mistaken for glioma in 7 and medulloblastoma in two. In a study by Traub et al22 only in 3 patients out of 11 who presented with mass lesion tuberculoma could be confirmed after brain biopsy. They also reported that brain biopsy was a risky procedure, and might even lead to death.

SEROLOGICAL EVIDENCE OF TUBERCULOSIS

Serological tests for the diagnosis of tuberculosis, based on the recognition of serum IgG antibodies of selected mycobacterial antigens and the use of enzyme-linked immunosorbent (ELISA) technique have been developed. When diagnosis is in doubt, serological evidence of tuberculosis may prove useful in the absence of histopathological confirmation. Antimicrobial antibodies are absent in healthy individuals. A positive test by ELISA technique can be used as supportive evidence in the diagnosis of intracranial tuberculoma.23 For example, in a patient having multiple nodular enhancing lesions of brain along with subcutaneous nodules, ELISA was negative for neurocysticercosis while it was positive for tuberculosis. Biopsy of subcutaneous nodule also showed tuberculous granuloma.24 However, a major limiting factor with serological tests remains the high cost.

TUBERCULOSIS ELSEWHERE

If facilities for serological studies are not available, a reliable diagnosis can be made if there is evidence of tuberculosis elsewhere.25 A chest X-ray should be done in every patient. In the study by Jaya Kumar et al,21 pulmonary tuberculosis was evident in 14 out of 52 patients and seven others had history of close contact with other tuberculous patients in the family. In all these cases brain biopsy confirmed tuberculous nature of intracranial mass lesions. One of our patients had multiple small nodular lesions scattered throughout the brain. X-ray chest showed unequivocal evidence of pulmonary tuberculosis. Patient responded well to antituberculosis therapy (Fig. 2).

ASSOCIATION WITH TUBERCULOUS MENINGITIS

It is not uncommon to find co-existing
tuberculomas in the presence of tuberculous meningitis. These lesions appear as discrete nodules or grape like clusters of ring enhancing lesions adjacent to the basal cisterns. In the presence of clinical, cerebrospinal fluid and CT criteria diagnostic of tuberculous meningitis, diagnosis of tuberculomas can be made with confidence. Demonstration of tubercle bacilli on culture or guinea pig inoculation is positive only in small proportion of patients and so it can not be relied upon.

NEWER METHODS OF RAPID DIAGNOSIS

Gene amplification by the polymerase chain reaction (PCR) to identify mycobacterial DNA has been used with great sensitivity and specificity. If this technique is available, it offers great promise for rapid diagnosis. In reference laboratories with sufficient instrumentation, high performance chromatographic techniques are capable of rapidly identifying mycobacteria in caseous material, by the presence of characteristic mycobacterial lipids.

RESPONSE TO ANTITUBERCULOSIS TREATMENT

When the diagnosis of tuberculoma is considered probable, a trial of antituberculosis therapy may be instituted even without histopathological confirmation. Improvement in clinical and radiological features may provide valuable evidence for the diagnosis of these lesions. However, the response to antituberculosis treatment may not be rewarding every time as these lesions are known to increase in size on treatment adding to the problem of diagnosis and management.

CONCLUSION

Despite recent advances in imaging techniques, the diagnosis of intracranial tuberculoma remains a challenge. However, a diligent search for certain indicators of tuberculous nature of intracranial lesion should be made. Presence of these markers helps in making fairly accurate diagnosis of intracranial tuberculomas and antituberculosis treatment may be started with confidence.

REFERENCES


27. Ahuja, G.K., Mohan, K.K., Prasad, K. and Behari, M. Diagnostic criteria for tuberculous meningitis and their validation. Tubercle & Lung Dis. 1994, 75, 149.

