

Computed Tomographic evaluation of Pott's disease in Accra

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Summary

Background: Radiological investigations are central in the diagnosis and management of TB spine. In Ghana there is a dearth of literature on the disorder. This paper seeks to describe the CT features of the bony and soft tissue changes in Pott's disease.

Method: It is a descriptive report of the CT scans performed on 30 patients with proven Pott's disease from January 1998 to December 2000 at the Korle Bu Teaching Hospital Accra, Ghana.

Results: The disorder was common among children and young adults (76.7%). Chronic back pain was the frequent presenting complaint (53.3%). The dorsal spine remains the site of preference while T11 recorded the highest incidence (73.3%). The vertebral body was destroyed in all the cases and the fragmentary type of bone destruction was the common observation. The incidence of cord compression demonstrated by CT was high (73.3%). Other findings were paraspinal and epidural masses observed in (66.7%) and (73.3%) respectively.

Conclusion: CT images demonstrated the spinal level of destruction. Improved resolution also showed detailed changes within the outlined soft tissue masses, facilitating early diagnosis and prompt initiation of therapy.

Key words: Pott's disease, Ghana, CT-scan.

Résumé

Des enquêtes radiologiques sont obligatoires dans le diagnostic et la prise en charge de TB de la colonne vertébrale. Au Ghana, il y a la pénurie de la documentation sur le trouble. Cet article fait des efforts de décrire les traits de CT pour ce qui est du changement de tissu mou et osseux dans la maladie de Pott.

Méthode: C'est un rapport descriptif de CT examiné au scanner opéré sur 30 malades atteints de la maladie de Pott éprouvée de janvier 1988 au décembre 2000 au centre hospitalier universitaire de Korle Bu, Accra, Ghana.

Résultats: Le trouble est courant parmi des enfants et jeune adultes 76,7% un mal de chien dans le dos était la plainte courante pendant la présentation (53,3%). L'épine dorsale est toujours le siège de préférence tandis que le T11 est recensé ayant l'incidence la plus élevée (73,3%). La colonne vertébrale était détruite dans tous les cas et l'observation la plus courante est le type fragmentaire de la destruction d'os. L'incidence de compression de cordon démontrée par CT était élevée 73,3%. D'autres résultats étaient grande quantité de paraépine et épinal remarqués en 66,7% et 73,3% respectivement.

Conclusion: des images à travers le CT ont démontré le niveau de la destruction dans la colonne vertébrale. Résolution améliorée a également démontré des changements détaillés à l'intérieur de grande quantité de tissu mou déjà indiqués, ce

qui permet un diagnostic immédiat et l'initiation rapide de la thérapie.

Introduction

Tuberculosis (TB) of the spine otherwise known as Pott's disease remains an important medical problem in West Africa.^{1,2,3} Its morbidity and mortality rates are also well known in the subregion.^{1,2,3,4,5} Expectedly radiological investigations are central in the diagnosis and management of the disease.^{4,6} In 1997 Obisesan et al.⁴ in Nigeria described the plain film findings in TB spine in Ibadan Nigeria. However very little has been documented about the disorder in Ghana. The correlation of the radiological picture of Pott's disease together with an understanding of its pathophysiology is said to be vital to the initiation of appropriate therapy and overall prognosis.^{1,2} Since the advent of Computed Tomography (CT) neuroimaging has been given a boost.^{4,5} The dependency of this imaging modality on attenuation numbers is known to enhance the differentiation between soft tissue and bony abnormality, which is invaluable in demonstrating disc, vertebral, and spinal cord disorders in TB spine. The aim of this study is to describe the CT features of Pott's disease in Ghana in order to facilitate early diagnosis especially with the recent resurgence of tuberculosis in association with HIV/AIDS.

Material and Methods

This is a descriptive study of the CT scans performed on 30 patients with proven Pott's disease whose diagnosis were based on clinical and radiological findings. The study period was between January 1998 to December 2000. All procedures were done in the Department of Radiology, Korle - Bu Teaching Hospital Accra. Patients were examined using a Philips CSQ Scanner. Fifteen mls intrathecal metrizamide was administered in all the patients before post contrast scanogram and contiguous 4mm axial slices were done. The cuts were performed from one vertebra above, through the region of interest to just one vertebra below the level of the disease, after the scanogram had been reviewed.

These CT images were analysed with regards to the following: presence of scoliosis and or kyphosis, evidence of vertebral destruction and disc space involvement, region and number of vertebrae affected, type of bony destruction and the site of vertebral destruction, whether in the body or posterior elements. The presence of any soft tissue; Para spinal or epidural as well as calcified debris were also noted.

Results

Of the 2,112 CT scans of the spine done during the four year - period only 30 (1.42%) were carried out for Pott's disease. These patients were made up of 20 males and 10 females aged 2 - 47years (mean 32years).

Table 1: This is the age distribution of the patients in the

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study. The peak incidence was in the third decade and the male female ratio was 2: 1.

Table 1 Distribution of age and sex in the 30 patients with Pott's disease

Age groups	Number (Percentage)		
	Male	Female	Total
0 - 9	3(10)	3(10)	6(20)
10 - 19	5(16.7)	2(6.7)	7(23.3)
20 - 29	7(23.3)	3(10)	10(33.3)
30 - 39	4(13.3)	1(3.3)	5(16.7)
40 - 49	1(3.3)	1(3.3)	2(6.7)
Total	20(66.7)	10(33.3)	30(100)

Table 2 Clinical presentation and percentage incidence

Clinical presentation	Number	(%)
1. Back pain	16	(53.3)
2. Paraplegia	12	(40)
Flaccid	3	(10)
Spastic	9	(30)
3. Neck pain	3	(10)
4. Inability to walk	14	(46.7)
5. Kyphosis	27	(90.0)
6. Soft tissue swelling over the spine	6	(20)
7. Urinary incontinence	5	(16.7)
8. Feecal incontinence	3	(10)
9. Feecal and Urinary incontinence	2	(6.7)
10. Quadripareisis	2	(6.7)

Table 2: This describes the clinical features of the patients. The most common presenting symptom was longstanding back pain and this occurred in 16(53.3%), while inability to walk was noted in 14(46.7%) and quadripareisis in 6.7%.

Table 3 Distribution of vertebral destruction in the 30 cases of Pott's disease

Site of lesion	No (% out of 30 patients)
Cervical spine	3(10.0)
Thoracic spine	11(36.7)
Lumbar spine	7(23.3)
Thoraco lumbar spine	9(30.0)
Lumbo sacral spine	--
Sacral spine	--

Table 4 Computed tomographic features of Pott's disease and incidence

CT features	No (%out of 30)
1 Site of vertebral destruction	
• Vertebral body	30(100)
• Posterior element	18(60.0)
the pedicles	9(30.0)
the laminae	4 (13.3)
spinous process	3(10.0)
transverse process	2 (6.6)
2. Intervertebral disc destruction	26(86.7)
3. Presence of paraspinal soft tissue	20(66.7)
Unilateral	14 (46.7)
Bilateral	6 (20.0)
4. Associated cord compression with epidural mass	22(73.3)
5. Kyphoscoliosis	27(90.0)
6. Straightening of the spinal curvature	10(33.3)

Table 3 shows the distribution of the lesion in the spine. The highest frequency of destruction occurred in the dorsal spine (11/30,36.7%) followed by the lumbar (7/30,23.3%) and only 3 cases were noted in the cervical spine. Multiple vertebral

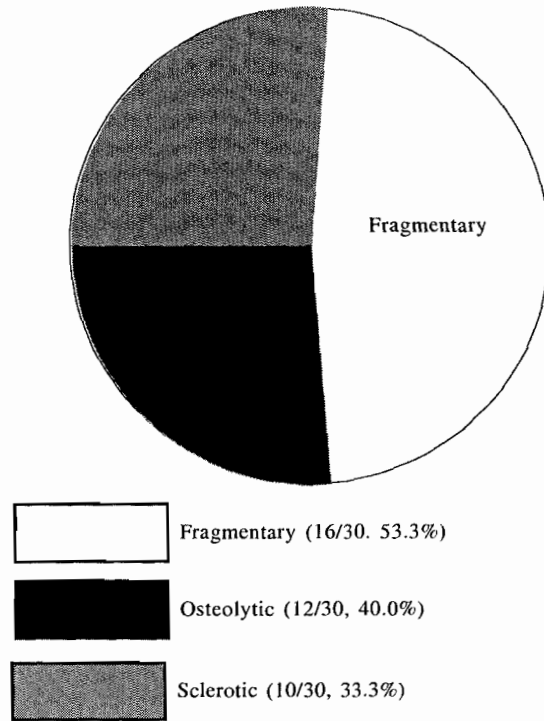


Fig. 1 Piechart showing the type of bone destruction in the spine.

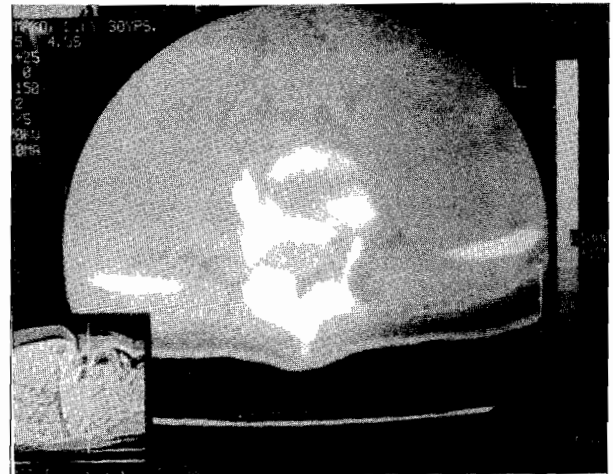


Fig. 2 Contrast enhanced axial CT image of the vertebral body showing fragmentary pattern of bone destruction. Note the extradural compression of the spinal cord on the right.

body involvement were demonstrated in 26/30(86.7%), of these 86.7% 16(53.3%) involved two contiguous vertebral bodies. T11 recorded the highest incidence of destruction 73.3%. Skip lesions were seen in only (2/30, 6.7%).

Table 4 has listed the various CT features recorded in the study. The scanogram confirmed kyphoscoliosis in 90.0% most of which were in the dorsal spine. The vertebral bodies were destroyed in all 30 cases. In 18(60.0%) there were also destruction of the posterior elements. The common site of destruction in the posterior element was the pedicle (50.0%). Associated lamina destruction was recorded in 4(13.3%), while

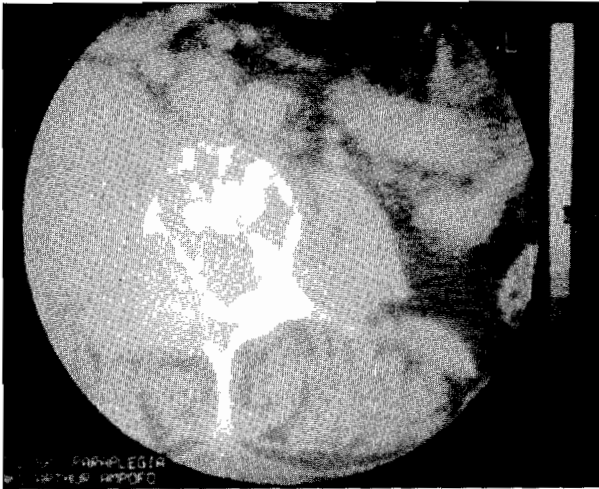


Fig. 3 Contrast enhanced axial CT image of the intervertebral disc showing irregular osteolytic destruction. Associated right paraspinal and extradural soft tissue masses are also present.



Fig. 4 Contrast enhanced axial CT image showing pedicular destruction with bilateral paraspinal soft tissue containing calcific densities.

the spinous processes were affected in 3(10.0%). The costal heads of the ribs were destroyed by an equal incidence. Associated paraspinal soft tissue masses were demonstrated in 20(66.7%) and calcifications were present in 50% of these masses. Fig. 4 They were noted within the Psoas muscles as prominent soft tissue densities with loss of the usual fat planes. These paraspinal abscesses even though at the level of the bony destruction, were demonstrated in their entire longitudinal extent by CT. They were always significantly greater than the extent of the vertebral body destruction. The average extent of these soft tissue masses was 4 vertebral body lengths when compared with an average of two body lengths in the case of the bony disorder.

Bony destruction

Fig 1 shows the pattern of destruction. The fragmentary type Fig 2 occurred most 16(53.3%), while the sclerotic type was found in 10(33.3%).

Intervertebral disc involvement

The hypodense end plates appeared irregular in outline and showed several areas of destruction within it. This was

noted in all the 86.7% with destruction of contiguous vertebral bodies.

Cord compression

Neurological signs of cord compression were present in 22(73.3%) but compression by epidural mass was seen in all the patients. This compression was enhanced by intrathecal contrast. The bony fragments within the epidural soft tissue mass were also well demonstrated Fig 4 in 6(20.0%). The axial images produced a reasonable resolution to enhance proper evaluation of the paraspinal and epidural masses.

Discussion

Though a low CT scan frequency of the spine in Pott's disease (1.42%) is noted in our study. This disorder is said to occur in approximately 1% of patients with Tuberculosis^{4,5,6,7} while TB spine accounts for more than 50% of musculoskeletal TB.^{6,7,8} The disease commonly affects children and young adults.^{5,6,7} This agrees with our report where 23(76.7%) of our study population were below 30years. Chronic back pain is also a known presenting complain.^{4,5} This can occur alone or with other symptoms as stated in table 2. Like previous reports in the subregion.^{3,4,5} The dorsal spine remains the site of preference (56.7%) with T11 recording the highest incidence of 73.3%. This again is in consonance with the report by Obisesan et al.⁴ This site of predilection in the lower dorsal and upper lumbar spine is said to be due to the ease at which these areas twist, strain and also undergo minor trauma which helps the tubercle bacilli to settle in them.^{4,5} Although single level of contiguous vertebral involvement is more frequently observed,^{8,9} multilevel involvement can also occur.¹⁰

The focus of infection can either be in the vertebral body or around the disc.¹¹ When vertebral body destruction occurs centrally, there is reduction of the vertebral height, which was best demonstrated in the reconstructed sagittal images. The involvement of vertebral appendages and ribs is usually due to direct spread of the disease from the vertebral body.¹² This posterior element extension is common in the Negroid population.^{3,4,12} Our study is in agreement with this observation as 60.0% (Table 4) had posterior element involvement. In such cases the pedicles were the frequent site of destruction especially in the dorsal spine 83.7%. This is attributed to the close proximity of the contiguous thoracic vertebrae.^{13,14} The intervertebral discs 26(86.7%) showed irregular osteolytic destruction in the axial images (Fig 3) and narrowed outline on the sagittal slices.

Tissue necrosis and breakdown of inflammatory cells result in paraspinal abscess which were noted in 20(66.7%). These paraspinal masses were detected at the exact level of the disorder, which is possible because of the increased contrast and improved resolution between the abscesses and the normal paraspinal soft tissue, provided by the CT images (fig 4) when compared with those of conventional radiography. The abscesses were noted above and or below the level of the involved vertebra and accounted for an average of 4 vertebral body lengths in their longitudinal extent.

These soft tissue masses have been characterised by their CT attenuation values into granulation tissue or frank

abscess; the latter having higher values than the frank abscess.^{15, 16} The abscess can track intraspinally into the canal causing an epidural compression which is well demonstrated by the displacement and compression of the hyperdense intrathecal contrast (fig 4). The frequency of cord compression diagnosed by CT was high in our study 73.3%, a radiological finding made easy by the use of the bony window in CT images. The presence of bony fragments within these epidural masses was well demonstrated in 6(20%) (fig 4).

The fragmentary type of bone destruction recorded the highest incidence 60.0% Fig.1 This was demonstrated in the vertebral body and appendages fig.2 It is said to be due to numerous residual small bone fragments that were readily picked up by the bony window. The above findings are in consonance with other reports.^{8,9} A combination of osteolytic and fragmentary destruction was observed to be common.

Conclusion

This communication reiterates spinal TB as an important differential diagnosis for chronic back pain. The authors agree that the demonstration on CT images of fragmentary bone destruction especially if associated with para spinal soft tissue mass is strongly indicative of tuberculosis of the spine. The presence of calcification or bony fragments in this soft tissue mass lends further support to the diagnosis. In patients with neurological deficit, CT accurately defines the presence and extent of epidural compression and is especially useful in planning tissue biopsy and in the detection of bone fragments within the epidural space especially if surgery is contemplated.

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Intracerebral abscesses: Outcome following management in the CT era

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Summary

Background: There are no pathognomonic presenting features of intracerebral abscesses. Their clinical features could be confused with those of a tumour or any other space occupying lesion.

Study Design: We analyzed the symptoms, predisposing factors, diagnostic modalities, prevalent causative microbes, management and outcome in 11 patients, for whom complete records were available and who were managed for confirmed intracerebral abscess in our Neurosurgical Unit from 1996 to 2000 and compared our findings with those from other series.

Results: In these patients focal neurological deficit was the most common clinical feature, trauma was the most predisposing event and Computerised Tomography (CT) Scanning remained the most dependable diagnostic tool. In our practice, burr hole drainage augmented with a minimum of 4 weeks intravenous antibiotics, was the most frequently used treatment modality.

Conclusion: The outcome was satisfactory (ability to return to pre-morbid activities and duties, with no disabling neurological deficits) in 72.8% cases. There was one death. This modality remains an effective way of treating patients with intracerebral abscess.

Key words: Intracerebral abscess, Computerized tomography, Burr hole, Craniotomy, Craniectomy.

Résumé

Introduction: Il n'y avait pas de cas traits pathognomoniques d'abcès intracérébraux. Leurs traits cliniques pourront être confus avec ceux d'une tumeur ou n'importe autre lésion dans l'espace.

Plan d'étude: Nous avons analysé les symptômes des facteurs prédisposants, modalités diagnostiques, la prévalence des microbes causatifs, la prise en charge et les résultats chez les 11 patients dont les dossiers détaillés sont disponibles et chez qui on avait traité pour l'abcès intracérébral dans notre Service Neurochirurgical de 1996 à 2000 et nous avons comparé nos résultats avec ceux des autres séries.

Résultats: Chez ces patients, le déficit focal neurologique était le trait clinique le plus courant. Le traumatisme était un événement le plus prédisposant et le scanner, Tomographie calculée, est toujours un instrument diagnostique le plus fiable. Dans notre domaine, le drainage burr hole augmente avec des antibiotiques intraveineux de 4 semaines au minimum était la méthode du traitement le plus couramment utilisé.

Conclusion: Le résultat était satisfaisant (capacité de reprendre des activités prémorbides et des devoirs, sans aucune infirmité neurologique ou déficits) dans 72,8% des cas. Il y avait une mort. Cette méthode reste toujours un

moyen efficace de soigner des patients atteints d'abcès intracérébral.

Introduction

Intracranial abscesses are classified into three types viz. Epidural, Subdural and Intraparenchymal. In 1876, Sir William Macewen first diagnosed, localised, and suggested the treatment for this disease.¹ The causative organisms are mainly gram-positive cocci^{2,3} except in the paediatric age group where *Haemophilus influenzae* is more frequently implicated. However, with meticulous microbiological culture techniques, anaerobic organisms - *Bacteroides* and *Streptococci spp* - are now frequently seen. The major clinical features include Headache (70 - 97%),^{4,5} Fever (50 - 55%), Seizures (30 - 50%), Nausea and Vomiting (25 - 50%)^{6,7} and altered level of consciousness (65%)^{4, 5, 8} ranging from confusion and drowsiness to obtundation and coma; and in most large series, over 60% of patients present with focal neurological deficits.^{4,5} Of all the scientific advances made since Macewen's pioneering efforts, none has impacted much on the management of cerebral abscess as Computerised Tomography, CT^{9,10} and more recently, Magnetic Resonance Imaging, MRI. The treatment options include (a) medical treatment with intravenous antibiotics only^{9,11,12}. (b) initial antibiotic therapy followed by Burr hole aspiration; (c) burr hole aspiration combined with antibiotic therapy; and (d) craniotomy/craniectomy with excision of the abscess wall. Published series report varying outcomes by these modalities^{13, 14, 15} but the consensus is that drainage and excision yield superior result.¹³ The results of management over the past 40 years have progressively improved; for example, mortality figures as high as 42% in the pre-CT era have declined to 2.9% recently.¹⁶

However, with the advent of the Acquired Immunodeficiency Syndrome, AIDS, the incidence, morbidity and mortality appear likely to rise again in the coming years,¹⁷ especially in areas of high prevalence of this disease.

In this study, we evaluated intracerebral abscesses seen at the University College Hospital, UCH Ibadan - a major referral centre for neurological diseases in Nigeria.

Materials and Methods

Between 1996 and 2000, a total of 45 patients were managed in our Neurosurgical Unit for intracranial abscesses. These consisted of 2 epidural, 21 intraparenchymal (including intraventricular) and 22 subdural abscesses. Comprehensive hospital records were available for the 2 epidural, 17 of the 21 intraparenchymal, and 9 of the 22 subdural cases. Of the 17 intraparenchymal cases, 11 were intracerebral, while 6 were ventricular abscesses, all of whom were infants.

The clinical, laboratory and radiological records of these

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11 cases of the intracerebral abscess were retrospectively reviewed. We compared our results with published data.

Results

The common presenting symptoms among the 11 patients were: Altered level of consciousness 7(63.7%), seizures 6 (54.6%), headache 5 (45.5%), fever 5 (45.5%) and vomiting 4(36.4%); Table 1. Ten patients (91%) had focal neurological deficits, the most common of which was hemiparesis 9 (81.9%).

Table 1 Age and major clinical features

Age	No
1 - 10	-
>10 - 20	5
>20 - 30	3
>30 - 40	2
>40 - 50	1
>50	-
Major clinical features	No
Focal Neuro. Deficits	10
Altered sensorium	7
Seizures	6
Headache	5
Fever	5
Nausea/vomiting	4

The male: female ratio was 4.5: 1. An analysis of the age distribution showed that the majority of patients 5(45.5%), were in the >10 - 20 year age group, whereas >20 - 30 year olds were 3(27.3%), >30 - 40 years 2 (18.2%), and >40 - 50 years 1 (9.1%). There were no patients older than 50 years. Table 1. One patient had a congenital cyanotic heart disease (double output right ventricle, mitral atresia, atrial septal defect and patent ductus arteriosus).

The predisposing factors were trauma 6(54.6%), iatrogenic (post-craniotomy/craniectomy) 3(27.3%), sepsis 1(9.1%); and immunodeficiency 1(9.1%). Of the trauma cases, 3(27.3%) had gunshot injuries to the head while the remaining 3 cases had road traffic accident, assault and a fall from a height, respectively. All 6 cases had compound skull fractures, 3 of which were depressed fractures. At presentation in hospital, 3 of the head injured cases were mild (GCS 13 - 15), 2 were moderate (GCS 9 - 12), and 1 was severe (GCS 3 - 8).

The diagnosis was made with CT in 9 patients (81.9%), and by clinical evaluation in the remaining 2(18.2%); and the average duration between definitive diagnosis and treatment was 14 days.

Ten patients were surgically treated while 1 opted out of treatment and was discharged on request after he was confirmed HIV positive. The surgical treatment consisted of burr hole aspiration in 4 cases, craniotomy in 3 and craniectomy in 3. One of the 3 cases treated by craniotomy had a foreign body (bullet) within the abscess cavity which was removed during the drainage and excision, while the remaining 2 patients underwent re-opening of an infected craniotomy to drain abscesses following gross total excision of tumours (one sphenoidal ridge meningioma, and a pituitary

adenoma). Two of the 3 cases treated by craniectomy had traumatic compound depressed skull fractures, and the third was a postoperative infection following a posterior fossa craniectomy for cystic cerebellar astrocytoma. We extended the craniectomy in order to explore and excise the abscess cavity.

We isolated the following organisms from the abscesses: *Klebsiella spp.* 3 patients, *Escherichia coli* 2 patients, *Pseudomonas aeruginosa* 1 patient, and *Staphylococcus aureus* in 4 patients. The culture was sterile in 3 cases, all of whom were already receiving third generation cephalosporins prior to laboratory testing. In 3 patients there was a mixed growth of *Staphylococcus aureus* and *Klebsiella spp.*; and 1 (9.1%) had a mixed growth of *Escherichia coli* and *Staphylococcus aureus*.

The organisms cultured were mainly sensitive to ceftriaxone, ceftazidime, gentamicin and ciprofloxacin; each in combination with metronidazole. Of the 10 surgically treated patients, 1 (9.1%) died while on treatment, another remained with severe neurological deficit from the primary traumatic brain injury, while the remaining 8 (72.8%) made satisfactory recovery (minimal or no neurological deficits, and return to per-morbid activities and duties.)

Discussion

A brain abscess is initiated when micro-organisms are introduced into cerebral tissue as a result of trauma, contiguous infection or haematogenous dissemination. There are four phases in the development of an abscess: Early cerebritis (days 1 - 3), late cerebritis (days 4 - 9), early encapsulation (days 10 - 13) and late encapsulation (day 14 onwards).^{18, 19} Suppurative processes of the paranasal sinuses, middle ear and mastoid, as well as postoperative inoculation, post-traumatic contamination and congenital heart diseases with right to left shunts are the common predisposing factors.^{4, 20, 21} Rish et al observed that post-traumatic abscesses occur relatively early after trauma.²²

Although the source of infection is frequently apparent, the definitive cause may remain obscure in 10 - 37% of patients.²³ In our study, trauma was the leading cause (6/ 11 patients) and teenagers (5/11 patients) were the most frequently afflicted. The male : female ratio of our study was 4.5:1. This profile is similar to that observed by Brewer et al,²⁴ and Samson and Clark.⁴

The single patient with sepsis (9.1%) had an Eisenmenger complex. Right-to-left shunting of cardiac blood not only leads to hypoxaemia, it also allows blood that has not passed through the filter of the pulmonary bed to reach the cerebral circulation. This leads to a hypoxic environment in the brain, which favours microbial implantation. Abscess associated with congenital heart anomalies are generally solitary;²¹ but our single patient with cardiac disease harboured multiple abscesses involving the frontal and parietal lobes. Cerebral abscess in patients with cyanotic heart disease has been shown by Fischer et al to be a leading cause of morbidity and mortality in these patients.²⁵

All the patients with trauma as the predisposing factor presented between 1 - 10 days after injury. This time frame is consistent with previous observations.²²

Compared with the literature in which focal presenting signs are seen in 60% of patients, a very high proportion of our patients (10 of the 11) presented with focal neurological deficits. Hemiparesis (9/11 patients) and altered sensorium (7/11 patients) were more frequent presenting features than headache (5/11 patients) and fever (5/11 patients). We believe that this is because patients do not present early for specialist care. Poor transportation and communication infrastructures, the dearth of health insurance inadequate manpower and diagnostic facilities and poor patient education are some of the factors that contribute to delay in presentation to specialist care. Late presentation permits the disease to evolve to an advanced stage (the accumulation of pus and the development of peri-lesional oedema) in which focal signs become prominent. In our resource-poor environment, early surgical intervention is therefore infrequent. Similarly, serial neuroimaging studies for follow-up in primary conservative management and for post-operative care are difficult.

The second leading presentation in our series was an alteration in level of consciousness. Most of the abscesses were supratentorial in location and were sizeable enough to impair consciousness. This further attests to the significance of the delay in presentation of our patients. Seizures in 6 cases (54.6%) were the third most common features. This is not unusual²⁶ In many of these patients, we relied on family members and friends for the history of the illness. Evaluation of subjective symptoms such as headaches may therefore be fraught with inaccuracy. Furthermore, in patients with head trauma, the real onset of headache due to cerebral abscess might be masked in the continuum of features from the main event of trauma.

Our microbial profile is similar to what has been previously reported,⁸ leads with coliforms such as *Klebsiella spp.*, *Escherichia coli* and *Pseudomonas aeruginosa*, all of which constituted 54.6% with *Staphylococcus aureus* seen in 36.4% of the cases. This is in keeping with other reports.²⁶ According to the literature, sterile cultures may be found in 25 - 30% of patients. Our experience is similar. But, de Louvois et al have reported that positive cultures could be virtually obtained in every pus sample by meticulous microbiological techniques even in the presence of antibiotic therapy.²⁷ Logan and co-workers in United Kingdom have however been able to make a bacteriological diagnosis using the Polymerase Chain Reaction for *Neisseria meningitidis* IS1106 from CSF, and 16S rRNA gene sequencing from the specimens of pus. Cultures from these specimens had been previously and consistently sterile due to antibiotic therapy.²⁸

In making our definitive diagnosis, CT scan was performed in 9 cases. It was positive in all nine, probably because the disease had evolved to a stage of an easily identified space-occupying lesion before presentation. In two patients, diagnosis was limited to clinical assessment due to lack of funds for CT, although the history and clinical features were considered diagnostic. In some series, CT sensitivity, especially in the early phases, ranged from 70 - 90%,^{9, 10} and cerebral angiography and the more sensitive Magnetic Resonance Imaging, MRI can improve the accuracy of diagnosis.

All of our patients received surgical treatment. Of the

different surgical techniques used, burr hole aspiration was the most frequent in our series (4/10) and with very good results, supporting results from Ohaegbulam and Saddeqi, and several other workers.^{29, 30, 31} The other methods, craniectomy and craniotomy simply reflect the aetiologic factors of traumatic head injuries and craniotomy in the respective cases. In the work by Emery et al, Burr hole aspiration was done in 79.5% of cases and craniotomy with excision 8.8%¹⁶

Brain abscess as a complication of a penetrating head injury is preventable by prompt and aggressive debridement of all necrotic non-viable tissues at the time of injury; but the average duration between diagnosis and treatment is relatively long, 14 days in our series. As a result, our patients are at great risk of developing intracranial abscesses. We have already discussed the factors responsible for late presentation (*vide supra*).

All our patients had specific intravenous antibiotic treatment as determined by microbiological studies, post-operatively, for at least 28 days. This duration of treatment is in excess of the conventional practice of 14 to 21 days.³² However, the rationale behind giving antibiotics beyond 11 days, lately, came under scrutiny with the demonstration by Jamjoom³³ that a short course antibiotic therapy is sufficient after drainage, if C-reactive Protein, CRP returns to normal. Despite the short duration of this study there was no recurrence in 6 - 36 months of follow-up.

The outcome from our series is as follows: there was one death; in one patient, there were persistent severe neurological deficits sustained primarily from the severe head injury (Glasgow Coma Scale score of 6 at presentation); HIV-positive patient was on requested to be discharged when his preoperative HIV status was confirmed positive; 8 cases (72.8%) who made good recovery, returning to their pre-morbid activities. In 5 of these patients complete neurological recovery was evident prior to discharge, after which the patients were lost to follow up; the others were followed up for 2 - 10 months before they stopped attending the clinic. Our mortality rate of 9.1% is consistent with the figures in published series which vary between 2.9% and 10%.^{8, 25, 30} Generally though, our indices appear very encouraging especially in terms of the satisfactory outcome from our management modalities.

Conclusion

Trauma remains a very important predisposing factor in cerebral abscess, coliforms are the leading isolates from abscess specimens, and CT is the best readily available imaging technique in our practice. A combination of surgical drainage augmented with the appropriate antibiotics remains an effective management strategy for securing a favourable outcome.

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