Intracranial Abscesses: Epidemiological trend over a 39-year period at the University of the West Indies

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Abstract

Intracranial abscesses are clinically significant lesions associated with considerable morbidity and mortality. This study aimed to document the incidence, presentation, underlying causes and demographic features of pathologically confirmed intracranial abscesses at the University Hospital of The West Indies over a 39-year period, (1970-2008) and to analyse the change in trend over two arbitrarily chosen time periods, 1970-1989 and 1990- 2008. Ninety three cases were identified. There was a downward trend from 3.8 cases per year to 1.56 cases per year over the time periods. Ages ranged from 3 months to 76 years, with a M: F ratio of 1.45:1. The commonest underlying cause was infection of the ear, nose and throat. Most abscesses were large, solitary lesions occupying the frontal lobe. Streptococci and Gram-negative organisms were the most frequently isolated organisms. In the second time period abscesses due to Toxoplasma gondii in HIV infected patients were also identified.

INTRODUCTION

Intracranial abscesses, including extradural, subdural, and intraparenchymal abscesses, though rare, are a significant problem associated with considerable morbidity and mortality (1, 2). Nevertheless, a local series recently reported substantial improvement in the outcome of such cases since the advent of computed tomography (CT) technology (3). In the face of the AIDS pandemic, there has been global resurgence in the overall prevalence of brain abscesses (4). Also the incidence of fungal brain abscesses has reportedly increased due to the frequent administration of broad-spectrum antimicrobials, immunosuppressive agents and corticosteroids.(2, 5) This article deals with the incidence, presentation, the changing trend in frequency and the underlying predisposing factors of intracranial abscesses over a 39 – year period in a developing country.

MATERIALS AND METHODS

Post mortem and surgical records of all the pathologically confirmed intracranial abscesses diagnosed in the Pathology Department of the University Hospital of the West Indies (UHWI) between January 1970 and December 2008, a 39-year period, were retrospectively reviewed. Patients with both surgical specimens and autopsy reports were counted as one case. Demographic, clinical and pathologic data including age and sex of the patients, presenting symptoms, the location, number and size of the abscesses and the presence of underlying risk factors were analysed. Information regarding the nature of the culpable organism(s) was also sought for each case. The results were compared in the context of two arbitrarily defined time periods: 1970-1989 and 1990-2008.

RESULTS

DEMOGRAPHICS

A total of 12,724 autopsies were performed including 7,869 in the first and 4,885 in the second period and 188,803 surgical specimens were examined including 81,411 in the first and 107,392 in the second period.

A total of 93 cases of intracranial abscesses were identified including 78 cases of intraparenchymal, 13 subdural and 2 extradural abscesses. Of the 93 cases, 65 (69.9%) were described at post-mortem and 28 (30.1%) were diagnosed on biopsy material; hence intracranial abscesses represented (65/12,724) 0.51% of all the autopsy cases and (28/188,803) 0.014% of surgical specimens.

Seventy cases occurred between 1970-1989 and 23 cases between 1990-2008. There was an overall slight male preponderance with an overall M: F ratio of 1.45:1. Patients ranged in age from 3 months to 76 years. There were 23 children aged 12 years and under and 18 patients aged 50 years and over. Adults aged 20-49 years comprised the largest group with 31 patients, followed by adolescents

(aged 13-19 years) with 21 patients. On analysis of each time period, it was noted that adults 50 years and over constituted the largest patient group (39 %) between 1990-2008 (Table 1).

Figure 1

Table 1. Cases per age group in each time period.

Age (yrs)	≤ 12	13-19	20-49	≥ 50	Total
1970-1989	**19**	**17**	**25**	**9**	**70**
	27.1%	24.3%	35.7%	12.9%	
1990-2008	**4**	**4**	**6**	**9**	**23**
	17.4%	17.4%	26%	39.1%	**93**

CLINICAL FEATURES

Clinical data was available in 78 cases. Most patients (83.8%) presented with multiple clinical features suggestive of a space occupying lesion as seen in Table 2. About thirty-one percent of patients had headache, either alone or in combination with other symptoms, 30.1% had fever, and 22.6% presented with hemiparesis. Other significant clinical features included seizures (20.4%), decreased consciousness (18.3%) and confusion or strange behavior (10.8%). Patients presenting with both headache and fever with or without additional clinical features were accurately diagnosed clinically

Figure 2

Table 2. Clinical features of intracranial abscesses at the UHWI

Symptoms/Signs	No of cases
Headache	**29** (31.2%)
Fever	**28** (30.1%)
Hemi paresis	**21** (22.6%)
Seizures	**19** (20.4%)
Decreased conscious level	**17** (18.3%)
Confusion	**10** (10.8%)
Vomiting	**9** (9.7%)
Meningism	**8** (8.6%)

LOCATION

In 78 cases (83.8 %) the abscesses were intraparenchymal; 13 had subdural and 2 showed extradural abscesses. Of the 78 intraparenchymal brain abscesses, 68 (87.1%) were solitary lesions and 10 (12.8%) were multiple discrete lesions. Of the solitary intraparenchymal lesions, most (74%) were located in the cerebral cortex, predominantly in the frontal lobe (41%). In 16% of cases, abscess cavities were large and occupied contiguous lobes. Subcortical lesions (7%) included those involving the basal ganglia, internal capsule, thalamus and the region of the sella turcica. Cerebellar involvement was infrequent (3%). In 16% of cases the precise location of the abscess cavity was not specified.

SIZE

The size of the lesion was documented in 35 cases of intraparenchymal abscesses, and 5 lesions were merely described as “large”. Where documented the size ranged from 0.5cm to 13 cm in maximum dimension. In one case multiple microabscesses were identified histologically. The largest subdural empyema measured 100 ml.

PREDISPOSING FACTORS

The commonest overall risk factor was ear nose and throat (ENT) infections (16.1%) such as sinusitis (8.6%), otitis media (5.4%) and mastoiditis (2.1%). Infective endocarditis (12.9%) was the second most common risk factor whether on a background of congenital heart disease (8.6%), rheumatic heart disease (1.1%) or without any underlying cardiac pathology (3.2%). Other significant risk factors included a history of immunocompromised status and head trauma (10.8% each), and pulmonary sepsis (9.7%). In as many as 31 cases (33.3%) no risk factor or source of sepsis was identified.

The relative contribution of each risk factor per time period analysed was significantly different. ENT infections together represented the major risk factor (17.1%) in the earlier period. Infective endocarditis was associated with a significantly smaller percentage of cases in the latter (4.3%) than in the earlier period (15.7%).

The immunocompromised group formed the largest group; 26.1% of cases in the latter period compared to 5.7% of cases in the first time period. Toxoplasma infection in HIV positive patients was the commonest underlying etiology of intracranial abscesses in the latter and fungal infections in the first time period. The underlying causes of immunosuppression in the cases with fungal abscesses included one patient with systemic lupus erythematosus on steroid therapy; one patient receiving chemotherapy for non –Hodgkin’s lymphoma, one patient with homozygous sickle cell anemia receiving multiple broad spectrum antibiotics and one case of Cryptococcus neoformance infection where the underlying cause for immunosuppression was not known.

While traumatic cases showed a slight upward trend, lung infections were dramatically absent in the latter time period.

Figure 3

Table 3. Predisposing factors in each time period

Risk factors/Source of Sepsis	1970-1989		1990-2008		Total	
ENT† infections	**12**	17.1%	**3**	13%	**15**	16.1%
Sinusitis	7		1			
Otitis Media	4		1		5	
Mastoiditis	1		1		2	
Infective Endocarditis	**11**	15.7%	**1**	4.3%	**12**	12.9%
CHD†	7		1		8	
RHD†	1				1	
De novo	3				3	
Immune compromise	**4**		**6**	26.1%	**10**	10.7%
Leukemia/lymphoma, on chemotherapy	2				2	
Diabetes	-		1		1	
Corticosteroid therapy	1		1		2	
HbSS, on broad-spectrum antibiotics	1				1	
HIV	-		4		4	
Trauma	7	10%	3	13%	**10**	10.7%
Lung infection	**9**	12.9%		0.%	**9**	9.6%
Abscess	5				5	
Pneumonia	4	5.7%			4	
Surgery	2	2.9%	1	4.3%	**3**	3.22%
Craniofacial surgery						
Others	**3**	4.3%			**3**	3.22%
Distant sepsis	2				2	
Local sepsis	1				1	
Scalp infection with osteomyelitis						
None identified	**22**	31.4%	**9**	39.1%	**31**	33.3%
Total	**70**		**23**		**93**	

†ENT – ear, nose and throat, CHD – congenital heart disease, RHD – rheumatic heart disease, HIV- human immunodeficiency virus,

Among the 31 cases with no identifiable risk factor or source of infection there were 3 subdural empyemas, one extradural abscess and 27 intraparenchymal lesions, most of which were solitary lesions located superficially in the frontal lobe.

MICROBIOLOGY

Microbiologic information was available for 37cases, most often as formal culture reports, but in some cases organisms were described on histological examination. No growth was reported in 2 of the 37 cases, and in 4 cases there was polymicrobial growth that was reported as being consistent with contamination. In the thirty one cases where causative organisms were identified, 23 grew pyogenic bacteria on culture. Streptococcus was the most commonly isolated organism, followed by gram negative bacilli and staphylococcal species. Fungi were identified in 4 cases and all were seen in the first time period (Table 4).

Four cases were diagnosed with cerebral toxoplasmosis with abscess formation. All of these were HIV positive and presented in the latter time period.

The identity of the causative organism was elucidated in 24/70 (34.2%) of cases in the first period, and 7/23 (30.4%) of cases in the latter period.

Figure 4

Table 4. Causative pathogens in 34 Intracranial Abscesses at the UHWI

Organism		1970-1989	1990-2008	
Streptococci		**9**	**1**	**10**
	Anaerobic Streptococci	2		2
	Microaerophilic Streptococci	4		4
	S. Pneumoniae	2		2
	S. Viridans	1		1
	Streptococcus sp. (NOS)		1	1
Gram-Negative		**7**	**1**	**8**
	E. Coli	1	1	2
	Enterobacter sp.	2		2
	K. Pneumoniae/P. Aeruginosa	1		1
	Proteus Mirabilis	2		2
	Gram negative bacilli (NOS)	1		1
Staphylococci		**4**	**1**	**5**
	S. Aureas	1	1	2
	S. Pyogenes	1		1
	Coagulase Neg Staphylococci	1		1
	Staphylococcus sp. (NOS)	1		1
Fungi		**4**		**4**
	Candida sp.	1		1
	Crytococcus Neoformans	2		2
	Nocardia Asteroides	1		1
Parasites			**4**	**4**
	Toxoplasma gondii		4	4
Total		**24**	**7**	**31**

TREND OF OCCURRENCE OVER TIME

The absolute frequency of intracranial abscesses identified in our pathology records decreased from 38 cases in the first decade (an average of 3.8 cases/year), to 0.9 cases/year in the 1990's, with a slight resurgence at the turn of the century with 1.56 cases/year in 2000-2008 (Figure 2).

The frequency of abscesses decreased mainly in autopsy cases with time; intracranial abscesses represented 57/7869 (0.72%) of autopsy cases up to 1989, compared to only 8/4885 (0.16%) of autopsy cases after 1990. The relative frequency of intracranial abscesses among biopsy specimens remained largely unchanged; cases represented 13/81,411 (0.016%) of surgical specimens in the first period, and 15/107,392 (0.014%) in the latter period.

The main source of material from which the diagnosis was made differed over the years; before 1990, most

pathologically confirmed cases of intracranial abscess were identified at post-mortem examination 57/70 (81.4%), and in the latter time period biopsy specimens predominated 15/23 (65.2%).

DISCUSSION

EPIDEMIOLOGIC TRENDS

In this study the data has been collected from the autopsy and surgical records available in the department of Pathology. About 70% of the cases were described at post mortem in contrast to the other local study which dealt only with surgically managed cases (3).

The significant decrease in the number of pathologically confirmed cases, from 3.8/year to 0.9/year with an upturn in frequency since the year 2000 mainly due to the rise in HIV infection is in keeping with the findings published by other authors (4, 5). However HIV positive cases, which are responsible for an overall increase in the incidence of intracranial abscesses in recent times as reported in other series, are underrepresented in this study because autopsies are not performed on known HIV-positive patients in this institution due to safety concerns. All four cases of intracranial abscesses in HIV-positive patients in this series were diagnosed in surgical specimens.

In some countries the incidence of intracranial abscesses does not appear to be on the decline (2, 5,); however, decreased morbidity and mortality rates have been reported locally (3). This is largely due to accurate clinical diagnosis, improved imaging techniques and successful surgical management of the lesions along with improved treatment of many of the underlying associated diseases, such as congenital heart disease as well as ENT and lung infections The decrease in the number of autopsy cases seen in the latter years may be a reflection of a decrease in mortality or a decreased need for autopsy as clinical diagnosis is now faster and more accurate.

RISK FACTORS AND PATHOGENESIS

Solitary brain abscesses are usually caused by local spread of infection from adjacent structures such as the paranasal sinuses, the middle ear or from an infected traumatic or surgical wound. ENT infections were the commonest underlying cause resulting in frontal lobe abscesses in both time periods though there was a downward trend in the incidence in the later time period, an observation also reported by others (4, 5, 6, 7) Traumatic infection rose over the second time period due to an overall increase in the incidence of autopsies in trauma cases, in keeping with other studies. (2, 8).

Hematogenous spread from a distant focus such as the heart or lung forms the clinical setting for multiple abscesses. In a study from Boston, congenital heart diseases remained the commonest underlying cause in children (5). In our study, infective endocarditis and lung infections were common predisposing factors in the first time period in all age groups; however, the former decreased remarkably in the second period while lung infections resulting in metastatic abscesses were not seen at all after 1990 (Table 3). This possibly is due to better public awareness, early diagnosis and proper management of congenital and rheumatic heart diseases over the period. Similarly, timely use of appropriate antibiotics might have stopped spread to the brain.

With the increase of immunosuppression, fungal abscesses were seen more commonly in recent times (5). Interestingly, all of our fungal abscesses occurred during the first half of the study period (Table 3) and the patients were immunocompromised either due to the administration of antibiotics, corticosteroids or chemotherapeutic agents. HIV infection with cerebral toxoplasmosis was seen entirely in the later half in keeping with the rise of AIDS cases world wide

Usually in 10% to 15 % of cases, the source of infection is unknown (9, 10). Occasionally as high as 51% of such cryptogenic abscesses have been documented (6). In this study, in both time periods, no underlying cause was recognized in a significant number of patients 31/93 (33.3%). In some cases it may be possible that the initial insult, such as frontal sinusitis or otitis media, had resolved or was no longer evident clinically or pathologically at the time of diagnosis of the intracranial abscess.

ORGANISMS

Gram-negative organisms have been found to be of increasing significance in brain abscesses over time by some authors (2). However, as in our study, many other series have reported Streptococcal and Staphylococcal species as the most commonly implicated pathogens (3, 5, and 7). An important limitation of this study is the missing data; we cannot ascertain what the true microbial pattern would be if all the culture reports were available for all autopsy and biopsy cases. To adequately assess the microbial spectrum, fungal and mycobacterium cultures would have to be carried out routinely on all the cases of intracranial abscesses. Another limitation is that autopsies are not performed on

known HIV-positive patients because of inadequate biohazard protective materials, thereby limiting evaluation of intracranial abscesses associated with HIV infection. Despite this lack of data, as many as 17% (4/23 cases) of cases of intracranial abscess in the latter 19 years was caused by Toxoplasmosis gondii in HIV-positive patients in the surgical specimens. None were identified in the first time period. All the patients with fungal abscesses in our series presented during the first time period; though immunocompromised, they were not known to be HIV infected.

LOCATION

A local clinical series of 25 patients published in 2000 by Donaldson et al (3) revealed that subtotal empyemas was more common than a localized intraparenchymal abscess at the UHWI. The discrepancy between that series and the present one is possibly due to the fact that the former study was basically clinical with samples being submitted for culture and not for histological examination in Pathology Department.

In terms of the pattern of the pathology associated with certain risk factors, it has often been touted that cardiac pathology is a significant risk factor for multiple abscesses (5, 7, 11); this was demonstrated in this study where nearly half of the multiple abscesses were due to an underlying cardiac pathology.

CLINICAL FEATURES

There was a slight male preponderance in our study in keeping with the other local series (3). In a study by Carpenter et al (8), males were three times more commonly affected,

While in another series of 25 autopsy cases, 24 were males and only one was female (9).

In our study, adults over the age of 20 years were most frequently involved in both time periods. In the later time period 1990 -2008, patients 50 years and over were most commonly affected. In a similar time period, Donaldson et al (3) documented in their study that the commonest age was 11 - 20 years locally. This discrepancy is possibly due to the fact that the patients in the latter study were successfully managed surgically and no sample was received in the Pathology Department; hence those cases would not have been included in our study.

Headache, fever and hemiparesis were the most commonly described clinical features in our series which is similar to most other studies (2, 3, 5, and 9). The retrospective nature of this study precludes determination of prognostic significance of specific clinical features. The level of consciousness at presentation has been shown by other authors to be of great prognostic value (8). McClelland et al (7) found that the mortality rate was uniformly increased once there was any appreciable deterioration in the level of consciousness. There was an interesting relationship between the level of consciousness and prognosis in the varying sites of the abscesses. Reduction in the level of consciousness, even to a comatose state in frontal lobe abscesses, was less sinister than a comparable reduction in the level of consciousness with temporal lobe abscesses. This would indicate that the space-occupying aspect of abscesses in strategic positions is perhaps as important as the infective or toxic components of the lesion, the temporal lobe abscess being more likely to cause uncal herniation and brainstem pressure effects at an earlier stage.

CONCLUSION

Intracranial abscesses at the University Hospital of the West Indies are most commonly solitary lesions, particularly affecting the frontal lobe and are most often secondary to sinusitis. Multiple abscesses resulting from infective endocarditis and lung infections have dramatically decreased in recent years. Patients with intracranial abscesses most commonly presented with headache, fever and hemiparesis. Streptococci and gram-negative bacilli were the most frequently isolated organisms. There has been a significant overall decrease in the frequency of pathologically confirmed intracranial abscesses over the last few decades; a slight increase in frequency has been noted in recent years due to cerebral toxoplasmosis in HIV infected patients and this is therefore an important emerging risk factor.

The downward trend in the frequency of autopsy cases possibly reflects improved clinical diagnosis, better imaging techniques and successful treatment resulting in decreased mortality associated with this disease, a trend which has also been noted in several developed countries.

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