

# Non Traumatic Intracranial Infections at the University Teaching Hospital Lusaka, Zambia

L. Chikoya

*University Teaching Hospital, Department of Surgery,  
P/Bag RW 1X, Lusaka Zambia. E-mail: laston.chikoya@unza.zm*

## ABSTRACT

**Background:** Non traumatic intracranial infections are a well recognized disease process encountered in neurosurgery and otolaryngology practices. In this case series study, we analyze the patients that presented with this condition to the neurosurgical unit of the University Teaching Hospital in Lusaka, Zambia.

**Methods:** This is a prospective analysis of a case series of patients that were treated for non traumatic intracranial infections. The analysis involved the following parameters: age, sex, clinical presentation, HIV serostatus, CT/neurosurgical findings, microbiology, and treatment outcome. This was done over a 3-year period.

**Results:** Eighteen patients were treated for non traumatic intracranial infections, of which 12 were male and 6 were female. The youngest patient was 9 and the oldest was 70, with a mean age of 25.33 years. Headache and fever were the most common clinical presentation, followed by sinusitis. Six patients were HIV-positive and 5 were already on HAART prior to presentation. Intracerebral abscesses, both solitary and multiple, were seen in 10 patients, while epidural and subdural empyema were present in 2 patients each. In one patient, localized encephalitis was seen, and the other 3 patients had a mixture of intracerebral abscess and subdural empyema. Gram-positive cocci comprising streptococci and staphylococci were isolated in 10 cases, while negative cultures were seen in 4 and actinomycete was seen in 1 patient. Fourteen patients had a good outcome, while 4 patients died, including 3 with a positive HIV serostatus. Two of these HIV-positive patients had very low CD4 counts.

**Conclusion:** The pattern for non traumatic intracranial infections seen at the University Teaching Hospital in Lusaka is not different from other published series. However, the role of HIV in the treatment outcome needs further study.

## INTRODUCTION

Intracranial infection is one of the common conditions seen in neurosurgery. It is also seen frequently as a complication of infections of the ear and sinuses. There are many causes for intracranial infection, such as trauma, post-operative infections, and extensions from localized septic foci to name a few. In a review of 113 intracranial infections by Danziger A. and others, head trauma and otolaryngology sources were found to be the most common[1]. Giannoni C.M. and others found a 5.9% overall prevalence of intracranial infections arising from sinusitis[2]. Trauma and infection are among the leading causes of mortality and morbidity in many developing countries, including Zambia

## MATERIALS AND METHODS

This study was a prospective case series of patients who presented with non traumatic intracranial infections to the neurosurgical unit at the University Teaching Hospital. All patients were referred due to clinical suspicion for intracranial infection and abnormal cranial CT scan. Subjects were assessed with regard to age, sex, clinical presentation, HIV serostatus, CT and neurosurgical findings, microbiology, and treatment outcomes. Counseling, testing and informed consent was done for the patients who did not know their HIV serostatus. HIV antibody testing was performed using Determine HIV-1/2 test (Inverness Medical Innovations,

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Cranfield, UK) for screening and Uni-Gold Recombigen® HIV Test (Trinity BioTech, Bray, Ireland) for confirmation.

## RESULTS

From May 2005 to August 2008, a total of 18 patients were treated for non traumatic intracranial infection. There were 6 females and 12 males. The age ranged between 9 and 70 years old, with a mean of 25.33 years. All patients presented with headache and fever. In the younger age group (age 9 to 15), there was a positive history of severe sinusitis prior to the onset of the intracranial infection. Sinusitis was not present in the older age group (age 16 to 70).. In addition to headache and fever, 3 had scalp abscesses, while 2 presented with focal neurological deficits. On average, all patients were seen within a week following onset of symptoms.

**Table 1**

Clinical Presentation	
Headache and Fever	18
Sinusitis	11
Scalp abscess	3
Focal CNS deficits	2

All patients were counseled and tested for HIV prior to treatment. Six out of the 18 patients (33%) were positive for HIV (5 were already on HAART), while 12 were negative for both HIV-1 and -2. The age range for the seropositive patients was 9 to 56 years. The prevalence of HIV in the general population in Zambia was 14.3% in 2007.[9]. In this case series the prevalence is 33%, which is more than two times that of the general population, despite the small number of cases. All but 3 patients underwent craniotomy and drainage of the intracranial pus. The site of the intracranial sepsis is shown in Table 2.

Samples of pus from patients undergoing craniotomy were sent for microbiological studies. The commonest pathogens isolated were *streptococcus* species in 6 patients while *Staphylococcus aureus* was isolated in 3 patients and

CT/Neurosurgical findings	
Epidural empyema	2
Subdural empyema	2
Intracerebral solitary abscess	4
Intracerebral Multiple abscesses	6
Encephalitis	1
Subdural empyema + Intracerebral abscess	3

**Table 2**

*Actinomycete* in 1 patient. A mixed growth of *streptococci/staphylococci* was isolated in 1 patient. Four patients had negative cultures.

**Table 3**

Microbiological results	
<i>S. aureus</i>	3
<i>streptococcus pyogens</i>	6
Mixed growth(staph/strep)	1
<i>Actinomycete</i>	1
Negative culture	4
Culture not done	3

Parenteral antibiotic (Ceftriaxone 1 gram) commenced intra-operatively on all 15 patients who underwent craniotomy and continued for 6 weeks depending on the culture and sensitivity patterns. However, in the 4 patients who had negative cultures, antibiotics were administered elsewhere prior to admission to the neurosurgical unit.

Fourteen patients had excellent outcomes. Four patients died, 2 of whom were HIV-seropositive. All 4 patients who died presented with multiple abscesses and had recurrences after surgery in the 3 that had craniotomy (see Table 3 below). Of the 4 mortalities, the 2 who were HIV-seropositive had *Staphylococcus aureus* and *Actinomycete* isolated from culture, respectively. Of the other 2 mortalities with negative serostatus, one had *Staphylococcus aureus*, while the other had no cultures done.

Both HIV-positive patients who died had very low CD-4 counts (25 and 75 cells/ $\mu$ L). In the former, HAART was not stated as the clinical condition was critical. The other 4 surviving HIV-positive patients had CD-4 counts above 200 and continued HAART upon discharge.

**Table 4**

Treatment Outcome	
Discharged	14
Died after recurrence	3
Died before surgery	1

One patient was diagnosed with encephalitis based on CT findings. He did not undergo surgery, and his condition resolved on empirical antibiotics. Surgery was also not done in 2 HIV-positive patients with small multiple abscesses. All patients had pre-operative CT scan without and with contrast (see Figures 1 and 2), followed by post-operative scans at 48 hours, 2 weeks and 8 weeks on completion of antibiotic therapy for the 12 that had craniotomy and survived. The 2 survivors on whom surgery was not performed had follow-up CT scans done at 2 and 8 weeks while on antibiotic therapy.

**Figure 1**



*CT scan without contrast showing multiple intracerebral abscesses with surrounding brain edema and midline shift in an HIV-positive patient.*

**Figure 2**



*CT scan with contrast showing intracerebral abscess and a small subdural empyema with midline shift in an HIV-negative patient.*

## DISCUSSION

Intracranial infection is one of the most common diseases encountered in neurosurgery. As in other Studies, there is a preponderance of male patients [3] (ratio 2:1). The infection source may be haematogenous arising from a distant septic focus, or an extension from local infection in the head and neck region. Ciurea A.V. and others reported that the bacteriological profile in intracranial sepsis shows a preponderance of Gram-positive cocci – 52.5%.[3, 4]. In our series, cultures from the pus samples showed streptococcus and staphylococcus as the most common bacteria (10/18 cases, 55.6%). Negative cultures are not uncommon, however. In this series, 4 patients who had received prior antimicrobial treatment elsewhere,(22.2%) had no growth on cultures. Ciurea A.V. and others showed that sterile cultures form a significant proportion of cases presenting with brain abscess (32.2%)[3]. Severe cases of para-nasal sinusitis or orbital cellulitis and otitis media can evolve into brain abscesses. Otitis media and para-nasal sinusitis are the commonest cause of brain abscesses[4]. This was seen in 11 of the patients in the younger age group in this series. In a 5- and 10-year retrospective study on sinusitis and orbital cellulitis, respectively, it was noted that the disease was most common in adolescents[5, 6]. Intracranial complications of sinusitis are a well documented problem[5, 6]. Chikoya and Erzingatian reported 3 out of the 14 patients with sinusitis had intracranial complications, while Jones and others reported a 12-case series of sinusitis with intracranial complications. [5, 6]. Proximity of the sinus to the cranial cavity, and also the thin wall of the sinus coupled with the valve-less connecting veins between the sinus and the cranial cavity lead to intracranial spread of infection[5]. It is because of these serious complications that para-nasal sinusitis or orbital cellulitis must be treated aggressively with prompt drainage and broad spectrum parenteral antibiotics.[5, 6]. In this case series, 1 patient from the younger age group died; this patient had multiple abscesses and also recurrence after surgery.

Analysis of the older age group of patients (age 24-70 years) in this series showed that out of the 7, 5 were HIV-positive and the onset of symptoms was not related to para-nasal or orbital cellulitis as in the younger age group. However, Grant A. et al showed

that sinusitis is an important and under-recognized cause of morbidity in patients with HIV disease.[7] Two patients died from this group; both had very low CD4 counts of 25 and 75, respectively. Impaired cell-mediated immunity may be a contributing factor to mortality in these patients. Actinomycete was isolated in one of the patients that died in this group. It has been reported in a number of studies and case reports that immunocompromised patients present with unusual pathogens causing intracranial sepsis[8]. In this group as well, the patients who died had multiple abscesses and also showed recurrence after surgery (Figure 1). Poor outcome has been associated with multiple abscesses and recurrences[4]. Habib A. A. and Mozaffar T. showed that in most developing countries, mortality rates are high ~21%.(3). In this case series, the mortality rate was 4/18 (22.2%), which is comparable to other literature. Among HIV-positive patients, the mortality rate of 2/6 (33.3%) seems higher when compared to the non-seropositive group of 2/12 (16.7%). However, the significance of these factors needs further study with larger case series.

The overall outcome for this case series was good in that 14 patients (77.8%) were discharged, including 4 who were on HAART, and subsequent reviews in the clinic have not shown recurrence of the intracranial sepsis in these cases. This has also been observed in the 2 patients that were not operated on but were treated with antibiotics and HAART.

This study had several limitations. First, this case series is too small to identify statistically significant associations. Second, patient inclusion depended on the decision of internal medicine and generalist providers to refer patients for neurosurgery evaluation. Thus, inclusion was not systematic and some patients with associated conditions may have been missed. Third, the study took place in a resource limited setting where some tests, such as viral PCR or MRI, were not available.

## CONCLUSION

The pattern of intracranial infections at the University Teaching Hospital in Lusaka, Zambia is similar to those in other published studies. The overall outcome of the treatment (both operative

and conservative) was good (77.8% discharge rate). The mortality of 22.2% is comparable to those reported in developing countries. As in other studies, multiple abscesses may be a risk factor for recurrence and death. The role of HIV infection related to risk and outcome needs further study, especially because the mortalities were associated with very low CD4 counts.

## ACKNOWLEDGMENTS

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