

# Record review of patients with Brain Abscess and Empyema at Chris Hani Baragwanath Hospital.

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## Abstract

Studies on brain abscess (BA) and Empyema are not routinely focused on the role of occupational therapy (OT) with these patients. There is a paucity of literature on deficits resulting from BA and Empyema other than hemiplegia. This study used a retrospective record review to determine the relationship between BA, Empyema, and resultant physical and psychosocial dysfunction. Patients with BA generally had more significant deficits than those with Empyema for both physical and psychosocial performance components. Hemiplegia was the most common physical deficit found with the most common psychosocial deficit being body concept. Remediation of these deficits falls within the scope of OT which is recommended for this patient population.

## INTRODUCTION

Brain abscess (or cerebral abscess) and Empyema are suppurative infections in the central nervous system. Both brain abscess (BA) and Empyema are rare but serious disorders<sup>1-3</sup> with an incidence of approximately two- three cases per million per year<sup>4</sup> occurring more commonly in underdeveloped countries<sup>5</sup>. The clinical findings, associated with BA and Empyema are related to the effects of a space occupying lesion. These symptoms include headache, fever, vomiting, seizures, mental changes and coma while the signs they present with are focal neurological deficits, papilloedema, hemiplegia, cranial nerve palsies and ataxia<sup>1,6</sup>.

No research could be found on occupational therapy (OT) related to this group of patients and the effect this condition may have on their occupational performance. Occupational performance is involvement in purposeful and goal directed activities of daily living which relates to an individual's ability to interact with the environment resulting in the use of discrete physical and psychosocial performance components. The term physical components refers to aspects like movement, while psychosocial performance components encompass the cognitive and perceptual aspects of doing<sup>7</sup>. Occupational therapists are primarily concerned with the remediation of physical and psychosocial deficits related to the psychosocial of doing, which prevent independence in the areas of work, play and activities of daily living<sup>7</sup>.

Due to the rarity of BA and Empyema<sup>1,2</sup>, especially in first world communities where most medical research is conducted, this condition has received little attention and there is sparse literature on the dysfunction in psychosocial performance components secondary to BA and Empyema. In the most recent study detailing this aspect Gormley et al. (1996) found that cognitive problems in participants with BA were actually their the most severe deficit found in this group of patients<sup>3</sup>. This was especially true in children with the long term implications being poor scholastic achievement up to six years post treatment<sup>3</sup>. This research as well as other literature does routinely list the physical performance component deficits including hemiparesis and focal neurological deficits such as epilepsy<sup>3,8</sup> secondary to BA and Empyema.

Thus, the purpose of this study was to investigate the physical and psychosocial deficits commonly found in the patient population presenting with BA and Empyema. The demographics of the population were also of interest as this condition is rarely seen even at Chris Hani Baragwanath Hospital in South Africa. Chris Hani Baragwanath Hospital is a 3500-bed academic hospital in Soweto serving an estimated population of three million people<sup>9</sup>.

## METHODS

### STUDY AIM

The primary aim of this study was to determine the

demographics of participants at Chris Hani Baragwanath Hospital presenting with BA and Empyema and the prevalence of physical or psychosocial deficits in these participants.

**STUDY DESIGN**

Although prospective study designs have been recommended for small and rare conditions like BA and Empyema<sup>10</sup> the drawback of this design is that it could take up to five years to get a representative sample. As a result a retrospectiverecord review was selected for this study. Thus a descriptive study using a record review of OT records of all participants with BA and Empyema, who attended school and were admitted to the Neurosurgery unit between 2005 and 2007, at Chris Hani Baragwanath Hospital was carried out. The information obtained from the OT records was demographic data as well as the initial OT assessment results.

It was determined that from a sample size of 31 participants a 90% confidence interval for the prevalence of physical and psychosocial deficits can be determined to an accuracy of 15%. This sample size was determined following the conservative approach that the prevalence of physical and psychosocial deficits in participants with BA and Empyema was assumed in 50% of the population. The confidence and accuracy was motivated by the fact that the research was addressing a rare condition<sup>1-3</sup>. Although at least 31 subjects were needed, 33 suitable records, which consisted of the entire population of patients presenting with these diagnoses during the review period, were sourced and reviewed.

**MATERIALS AND PROCEDURE**

The record review included occupational therapy files which contained information that had been gathered from patients ‘medical files as well as a comprehensive occupational therapy assessment. In order to fulfil the objectives of the research the detailed medical information was recorded on a data collection sheet which included the location of BA or Empyema, the cause of BA or Empyema, the demographic data of the participant which included age, gender, date of admission and discharge. There was no standardised assessment technique used to assess the physical and psychosocial deficits found during the OT assessment.

Unfortunately there is no standard protocol for recording of information which meant that the quality of some of the recorded information was very poor.

Descriptive statistics were used to analyse demographic

results and establish trends. Mean ages and percentages for place of residence and gender were calculated. The frequency of diagnosis and causes were determined and the prevalence of physical and psychosocial deficits were established in percentages.

**RESULTS**

**DEMOGRAPHIC INFORMATION**

The demographics of the population included an age range of eight to 21 years, with a mean age of 16.2 years. The majority of the participants were male and resided in Gauteng with 12% living in the North West province. Two subjects died subsequent to their admission to OT.

**Figure 1**

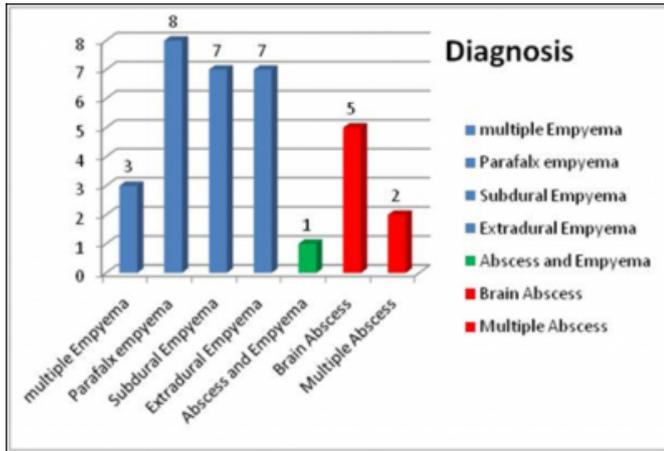
Table 1: Demographics of record review sample (n= 33)

| Characteristics                           |                             |  |
|---|-----------------------------|--|
| Age range (on initial assessment)         | 8 years – 21 years          | Mean age: 16.2 years   |
| Place of residence                        | Gauteng Province- 29 (88%)  | <ul style="list-style-type: none"> <li>• Soweto- 17 (57%)</li> <li>• Sebokeng- 3 (9%)</li> <li>• Bekkersdal- 2 (8%)</li> <li>• Randfontein- 3 (8%)</li> <li>• Orange Farm- 1 (2%)</li> <li>• Katlehong- 1( 2%)</li> <li>• Roodeport-1 ( 2%)</li> </ul> |
|   | North West Province-4 (12%) | <ul style="list-style-type: none"> <li>• Makwassie-1 ( 3%)</li> <li>• Orkney- 1 ( 3%)</li> <li>• Mafikeng- 1 ( 3%)</li> <li>• Ottosdal- 1 ( 3%)</li> </ul>   |
| Gender                                    | Males                       | 27 (81, 8%)  |
|   | Females                     | 6 (18, 2%)   |
| Deceased subsequent to initial assessment | 2                           |  |

The one participant was 21 years old but still attending school and was included in the sample as the inclusion criteria specified school attendance, not age.

**Figure 2**

Figure 1. Frequency of Diagnosis (n=33)



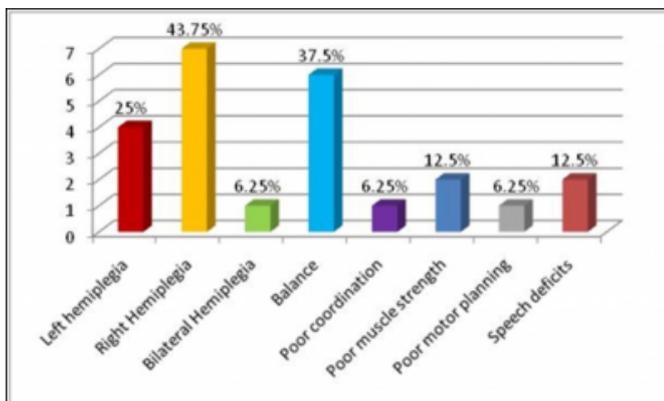
Empyema (multiple Empyemas, Parafalx Empyema, Subdural Empyema and Extradural Empyema) was found to be more common than BA, with this being the diagnosis in 75,8% of the total records reviewed. Three percent of participants presented with both abscess and Empyema and 21,2% presented with abscess (both single and multiple abscesses).

The most common cause of BA and Empyema was sinusitis (69,7%), followed by unknown causes and mixed causes.

Twenty four physical skill deficits were recorded. These were present in 16 of the participants. Some of the participants had multiple deficits. The most common physical deficit was hemiplegia with right hemiplegia being more common. Balance was affected in just over a third of these participants.

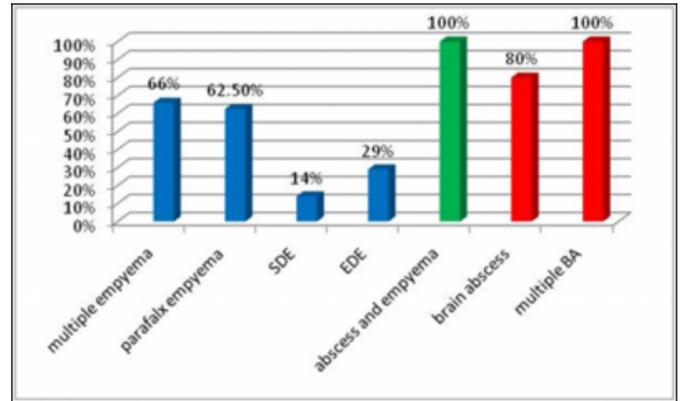
**Figure 3**

Figure 2. Frequency of physical deficits (n= 16)



**Figure 4**

Figure 3. Frequency of physical deficits per diagnosis (n=16)



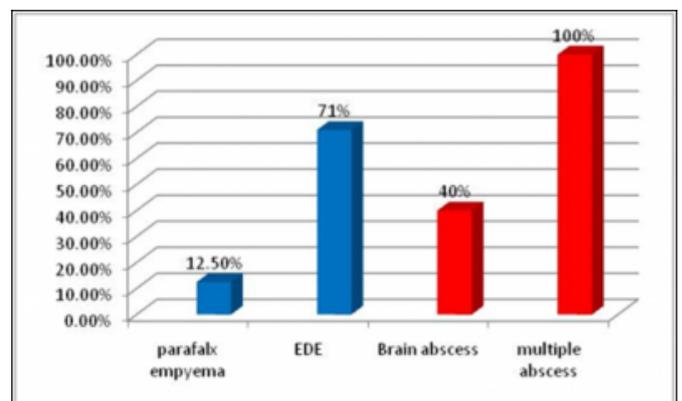
Analysis indicated that the participants who presented with multiple BA and abscess and Empyema had physical deficits 100% of the time. Physical deficits were present in 84% of all participants with BA. In the sample population with Empyema the prevalence of physical deficits was much lower, with 66% of participants with multiple Empyema and 62,5% of participants with Parafalx Empyema having physical deficits. Participants with Subdural Empyema presented with physical deficits in only 14% of cases, and in Extradural Empyema in only 29% of participants had deficits in their physical skills.

**Figure 4.** Frequency of psychosocial deficits (n= 10)

Of the 33 participants only 10 had problems in the psychosocial skills domain (30%). Again some participants presented with more than one of the deficits listed above. The most common deficit was poor body concept with a frequency of four, followed by poor concentration with a frequency of three.

**Figure 5**

Figure 5. Frequency of psychosocial deficits per diagnosis (n=10).



When the data was analysed according to diagnosis it is found that problems in the psychosocial skills domain only occurred in four of the seven diagnoses. As was seen with physical deficits, the participants with multiple abscesses had deficits in 100% of the cases. Participants with Extradural Empyema had the next highest prevalence with psychosocial deficits occurring in 71% of cases. Those presenting with BA had deficits in 40% of cases and participants presenting with Parafalx Empyema had deficits in only 12,5% of cases.

In summary the most common diagnosis found was Empyema with three times as many participants presenting with Empyema as compared to BA. The most common physical deficit seen was hemiplegia and the most common psychosocial deficit was poor body concept. Physical deficits were present in 48% of the subjects and psychosocial deficits present in only 30, 3% of the subjects.

## **DISCUSSION**

The number of available records for review over a two year period was 33, an average of 15.5 a year. This is a higher prevalence than that found by Domingo and Peters over 25 years ending in 1994<sup>11</sup> and by Sichizya et al. over a 10 year period ending in 2003<sup>12</sup> in Cape Town. They found an average of 3.92 and 12.1 cases a year respectively. There seems to be a trend of increasing cases and this may be due to the higher population in the Gauteng Province of South Africa with 21,4% of the population resident in Gauteng as opposed to only 10,9% in the Western Cape<sup>13</sup>. The areas the participants reside in have large indigent populations and BA and Empyema are both more common in poorly developed communities with little infrastructure and adequate access to health care<sup>5,14</sup>. These areas have populations from lower socioeconomic status (SES)<sup>15</sup> which has been linked with different health outcomes<sup>15</sup>. Poor living conditions have been linked to BA and Empyema<sup>5</sup> which may account for the cases being seen at Chris Hani Baragwanath Hospital, Gauteng.

Brain abscess and Empyema have been linked to inadequate health care and the increasing number of cases seen is thought to be due to poor accessibility to medical care. Increased immunodeficiency in these communities was considered as a possible factor<sup>14</sup> but only one of the sample was immuno- compromised indicating immuno- compromised may not be relevant a in the school- going population.

The causes of BA and Empyema in this research were most

commonly sinusitis, followed by unknown causes. The literature states sinusitis, otitis media and mastoiditis as the most common causes<sup>16,17</sup>. Other causes stated in the literature found in this research were meningitis and HIV related infections<sup>18</sup>. Unfortunately due to inconsistent record keeping localisation of the BA or Empyema was not recorded and so this cannot be linked to existing research.

The prevalence of mortality in brain abscess indicates the virility of an infection of the parenchyma itself, as compared to Empyema where the infection is not within the brain tissue<sup>3,6</sup>. The mortality rate in this study was lower than that reported in the literature but in keeping with diagnosis of BA which has been found to have a higher mortality rate than Empyema<sup>11</sup>.

Of the records reviewed two participants were deceased at the time of review. Both participants suffered from BA. This is 6% of the total population and 29% of the brain abscess (multiple and single abscess) population. This is in keeping with the statistics found in literature where mortality for BA ranged between 22 and 33%<sup>6</sup>, however not in keeping with mortality rates found by Johnson et al. which were as low as 5-10% in Washington, USA a developed country with better access to health care.

Of the total sample, 81.8% were male and 18.2% were female. This is similar to the literature which states that BA and Empyema are most common in boys<sup>16,17,19,20</sup>. Tewari et al. suggest the reason for this is there is rapid growth of the frontal sinuses in males and the fact that boys tend to blow their noses more vigorously<sup>16</sup>. The mean age of the participants included in the study was 16.2 yrs with an age range of 8yrs to 21 yrs. This is similar to trends discussed in the literature<sup>11</sup> and other studies on these conditions in South Africa which found that in most cases the subjects were in their second decade of life<sup>2,16,17,19,20</sup>.

Two of the participants were known epileptics prior to hospitalisation and there was no record of any of the other participants having post- Empyema or abscess seizures. One participant had both cerebral palsy and epilepsy, another documented learning problems and the one participant was HIV+ and had tuberculosis. These premorbid conditions may account for some of the physical and psychosocial deficits found in these specific participants. Unfortunately due to poor recording of information this information was not available.

Since OT is concerned with performance of activities of

daily living which include school based activities, both the physical and psychosocial deficits that participants presented with needed to be identified so the effect of these deficits on daily functioning could be considered. The areas of concern are presented in the literature as focal neurological deficits, cognitive impairment and seizures<sup>3</sup>. Data on physical and psychosocial skill deficits were therefore obtained from the occupational therapy records. The focal neurological deficits seen in this research were right and left hemiplegia's and bilateral hemiplegia. This finding concurs with other studies where hemiplegia was reported as the most commonly listed neurological deficit in BA and Empyema<sup>21</sup>. In this research hemiplegia was seen with 36% of participants with only two participants presenting with speech deficits (dysarthria and global aphasia), even though these deficits were also listed as common in the literature<sup>21,22</sup>. Other physical deficits seen were poor balance, poor coordination and poor muscle strength. Although Nielsen et al. list visual disturbances and hearing loss as other significant physical deficits<sup>22</sup>. Only one participant in this study was found to have hearing loss and only two participants had recorded visual disturbances related to the infection itself. In both these cases these problems resolved before discharge from hospital.

On review of the records it was found that ten participants of a possible 33 had psychosocial deficits (30%). These included poor concentration, poor body concept, poor basic concepts, poor problem solving, poor sequencing, poor physical planning, visual physical integration problems and poor figure ground perception. These deficits were identified on initial assessment in the acute stages of the illness and may have been related to the acute infective and surgical process. This may account for the high prevalence of psychosocial deficits found in this study compared to the prevalence reported in the literature. The presence of any psychosocial problems according to Gormley et al.(date) must be considered as it is these that have the most serious long term implications for patients with BA and Empyema<sup>3</sup>. This is supported by Carey et al (1977)<sup>23</sup>, who found that six years post abscess 70% of children assessed were struggling at school<sup>3</sup> and Nielsen (1983) who reports that 14.5% of patients with BA and Empyema (3- 40 years post treatment) had an intellectual impairment<sup>21</sup>. South African research conducted by Domingo and Peters also listed intellectual impairment as one of the long term implications of BA<sup>11</sup>.

Differences in number and type of physical and psychosocial deficits were noted in patients with BA and Empyema. The participants presenting with BA and the one participant who

presented with both Empyema and BA consistently had more deficits on initial assessment. One hundred percent of the participants with multiple BA and 80% of the participants with BA had physical deficits. The participant who had both BA and Empyema also presented with physical deficits, compared to patients with Empyema. Only 66% of participants with multiple Empyema, 62.5% of participants with Parafalx Empyema, 29% in Extradural Empyema and only 14% in participants with Subdural Empyema presented with physical deficits.

This increased prevalence of deficits (both physical and psychosocial) seen in patients with BA is in keeping with the pathology of the condition. A BA is an infection of the brain itself whereas an Empyema is outside the brain in the extradural or subdural space<sup>3,6</sup>.

In accordance with this 100% of the participants with multiple BA and 40% of those with single BA were found to have psychosocial deficits. Only 12, 5% of participants with Parafalx Empyema presented with these deficits while 71% of the participants with Extradural Empyema were found to have psychosocial deficits. The prevalence of psychosocial deficits in Extradural Empyema in this study is not in keeping with that reported in the literature which describes Extradural Empyema as less virulent and as having a less obvious clinical presentation<sup>24</sup>. The finding is also contradictory in terms of the anatomy of the Extradural Empyema which occurs in the extradural space and so should have less serious clinical implications<sup>4</sup>. The findings in this study were affected by the fact that two of the seven (28, 6%) participants presenting with Extradural Empyema were recorded as having premorbid problems. The one participant had epilepsy premorbidly and the other participant had learning problems according to his family. The results reflecting the prevalence of psychosocial deficits in Extradural Empyema must be viewed in this light.

A further factor that influenced the validity of the results of the study was the record review used as the method of data collection. Although this was an appropriate tool to use as participants could not be randomised<sup>25</sup> and due to the rarity of the condition<sup>14,16,20</sup> it did present some limitations. All records of participants attending school at the time of the initial sample were included in the study as this assisted in addressing the rigour of the study where only a small number of participants are available<sup>26</sup>.

The limitation experienced in this research however was the poor completion of the records. Many of the records were

incomplete and some details recorded were incorrect. There was also poor consistency in the data recording between records. This problem is supported by previously noted problems with record reviews is that they are compromised by clinicians who only record information that they feel is relevant<sup>25</sup>, the haphazard way they are kept<sup>27</sup>, poor emphasis on the quality of records<sup>28</sup> and a perception among clinicians that record keeping is not as important as clinical work<sup>28</sup>. The above points all impacted on the quality of records used in this study and therefore compromised the quality of the data obtained. Despite using an all inclusive sample only 33 records were available for review. This may impact the accuracy and applicability of the results found. Despite the small sample size the findings were similar to those found in the literature indicating that despite a flawed research technique there is generalisability of the findings.

## **CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDIES**

This initial study to determine the demographics of the population of patients presenting with BA and Empyema, between 2005-2007 at Chris Hani Baragwanath hospital, was to establish the physical and psychosocial deficits they presented with and whether there was a need for standard OT treatment of this group. The literature commonly associates these conditions with neurological sequelae but there is a paucity of literature regarding the specificity of the psychosocial and physical deficits. Although the population in this study was limited to one tertiary hospital within Gauteng, South Africa, from the findings, it is obvious that both psychosocial and physical deficits found in patients with BA and Empyema require input from OTs. Physical deficits, most commonly hemiplegia were present in just under half the patients and psychosocial deficits were present in just under a third of patients and it is therefore imperative that all patients with BA and Empyema, but particularly with BA are referred to OT for a comprehensive assessment of their psychosocial and physical skills.

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