FUNCTIONAL NEUROIMAGING IN SURVIVORS OF TORTURE

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Psychiatry

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DECLARATION

I, Thriyabhavan Ramasar declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in the branch of Psychiatry in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree examination at this or any other University.

---------- day of ---------- , 2011

DEDICATION

For my husband, Mayaven

And my children,

Kayur and Thalia

PUBLICATIONS AND PRESENTATIONS ARISING FROM THIS STUDY

- Poster Presentation – SASOP Congress, East London, 2010
- Oral Presentation – University of the Witwatersrand, Department of Psychiatry Annual Research Day, 2007
- Oral Presentation – University of the Witwatersrand, Department of Psychiatry Annual Research Day, 2011

ABSTRACT

Survivors of torture may have long-term physical, psychiatric and psychological sequelae. The aim of this study was to determine whether survivors of torture exhibit any psychopathology, whether they demonstrate abnormal findings on Brain Single Photon Emission Computed Tomography (SPECT) imaging, and whether correlations exist between Post Traumatic Stress Disorder (PTSD), Major Depressive Disorder (MDD), perfusion changes on Brain SPECT and Initial Self Reporting Questionnaire (SRQ8) scores. Thirty-six volunteers were recruited in a non randomised manner. Participants were assessed by a psychiatrist. The SRQ8, Impact of Event Scale – Revised (IES-R) and Montgomery Asberg Depression Rating Scale (MADRS) were administered. Participants underwent Brain SPECT imaging to assess cerebral perfusion changes. Data was analysed using Statistica 9.1. The primary psychiatric diagnoses made were PTSD, MDD or both. Participants with psychopathology had higher SRQ8, MADRS and IES-R scores. Although qualitatively, participants with psychopathology showed increased abnormal cerebral perfusion on Brain SPECT imaging, as compared to those participants without psychopathology, this could not be proven statistically. Perfusion changes were noted in the temporal cortices, parietal cortices, orbitofrontal cortices, thalami and basal ganglia. Higher SRQ8 scores were associated with higher scores on the MADRS and IES-R, and hence correlated with diagnoses of MDD and PTSD, but no direct association was noted with the visualised abnormal Brain SPECT imaging findings.

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LIST OF ABBREVIATIONS

DSM IV-TR	Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision
HIV	Human Immunodeficiency Virus
MADRS	Montgomery-Asberg Depression Rating Scale
MDC	Movement for Democratic Change
MDD	Major Depressive Disorder
PTSD	Post Traumatic Stress Disorder
SACST	Southern African Centre for Survivors of Torture
SPECT	Single Photon Emission Computed Tomography
SRQ8	Self Reporting Questionnaire 8
SRQ20	Self Reporting Questionnaire 20
ZANU	Zimbabwe African National Union
ZANU PF	Zimbabwe African National Union Patriotic Front
ZTVP	Zimbabwe Torture Victims Project
^{99m}Tc-HMPAO	Technetium-99m Hexamethyl-propylene amine oxide

CHAPTER ONE: INTRODUCTION

1.1 Background

There is a current and impending humanitarian crisis in the violation of human rights. Throughout the world, on a daily basis, deliberate and intentional physical and psychological harm is inflicted upon individuals.[1]

The consequences of these actions are immense, not just for the individual victims but for the world as a whole. There is a significant economic, social and moral burden that is imposed. Deliberate and intentional harm inflicted upon individuals can cripple a country and its people. In Africa alone, this is clearly evident in countries such as Rwanda and Zimbabwe.[2] The mass exodus of Zimbabweans to South Africa to escape violence and deteriorating socio-economic circumstances is an example that has impact on the individual and country as a whole.[2] The influx of asylum seekers to South Africa also has implications for health care workers treating survivors of torture.[3]

Numerous human rights violations have taken place in Zimbabwe over the past three decades but the last decade has shown the most sustained human rights violations in Zimbabwe's history.[4] Events leading up to this period are briefly documented below.[4,5]

In the late 1970's, the then Rhodesian government decided to negotiate independence for the country and on the 18 April 1980, Rhodesia gained independence and the country renamed, Zimbabwe. In 1980, the ZANU party (a liberation movement that has turned into a major political party) won the elections and Robert Mugabe became President of the

newly independent country. Initially, there was some stability but this slowly waned, socio-economic conditions deteriorated and as a result, an opposition party called the MDC was founded by trade unionist, Morgan Tsvangirai, after almost twenty years of a single party dominance. The opposition grew in the mid 90's due to the worsening economic and human rights conditions. Natural disasters like the drought and the forcible land redistribution practiced by the ruling party were key factors. The rivalries between ZANU-PF and the MDC intensified and the government (still led by Robert Mugabe) responded by brutally torturing and murdering opposition supporters.[6]

Unfortunately, most of the world has chosen to ignore the atrocities committed in Zimbabwe over the last decade and hence they are still perpetuated, along with atrocities in various other parts of the world.[7]

From a medical perspective, the research seeks to understand the impact of torture on brain functioning so that survivors of torture may receive better medical assistance. This report thus seeks to paint a clearer picture of the psychopathology of torture survivors, as well as highlighting the challenges for treatment.

1.2 Aim

To examine whether psychopathology in survivors of torture corresponds to functional neuroimaging and how this correlates with measures of psychopathology in terms of PTSD and MDD.

1.3 Objectives

The primary objectives of the study are two-fold and relate to the psychopathology of survivors of torture and their functional neuroimaging findings.

The primary objectives are thus to determine whether survivors of torture:

A) exhibit any psychopathology in terms of PTSD, MDD or other psychiatric diagnoses.

B) have abnormal cerebral perfusion on Brain SPECT imaging.

A secondary objective of the study is to ascertain whether correlations exist between PTSD, MDD, Brain SPECT imaging findings and initial SRQ8 scores.

1.4 Hypothesis

The hypothesis is that Brain SPECT imaging in survivors of torture reveals specific cerebral blood flow changes which correlate with diagnoses of PTSD and MDD as well as with higher SRQ8 scores.

This hypothesis is developed through a literature review and tested through the empirical study of survivors of torture in Zimbabwe who are now living in South Africa.

1.5 Structure of the Report

The rest of the research report contains the outputs of the study undertaken by the research on functional neuroimaging in survivors of torture. Chapter two presents a review of the literature focusing on an overview of torture, psychiatric diagnoses and functional neuroimaging. This is followed in chapter three by a detailed description of the methodology used in the research including an elaboration of specific techniques used in the study. Chapter four presents the main findings of the empirical data collection carried out by the researcher. Survivors of torture in Zimbabwe participated in the study and the collated and analysed results are presented in this chapter. In chapter five, a discussion of the results and their implications are presented before the conclusion and recommendations in chapter six. Supporting material in the form of references and appendices are included at the end of the report.

CHAPTER TWO: LITERATURE REVIEW

2.1 Torture

2.1.1 Definition of Torture

The United Nations Convention against Torture[8] defined torture as "an act or omission by which severe pain or suffering, whether physical or mental is intentionally inflicted on a person –

(a) for such purposes as -

(i) obtaining from that person, or from another person, information or a confession,

(ii) punishing that person for an act which the person concerned or a third person has committed or is suspected of having committed, or

(iii) intimidating or coercing that person or a third person

OR

(b) for any reason that is based on any form of discrimination, but does not include any such act that arises solely from, or is inherent in or incidental to, lawful sanctions"

2.1.2 Incidence/Prevalence of Torture

Despite the adoption of the United Nations Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment, (General Assembly Resolution 39/46,

December 1984)[8] it is believed that as many as ninety countries worldwide undertake physical and/or psychological forms of torture.[9]

Empirical research studies show that between 5% and 35% of refugees have suffered from some form of repressive violence or torture.[10] In a study of Bosnian refugees living in Croatia, 18% had experienced one or more torture events, and the respondents in the sample reported an average of 6.5 trauma events.[11] Other studies also confirm a high frequency of organised violence and torture.[12,13,14,15]

African countries have also been afflicted by torture and violence. Zimbabwe is an example.[4] A small series of epidemiological studies of torture in Mashonaland Central Province in Zimbabwe estimated that one adult in ten over the age of thirty was a survivor of torture.[16] More recently, in an analysis done by the ZTVP (February 2005 – April 2006), of 267 Zimbabweans who sought assistance from the ZTVP over an 18 month period, 40% of them reported having been victims of one torture incident, 41% reported two incidents and 19% reported three or more incidents.[17] A total of 40, 559 human rights violations in Zimbabwe have been reported by the Human Rights Forum between July 2001 and 2008.[4]

2.1.3 Types of Torture

There are different types of torture that people are subjected to. The most commonly experienced types are physical torture and psychological torture. Physical torture includes physical assault, deprivation and sensory overstimulation. Psychological torture includes verbal abuse, threats against the person and family, simulated executions and witnessing torture and violence.

2.1.4 Consequences of Torture

The consequences of torture are numerous, not just for the individual victims or perpetrators but also for the world as a whole. There is a huge economic, social and moral burden that is imposed. Torture can cripple a country and its people. This is evidenced by the large number of Zimbabweans fleeing across the borders daily. In 2002, approximately 120 Zimbabweans applied for asylum in South Africa; in 2003 this number increased to approximately 2700 and this number increased threefold in 2004 to 8500. These numbers kept on increasing through 2005 to 16000 and in the first quarter of 2006 alone, 7211 Zimbabweans applied for refugee status in South Africa.[17,18,19] Although the mass exodus of Zimbabweans is not solely due to torture, it does play a significant role.

From an individual viewpoint, survivors of torture may have long term physical, psychiatric and/or psychological sequelae. Numerous studies have looked at these sequelae. Common physical effects of torture include damage to muscles, ligaments and tendons; chronic backache; neurological problems and internal organ damage. The psychological effects include multiple losses, poor self-esteem, shame, guilt, relationship problems and identity crises. Often survivors of torture experience further traumatisation due to conditions in their country of exile, e.g. xenophobia. In addition, torture survivors exhibit various psychiatric diagnoses including PTSD, MDD, Dysthymia, Generalised Anxiety Disorder, Functional Psychosis, Somatoform Pain Disorders and Dissociative Amnestic Disorders.[20,21,22,23,24,25]

Torture represents a traumatic experience in which horror, helplessness and hopelessness are extreme. Therefore it can be expected that trauma related disorders e.g. PTSD and MDD are present at higher rates in torture victims than in other psycho traumatised individuals. In the study by Van Ommeren et al 418 tortured Bhutanese

refugees living in Nepalese camps were compared to 392 non-tortured compatriots. Tortured victims were more likely to exhibit PTSD, Somatoform Pain Disorders, Dissociative Amnestic Disorders, MDD and Generalised Anxiety Disorder.[21] Wenzel and his colleagues reported on a group of exiled survivors of torture presenting to an outpatient psychiatric department; the most frequent diagnosis in the 44 patients who were seen over a period of three years was PTSD (n = 40), but criteria for a diagnosis of other disorders were fulfilled in 34 patients, even years after the torture, mainly MDD or Dysthymia (n = 26). Criteria for functional psychosis were fulfilled in four patients.[22] Survivors of torture versus non-tortured political activists in Turkey had significantly more symptoms of PTSD and Anxiety/Depression. This suggests that torture itself has long term psychological effects independent of those related to uprooting, refugee status and other traumatic life events in a politically repressive environment.[23]

2.2 Psychiatric Diagnoses

For the purpose of this study, “psychiatric diagnoses” will include PTSD and MDD.

2.2.1 Post Traumatic Stress Disorder

PTSD is an anxiety disorder that may occur in persons who have experienced a traumatic event that has involved experiencing, witnessing or being confronted with actual or threatened death, serious physical injury, or a threat to one’s physical integrity. The three major elements of PTSD include re-experiencing the trauma through dreams or recurrent and intrusive thoughts, emotional numbing such as feeling detached from others and symptoms of autonomic arousal e.g. irritability and exaggerated startle response. The above symptoms should be present for more than one month and the disturbance should

cause clinically significant distress or impairment in social, occupational or other important areas of functioning.[26,27]

2.2.2 Incidence/Prevalence of PTSD

The lifetime prevalence of PTSD is estimated to be about 8% of the general population.[28] In torture survivors, research has revealed a lifetime prevalence of PTSD of 30-54%.[15,29]

2.2.3 Major Depressive Disorder

DSM IV-TR states that a person must have at least five of nine criteria for a major depressive episode. These criteria include a depressed mood, loss of interest or pleasure, significant weight or appetite changes, sleep disturbances, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive or inappropriate guilt, decreased concentration and recurrent suicidal thoughts, intent or plans. These symptoms must be present for at least two weeks, must impair social, occupational or other important areas of functioning and must not be due to the direct physiological effects of a substance or a general medical condition.[26,27]

2.2.4 Incidence/Prevalence of MDD

The lifetime prevalence of MDD in the general population is almost 17%.[28] The lifetime prevalence of MDD in torture survivors is estimated at 27% in some studies.[15,29]

2.3 Functional Neuroimaging

2.3.1 Brain Single Photon Emission Computed Tomography

Brain SPECT is a perfusion study which allows the detection of injected cerebral blood flow radiopharmaceuticals and their perfusion into different brain areas, thereby allowing observation of the biochemical and physiological processes occurring in the brain.[30]

SPECT allows us to study regional differences in cerebral blood flow within the brain. The information on cerebral blood flow correlates highly with the rate of glucose metabolism because the rate of glucose utilisation in the brain is tightly coupled to the rate of blood flow. Therefore the use of either of the two provides a measure of the degree of cerebral functional activity. SPECT uses compounds labelled with single photon-emitting isotopes such as technetium-99m and iodine-123. In order to assess blood flow over the whole brain, tracers like ^{99m}Tc-HMPAO are used. The isotope attaches to molecules that are highly lipophilic and rapidly cross the blood-brain barrier and enter brain cells. Once inside the cell, the ligands are enzymatically converted to charged ions, which remain trapped in the cell. Thus, over time, the tracers are concentrated in areas of relatively higher blood flow.[28]

Researchers have used functional imaging to study groups of patients with various psychiatric diagnoses. This has allowed a better understanding of the neurological underpinnings and pathophysiology of mental illness.[28]

2.3.2 Neuroimaging Findings in PTSD

In PTSD, several different imaging techniques have been used to measure changes in cerebral blood flow, including Positron Emission Tomography, Brain SPECT, and Functional Magnetic Resonance Imaging. Neuroimaging in PTSD, for any traumatic event, not necessarily torture, has revealed changes in brain structure and function that may underlie the symptoms. These insights have allowed PTSD to change from a "traumatic neurosis" to a biologically based psychological disorder.

There are different findings and various inconsistencies in the neuroimaging of individuals with PTSD. Older studies, many of which utilised SPECT, have identified four brain areas of special interest; the hyperactive amygdala, the hippocampus which in PTSD usually exhibits smaller volume and declarative memory deficits, the cingulate gyrus and the orbitofrontal cortical regions which may not be able to inhibit the hyperactive amygdala to trauma related stimuli.[31,32,33,34,35,36,37]

A more recent review article by Francati et al published in 2007 highlights the most recorded findings in patients with PTSD, using Positron Emission Tomography, Functional Magnetic Resonance Imaging and SPECT as being decreased medial prefrontal cortex and increased amygdala activation. Inconsistent results in relation to regions like the hippocampus and adjacent parahippocampal gyrus have been found. These inconsistencies may be due to the wide variation of parameters in the different studies and the complex nature of PTSD.[38] Approximately 85% of all people suffering from PTSD who participate in functional brain imaging studies have either been war victims or victims of sexual abuse.[39] The majority have been suffering from PTSD for a very long time and exhibited relatively high rates of comorbidity or they use psychiatric medication, both of which are potential confounding factors. Some studies also did not include a trauma

exposed control group that had never developed PTSD. To generalise the key findings from previous studies, one needs to study varied populations with PTSD, including a wider spectrum of traumas, to focus on patients who have PTSD but no relevant comorbidity and to compare patient data with those of a traumatised control group.[40]

2.3.3 Neuroimaging Findings in MDD

In patients with MDD, functional neuroimaging studies have provided valuable information about abnormal neurophysiological activity in several brain structures. Different brain regions correlate with discrete symptom components that compose the overall syndrome of major depression.[41] Hence, although there are discrepancies between studies, consistent abnormalities in regional cerebral blood flow or glucose metabolism in the prefrontal cortex, anterior cingulate cortex, amygdala and basal ganglia in patients with MDD have been found. Studies using SPECT showed that these findings tend to occur particularly in the left hemisphere.[42,43,44]

2.3.4 Neuroimaging Findings in Torture Survivors

Few studies have looked at functional neuroimaging in survivors of torture. Only one study using SPECT showed that severe psychological trauma induced by torture can cause neurobiologic alterations that may contribute, even years after the original trauma, to a number of complaints commonly expressed by patients suffering from PTSD.[45] There is little data regarding functional neuroimaging findings in survivors of torture who subsequently present with MDD.

It is in light of the above, that this study plans to look at the psychopathology exhibited by survivors of torture, their functional neuroimaging findings and a possible association between the two.

CHAPTER THREE: METHODOLOGY

3.1 Sample

3.1.1 Population

SACST formerly known as the ZTVP, was established in February 2005. The ZTVP's mandate was to provide medical, psychosocial and legal services to primary survivors of organized violence and torture perpetrated in Zimbabwe from the year 2000 to date. In December 2006, the ZTVP became a partner project of the Centre for the Study of Violence and Reconciliation, until September 2007. SACST became an independent Section 21 Company in October 2007 and its mandate has expanded to respond to the needs of tortured asylum seekers and refugees from the African region as well as South African victims of gross human rights violations.[20]

SACST is located in Braamfontein, Johannesburg. Volunteers were recruited from the ZTVP project between 2007 and 2010.

3.1.2 Size

A total of 36 volunteers were recruited to participate in the study. 15 of these participants had psychopathology while the remaining 21 had no psychopathology.

3.1.3 Inclusion Criteria

All clients between the ages of 18 and 65 years, who were survivors of torture, who presented for the first time to SACST, were approached to participate in the study. Fifteen clients with psychopathology who had been exposed to torture and 15 clients without psychopathology were initially recruited to participate in the study. However, due to various factors (discussed under limitations) a further six controls were recruited. The traumatised individuals with psychopathology were individually matched as closely as possible, with traumatised individuals who did not have psychopathology, in terms of age and gender. The 15 clients with psychopathology were identified by the resident psychiatrist at SACST.

This study therefore recruited consecutive volunteers, visiting the trauma clinic, male and female with or without psychopathology.

3.1.4 Exclusion Criteria

Clients were excluded if they were/had:

- Pregnant
- Medically unstable
- Psychotic
- Suicidal
- Drug and/or Alcohol abuse/dependence
- Past psychiatric history

3.2 Monitoring Tools

3.2.1 Self Reporting Questionnaire 8

As part of the clinical assessment by SACST, the SRQ8 was administered. This is a widely used psychiatric screening instrument developed in Zimbabwe, which investigates eight common symptoms in the past week. The SRQ8 was derived from the SRQ20 developed by the World Health Organisation in 1980 to provide an instrument for reliably detecting non-psychotic mental disorders and is used widely in Africa as well as other developing countries. A cut-off of four has been used, since validation work with the SRQ8 has shown this to be predictive of significant psychological disorder.[46] Hence for this study a value equal or greater than four was considered significant.

3.2.2 Impact of Event Scale-Revised

The IES-R was first published in 1997 by Weiss and Marmar. It evaluates the subjective impact of a serious life event on a person. As an instrument, it is able to obtain reports of characteristic experiences from persons with PTSD or similar stress syndromes. It is a 22 item questionnaire that also yields sub scores for hyperarousal, intrusive and avoidance experiences. It has a total score of 88.The reliability of this scale has been supported by adequate test – retest results.[47] In terms of construct validity, the IES-R correlates reasonably well with the PTSD Checklist, a measure more closely tied to PTSD symptoms. A cut-off of 33 for a full scale score has been shown to provide optimum diagnostic accuracy against the PTSD Checklist.[48] Hence for this study a value equal to or greater than 33 was considered to be significant.

3.2.3 Montgomery-Asberg Depression Rating Scale

The MADRS is a simple, clinically orientated psychiatric rating scale that measures the treatment effects of antidepressants in depressive illness. It is a ten item scale with a total score of 60. The ten items included are all core symptoms of depressive illness. It has been shown to be highly reliable when compared to the Hamilton Rating Scale and can be used by trained nurses, psychologists and psychiatrists.[49] This scale was chosen despite it being a measure of change as it is a simple, quick scale and includes core symptoms of depression. It is not a diagnostic tool and hence there is no value indicative of a diagnosis of depression. A study by Leentjens and colleagues found that maximum distribution between depressed and non-depressed patients with Parkinsons disease was reached at a cut-off score of 14/15 for the MADRS.[50] Silberman and colleagues suggest that the MADRS shows good accuracy and correlation to the clinical diagnosis when a cut-off score of ten on the MADRS is used to recognise depression in mild to moderate Parkinsons disease patients.[51] In a review article the optimal MADRS cut-off was less than or equal to four to define remission based on a narrow definition, while the optimal cut-off was less than or equal to nine based on a broad definition.[52] Another study advised that MADRS less than ten should provide the clinician with a valid and reasonably objectifiable target for remission.[53] Hence for this study a score equal to or greater than 11 was considered to be significant.

3.3 Data Collection Techniques

- Subject information, both verbal and written, was given to each participant by the investigator (Appendix 1). The investigator was hence at hand to immediately deal with any questions arising.
- Written informed consent was obtained from each participant (Appendix 2).

- Clinical characteristics of the participants, the SRQ8 score and information pertaining to the actual torture was obtained from the SACST case records (Appendix 3 and 4).
- The names of the participants were not used. Instead each participant was given a unique identity number.
- Each participant was assessed during a clinical interview by one of two psychiatrists. Both psychiatrists followed the same clerking format and made diagnoses based on the DSM IV-TR. Any prior history of a head injury unrelated to the torture was documented during this interview.
- None of the participants received psychotrophic medications, nor formal psychotherapy prior to or at the time of data collection.
- The IES-R was administered to assess the presence and severity of traumatic stress symptoms (Appendix 5).
- The MADRS was also administered to measure the presence of, and severity of, depressive symptoms (Appendix 6).
- The 15 study participants and 10 of the controls underwent Brain SPECT imaging, using ^{99m}Tc-HMPAO at the Department of Nuclear Medicine and Molecular Imaging of the University of the Witwatersrand. The Brain SPECT Imaging was then analysed by a consultant in the Department of Nuclear Medicine and Molecular Imaging (Appendix 7).
- The source data was kept confidentially locked in the investigator's office.

3.4 Data Analysis Techniques

- Statistical analysis of the data was done using Statistica 9.1.

- A descriptive analysis of the demographic profile of the participants and their torture experience was noted.
- Results were expressed as mean +/- standard deviation and median (range) when data was not normally distributed.
- Comparisons were initially made between the study and control groups and the following variables were considered: IES-R scores, MADRS scores, SRQ8 scores, Right-Left Hemispheric ratios, Right-Left Thalamic ratios and Right-Left Temporal Lobe ratios. The Mann – Whitney Test was used for comparison of continuous variables not normally distributed.
- The group was then divided based on SRQ8 scores ; group 0 with scores < 4 and group 1 with scores ≥ 4. Comparisons between categorical variables were performed with a Fisher Exact Test. Comparisons were then made between the two groups using the above variables (IES-R scores, MADRS scores, SRQ8 scores, Right-Left Hemispheric ratios, Right-Left Thalamic ratios and Right-Left Temporal Lobe ratios) with the Mann Whitney Test.
- A value of $p < 0.05$ was considered significant.
- Segmental Analysis to provide a semi-quantitative analysis of brain blood flow was done with the use of the Segami Neuro Matching Application Brain SPECT software.

3.5 Financial Implications

- Funding was obtained from SACST and from the University of the Witwatersrand Faculty Research Grant.
- The funds were used to pay for the Brain SPECT scans.

3.6 Ethical Considerations

- Ethical approval was obtained prior to conducting the study from the University of the Witwatersrand's Human Research Ethics Committee. The protocol was approved unconditionally (Appendix 8). The protocol number is M070447.
- Permission to conduct the study was obtained from the Project Co-ordinator of SACST.
- Each participant had been exposed to torture. In order to minimise the effects of trauma the participant may have been exposed to, by repeatedly discussing the torture, most details pertaining to the actual torture were obtained from the SACST clinical records.
- Following the psychiatric assessment, all participants who necessitated either psychiatric or psychological management, were referred appropriately.
- A psychiatrist and a therapist at SACST were available and willing to attend to any psychiatric or psychological problems with regards to re-traumatisation arising from this study.

3.7 Limitations of study

A major limitation of this study was the patient population. The initial proposal was to compare 15 participants with psychopathology with 15 participants without psychopathology and match them according to age and gender as closely as possible. The majority of participants had entered South Africa illegally and were in financial distress. As a result they were often unavailable to come through for the Brain SPECT imaging, which was usually done a few days after the psychiatric assessment; either because they had moved away from the area, had found temporary employment or were

not contactable. This was especially a problem with the control group. The study group tended to be more reliable probably as they were psychiatrically unwell and required intervention. Hence six additional control participants were recruited and even then, the additional six did not all attend their imaging appointments for the reasons stated above.

A further confounding factor was a technical factor that did not permit the acquisition of Brain SPECT in the University of Witwatersrand Department of Nuclear Medicine for a period of time. Hence although participants were available, their imaging could not be done. Four imaging results were also lost due to problems with the machines in the Department of Nuclear Medicine.

Budgetary constraints necessitated a small sample size which in turn hampered statistical comparisons.

None of the participants were on psychotrophic medication or received formal psychotherapy at the time of data collection. However, a few participants did attend a group psychoeducation and supportive counselling session. This may have skewed their findings with respect to the absence of psychopathology.

CHAPTER FOUR: RESULTS

This section of the report presents the results of the empirical study carried out with survivors of torture. As noted in the methodology, the sample was drawn from Zimbabwean survivors of torture residing in Johannesburg, South Africa. The results present the characteristics of the sample, their experiences of torture, their psychopathology and results in various tests.

4.1 Baseline characteristics of participants

A total number of 36 participants entered the study (Table 4.1). These were divided into a study group of 15 (42%) and a control group of 21 (58%). The mean age of the participants was 35 years (SD = 8.6) with a minimum age of 20 and a maximum age of 51. The study group had a slightly lower mean age of 34 years (SD = 8.5) whilst the control group had a mean age of 36 years old (SD = 8.7). Approximately two-thirds (67%) of the participants were male and one-third (33%) were female. In the study group, 11 participants were male and four were female and in the control group, 13 were male and eight were female.

The marital status of the participants also varied with 23 (64%) participants being married; eight (22%) participants were single; four (11%) participants were widows, and one (3%) participant was divorced. In the study group, a greater proportion of the participants were married (80%) as compared to the control group (53%). At the time that this study was conducted, all participants were residing in the City of Johannesburg, South Africa although they originally lived in Zimbabwe. 29 (81%) participants resided with family or

friends, six (16%) participants resided at the Central Methodist Church and one (3%) participant had no fixed abode.

Table 4.1: Baseline characteristics of participants

Variable	Total Participants	Study Group	Control Group
Number of participants	36	15	21
Age (mean)	35	34	36
Gender (male)	24	11	13
Marital status (married)	23	12	11
Residence (with friends or family)	29	12	17
Education (tertiary)	19	10	9
Employed in Zimbabwe	32	15	17
Employed in South Africa	6	2	4
Handedness (right)	33	13	20

Participants in both groups had different levels of education. 19 (53%) participants had tertiary level education, two (5%) participants had A levels, ten (28%) participants had O levels, and five (14%) participants had between 1-10 years of schooling. The study group had slightly higher levels of education than the control group as a whole. Regardless of the different education levels, almost all the participants (89%) had been employed when they lived in Zimbabwe, all 15 of the study participants and 17 of the control participants. Of note, is that 12 participants were teachers (seven in the study group and five in the control group). At the time of the study, only 17% of participants were employed in South Africa, two in the study group and four of the control participants.

Overall 33 (92%) of the participants were right handed and three (8%) were left handed. Of the study participants, 13 (87%) were right handed and two (13%) were left handed whereas 20 (95%) of the control participants were right handed and one (5%) left handed.

4.2 Torture Experience

Allegations of the actual forms of torture are shown in Table 4.2 including the percentage of the sample and graphically depicted in Figure 4.1.

Table 4.2: Torture Experience

Variable	Total (%)	Study (%)	Control (%)
Physical torture (sustained)	27 (75)	10 (67)	17 (81)
Psychological torture (sustained)	36 (100)	15 (100)	21 (100)
Physical torture (witness)	32 (89)	14 (93)	18 (86)
Psychological torture (witness)	35 (97)	15 (100)	20 (95)

All participants (36 in number) were subjected to psychological torture while 27 (75%) participants were also subjected to physical torture. Most of the participants were also witness to torture with 89% witnessing physical torture and 97% witnessing psychological torture of others.

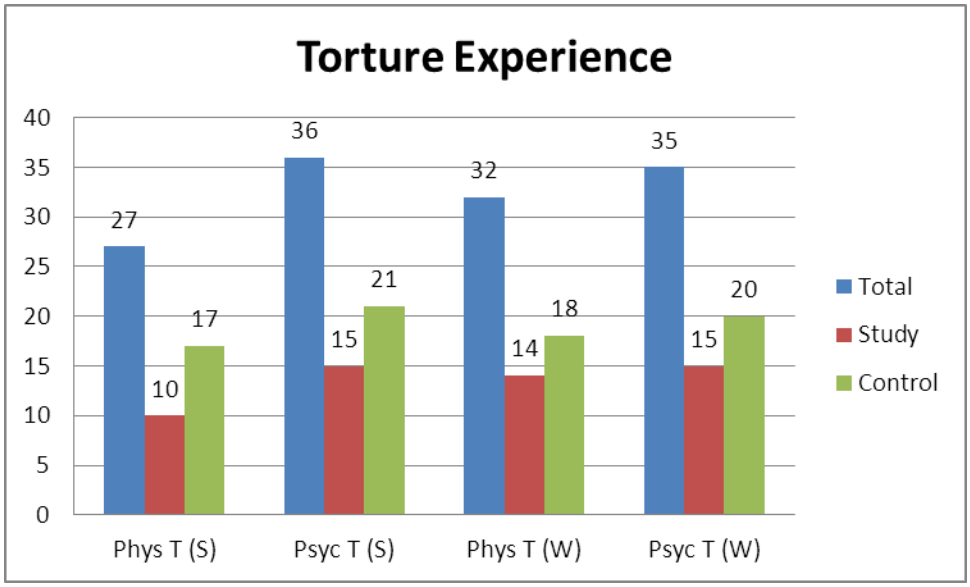

Figure 4.1: Torture Experience

Looking at the nature of the physical torture, only one participant overall (control group) sustained a head injury prior to the torture experience. This same participant also sustained a head injury during the torture. During the torture experience, a total of 15 (42%) of the participants sustained head injuries; nine study participants (60% of the study group) and six controls (29% of the control group) (Figure 4.2). The mechanism of head injuries included sustained blows to the head (10), suffocation (7) and drowning (3).

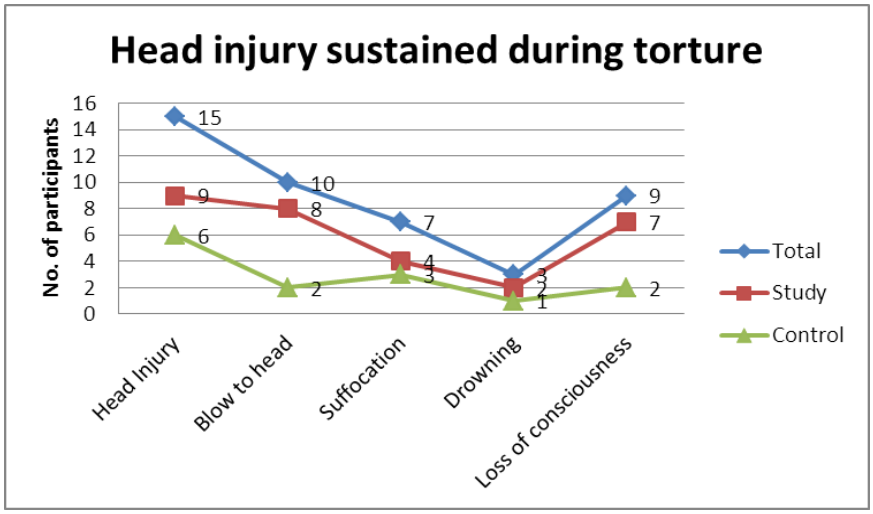

Figure 4.2: Head injury sustained during torture

Some participants sustained head injuries through multiple mechanisms (Figure 4.3).

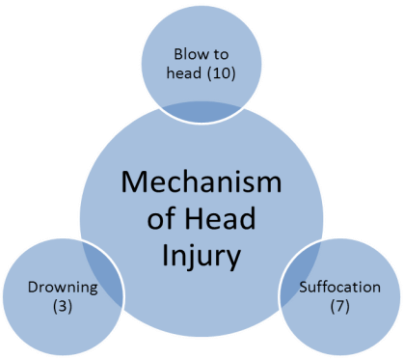

Figure 4.3: Mechanism of Head Injury

Nine (25%) of the participants experienced loss of consciousness secondary to the head injury; seven study participants and two controls.

4.3 Psychopathology exhibited by study participants

The participants in the study showed varied psychopathology with a significant proportion (53%) of participants having both MDD and PTSD (Figure 4.4).

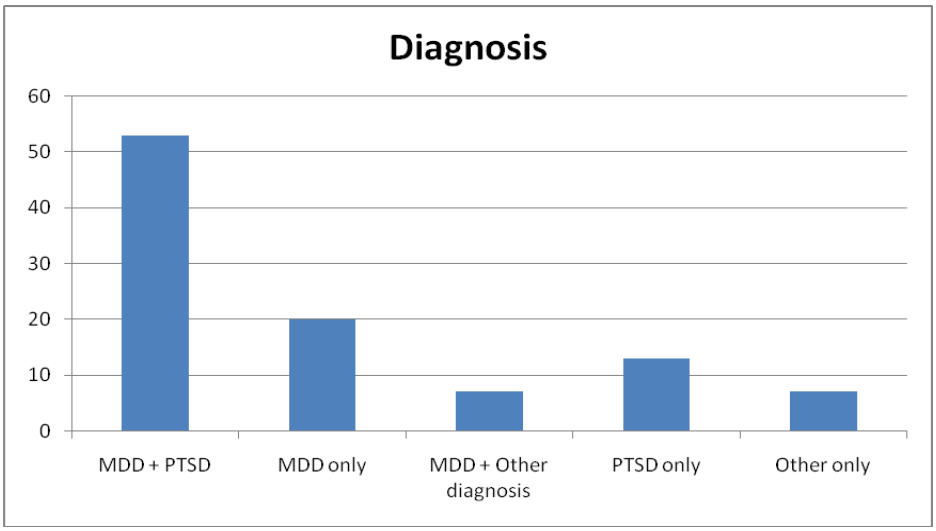

Figure 4.4: Psychopathology exhibited in the participants

Overall, MDD was a commoner finding than PTSD (12 versus 10 participants). Other forms of psychopathology include Complicated Bereavement and Adjustment Disorder with depressed mood only.

4.4 Rating scale results

Mean scores for the SRQ8, MADRS and IES-R, for all participants were significant (≥ 4, ≥ 11 and ≥ 33 respectively). The mean score for the SRQ8 test was 4.7 ± 1.9 with a difference between the study (5.8 ± 1.2) and control groups (4.0 ± 2.0), however both scores were significant. The MADRS and IES-R scores for the study group were significant while the scores for the control group were not (Table 4.3 and Table 4.4).

Table 4.3: Rating scales mean ± standard deviations

Variable	Total	Study	Control
SRQ8	4.7 ± 1.9	5.8 ± 1.2	4.0 ± 2.0
MADRS	11.7 ± 13.1	25.1 ± 9.4	2.2 ± 3.1
IES-R	34.3 ± 25	52 ± 20.7	21.7 ± 19.7

Table 4.4: Rating scales median (range)

Variable	Total	Study	Control
MADRS	(0 – 38)	28 (10 – 38)	0 (0 – 10)
IES-R	(2 – 79)	58 (9 – 79)	15 (2 – 70)

The differences between the study and control groups with respect to the following were statistically significant :-

- SRQ8 : $p = 0.0078$
- MADRS : $p < 0.0001$
- IES-R : $p = 0.001$

Appendix 9 provides the details of the SRQ8, MADRS and IES-R scores.

4.5 Correlations with SRQ8 scores

Participants in the study group had higher and clinically significant SRQ8 scores (≥4) as compared to those in the control group, (p = 0.0007) (Figure 4.5).

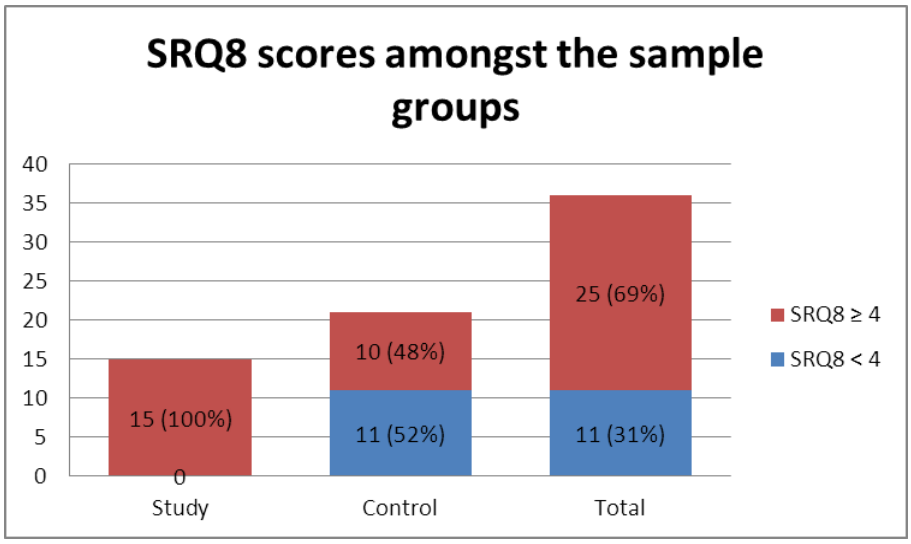

Figure 4.5: SRQ8 scores of the participants

Those participants with SRQ8 scores ≥ 4 (clinically significant) had clinically and statistically significant MADRS (≥ 11) and IES-R (≥ 33) scores as compared to the group with SRQ8 scores < 4 (Table 4.5).

Table 4.5: Rating scales mean ± standard deviations in participants with SRQ8 scores < 4 and ≥ 4

Variable	SRQ8 < 4	SRQ8 ≥ 4	P Value
MADRS	2.4 ± 3.1	15.8 ± 13.7	0.015
IES-R	18.2 ± 18.5	41.4 ± 24.4	0.01

4.6 Brain SPECT imaging results

Of the 36 participants in the study, 21 participants underwent Brain SPECT imaging (Figure 4.6). It was not possible to complete imaging for 11 of the patients, as they did not present for the imaging, and four scans were lost. Approximately 80% of the study group underwent Brain SPECT imaging while 43% of the control group underwent the Brain SPECT imaging.

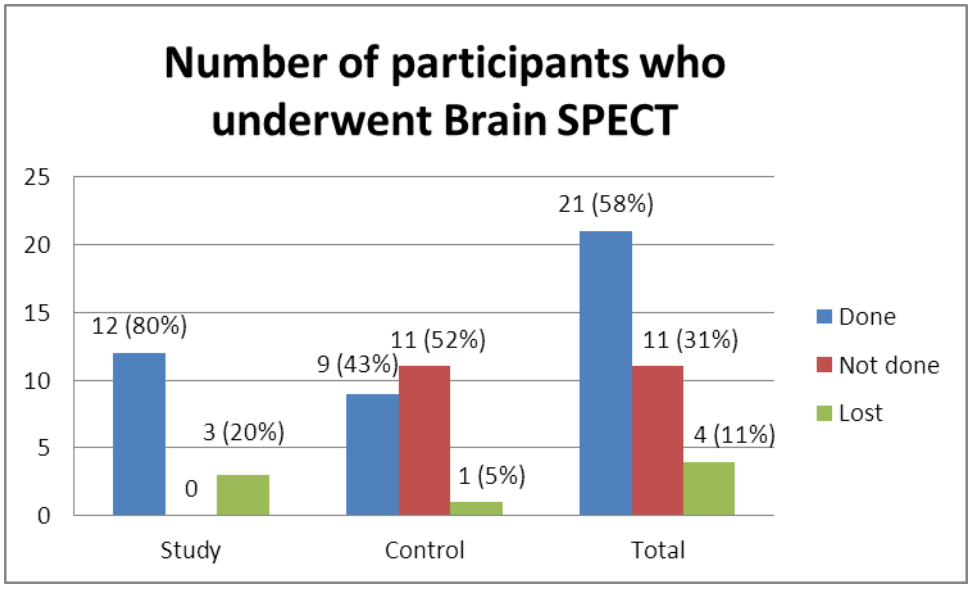

Figure 4.6: Number and percentage of participants who underwent Brain SPECT imaging

4.6.1 Quantitative results

The hemispheres, thalami and temporal lobes were assessed in terms of their right to left ratios for all patients (Table 4.6). The differences in the mean scores for the study and control groups were not statistically significant. The p values were as follows :-

- R-L Hemisphere ratio : p = 0.86
- R-L Thalamus ratio : p = 0.20
- R-L Temporal Lobe ratio : p = 0.65

Table 4.6: Mean ± Standard Deviations between the Right and Left Brain

Variable	Total	Study	Control
R-L Hemisphere ratios	0.979 (0.203)	0.946 (0.269)	1.022 (0.018)
R-L Thalamus ratios	0.996 (0.062)	1.013 (0.063)	0.974 (0.057)
R-L Temporal Lobe ratios	1.027 (0.062)	1.036 (0.067)	1.015 (0.058)

The differences in mean scores for participants with and without clinically significant SRQ8 scores were also not statistically significant (Table 4.7).

Table 4.7: Right and Left Brain mean ± standard deviations in participants with SRQ8 scores < 4 and ≥ 4

Variable	SRQ8 < 4	SRQ8 ≥ 4	P Value
R-L Hemisphere ratios	1.016 ± 0.016	0.964 ± 0.241	0.47
R-L Thalamus ratios	0.982 ± 0.064	1.002 ± 0.063	0.73
R-L Temporal Lobe ratios	1.024 ± 0.068	1.028 ± 0.063	0.79

Please see appendix 10 for quantitative values.

4.6.2 Qualitative results (Visual assessment)

The participants with psychopathology showed increased abnormalities in cerebral perfusion on Brain SPECT imaging as compared to those participants without psychopathology. All 12 study participants, who underwent Brain SPECT imaging, had perfusion abnormalities (Figure 4.7). Four of the nine control participants, who underwent Brain SPECT imaging, also had perfusion abnormalities while the other five controls had normal imaging (Figure 4.8). Perfusion abnormalities were detected in most participants in the temporal cortices. To a lesser extent; the parietal cortices, orbitofrontal cortices,

thalami and basal ganglia were also involved. There was no difference between the study and control participants with respect to the areas of the brain involved. The right and left sides of the brain were equally involved. Please see Appendix 7 for qualitative results.

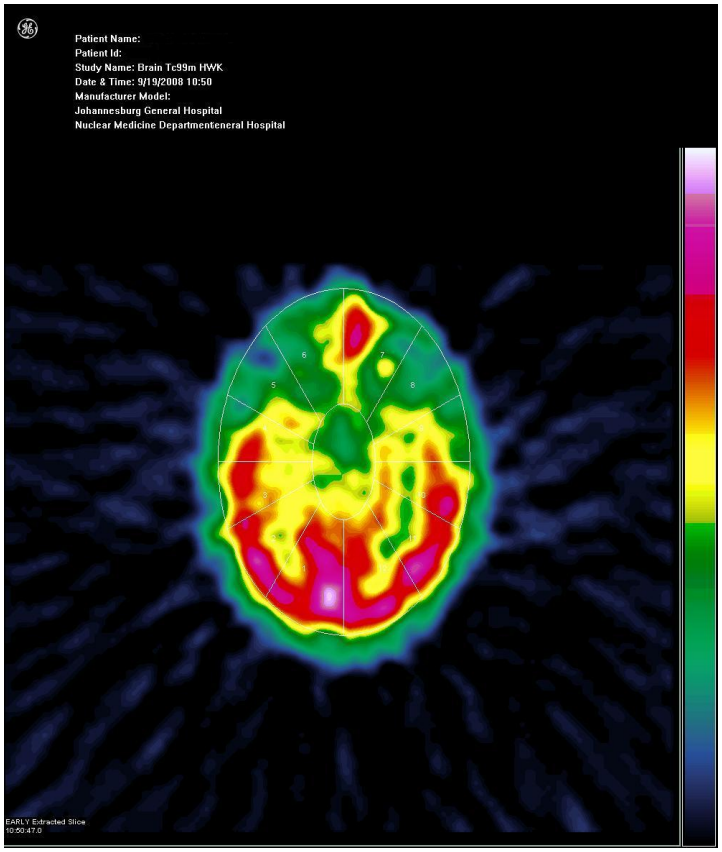

Figure 4.7: Abnormal Brain SPECT scan (Study group)

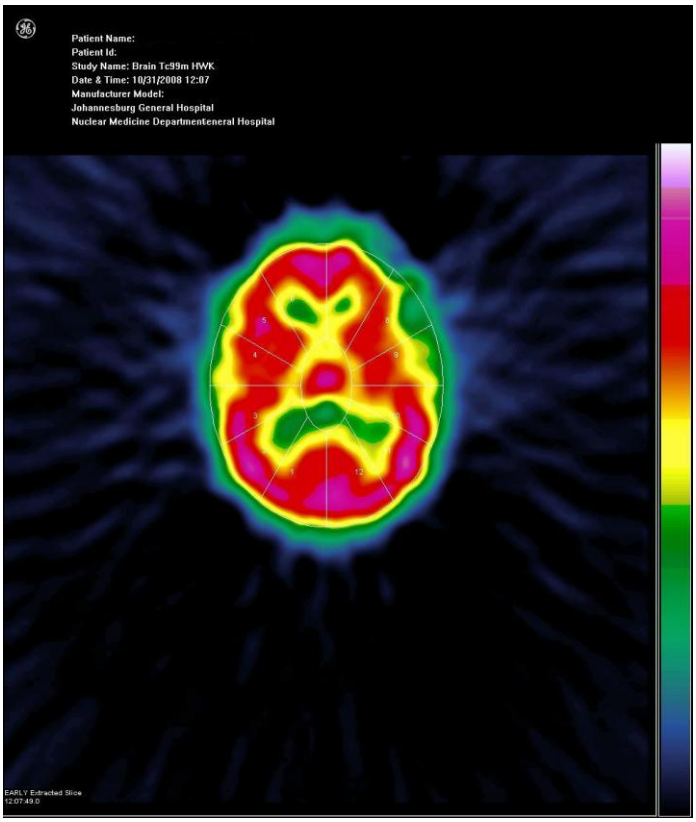

Figure 4.8: Normal Brain SPECT scan (Control group)

4.7 Summary of results

Study participants displayed psychopathology. The clinical interviews conducted by the psychiatrists revealed that the commonest finding was that of MDD in 12 of the 15 study participants, followed closely by PTSD in 10 participants. This finding was supported by the rating scale scores. The mean MADRS score for all participants was 11.7 ± 13.1 and the mean IES-R score was 34 ± 25.

The quantitative results for the Brain SPECT imaging were not statistically significant but the qualitative results revealed that participants with psychopathology had a visible abnormal cerebral perfusion specifically involving the temporal cortices, thus the reason

for the quantitative assessment of this cerebral area. The parietal cortices, orbitofrontal cortices, thalami and basal ganglia were also involved.

All participants had clinically significant SRQ8 scores (mean = 4.7 ± 1.9), though the score in those with psychopathology was higher to a statistically significant degree than that in the control group. In addition, those participants with higher SRQ8 scores (≥4) had clinically and statistically significant MADRS and IES-R scores, as compared to the group with lower SRQ8 scores. There was however, no statistical difference with respect to quantitative Brain SPECT imaging findings in those with SRQ8 scores < 4 and ≥ 4.

CHAPTER FIVE: DISCUSSION

5.1 Baseline characteristics of participants

The majority of participants exposed to torture were male, married and had been employed in their home countries. This is generally in keeping with the literature.[16,25] Most torture survivors have had some schooling, albeit usually between one and ten years. In the study, 53% of participants had received tertiary education and 33% were teachers in Zimbabwe. This may be explained by the political situation in Zimbabwe currently as anecdotal reports suggest that a number of highly educated individuals particularly teachers are presumed to be MDC supporters and hence are the targets of torture attacks.

5.2 Torture Experience

All participants endured psychological torture while 75% were also physically tortured. Reeler in his report entitled 'Subliminal terror?' makes mention of a series of unpublished reports by the Amani Trust which described psychological torture as being the most common form of torture.[4] The study supports this finding. In the study, 42% of those physically tortured sustained head injuries. The majority of the study participants (60%) were included in this head injury group. A review by Mollica et al[54] found that numerous studies of torture survivors and survivors of mass violence have linked psychiatric symptoms, neurologic impairment and traumatic head injury. One study showed that structural deficits in prefrontotemporal brain regions were linked to traumatic head injury

exposures and that these brain lesions were associated with symptom severity of depression.[54] This current study did not look specifically at the correlations between traumatic head injuries, psychopathology and brain imaging findings. This could possibly have added further value to the research and suggests an opportunity for further research. It is also interesting to note that 97% of the sample witnessed psychological torture being inflicted upon others and 89% witnessed physical torture being inflicted upon others. This suggests repeated trauma exposure which in itself may predispose to and perpetuate psychological and psychiatric disorders. Subramaney in her article highlighting experiences of a trauma clinic showed that individuals who experienced more than one traumatic event were more likely to have developed PTSD than those who experienced a single event.[55]

5.3 Psychopathology exhibited by study participants

The findings with regards to psychopathology in torture survivors in this research support published research that MDD and PTSD are often found in these individuals.[20,21,22,23,24,25] PTSD develops secondary to a traumatic event and hence one would expect that more participants would have PTSD than MDD. However, 80% of the study group had MDD while 67% of the study group had PTSD. This finding is supported by literature.[55] Subramaney suggests that this maybe due to a variety of factors including the nature of the trauma experienced, the nature of the diagnostic criteria used and underreporting of symptoms.[55] Both MDD and PTSD were present in 53% of the study group. The high comorbidity between MDD and PTSD has also been found in other studies.[55] A slight bias in the results of this study is expected, as the study participants were chosen on the basis of them having psychopathology.

5.4 Rating scale results

All study participants had significant SRQ8 (≥ 4), MADRS (≥ 11) and IES-R (≥ 33) scores. The significant MADRS and IES-R scores correspond well with diagnostic interview findings. Five of the 21 control participants did have significant IES-R scores ≥ 33, but on diagnostic interview they did not meet DSM IV-TR criteria[27] for PTSD. This may be because of the subjectivity of PTSD as a clinical entity. None of the control participants had MADRS scores ≥ 11. The use of the MADRS to aid in detecting depression is debatable. In this study the clinical interview and rating scale scores corresponded well and hence it was not felt that the choice of MADRS was a limitation.

5.5 Correlations with SRQ8 scores

The SRQ8 has been shown to be reliable and predictive of psychological disorders.[46] This was supported by the study as those with SRQ8 scores ≥ 4 had clinically significant MADRS and IES-R scores, which in turn tallied with greater diagnoses of MDD and PTSD.

5.6 Brain SPECT imaging results

The hemispheres, thalami and temporal lobes were the areas chosen to concentrate on with regards to the quantitative assessment due to changes on cerebral perfusion noted with visual assessment of Brain SPECT images performed in this group of participants. Although these areas do encompass the regions of interest in MDD and PTSD highlighted

in the literature, [31,32,33,34,35,36,37,42,43,44] they do not focus on the specific regions. This then may have contributed to the lack of statistically significant differences on imaging between those with and without psychopathology as well as those with SRQ8 scores < 4 and ≥ 4. The sample size in the study is the most likely reason for the lack of statistically valid significance in the statistical analysis. It could also be that brain imaging changes occur in torture survivors irrespective of the presence or absence of psychopathology. However, this is unlikely, as the qualitative results do reveal increased cerebral perfusion abnormalities in those with psychopathology as compared to those without psychopathology.

The qualitative brain imaging results for all study participants showed evidence of perfusion changes. All control participants except four, had normal perfusion patterns. One of these four was in fact HIV positive while another, although undiagnosed, had symptoms suggestive of HIV infection. The HIV infection could thus be the reason for the perfusion abnormalities detected.[56] A third participant from the control group with abnormal perfusion findings later went on to develop PTSD though he had no evidence of PTSD at the time of the data collection, except for an IES-R of 59. In addition, this same participant had sustained a head injury, albeit without loss of consciousness, during the torture which may, in itself, have been responsible for the perfusion changes. Although it could not be explained from the data collected why the fourth control participant had abnormal perfusion the following possibilities need to be considered :- delayed onset of PTSD still to come and the subjectivity of PTSD as a clinical entity. It is hence probable that this participant may still develop PTSD.

In the study, most perfusion abnormalities were seen in the temporal cortices. The parietal cortices, orbitofrontal cortices, thalami and basal ganglia were also involved. This is

generally in keeping with the literature.[31,32,33,34,35,36,37,41,42,43,44] Vangu et al in a South African setting using SPECT in patients with MDD pre-ECT showed perfusion abnormalities mainly in the temporal and frontal areas.[57] This is supported by the study. Studies in persons with MDD have identified perfusion abnormalities mainly in the left hemisphere.[42,43,44] In the study, there was equal involvement of the left and right hemispheres. This maybe so, because I did not differentiate between those with MDD and those with PTSD, but looked at a collective sample.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

Survivors of torture do exhibit psychopathology especially PTSD and MDD. There appears to be a presence of cerebral perfusion abnormality on Brain SPECT imaging, particularly involving the temporal cortices, in those with psychopathology. The parietal cortices, orbitofrontal cortices, thalami and basal ganglia are also probably involved. Higher SRQ8 scores are associated with higher scores on the MADRS and IES-R and correlate with diagnoses of MDD and PTSD, but no direct association has been noted with the visualised abnormal Brain SPECT imaging findings.

The findings from this study support the literature available and add to the limited knowledge base on functional neuroimaging in survivors of torture. This study also importantly highlights the issue that torture survivors should be assessed early and treated aggressively in order to alleviate the morbidity and mortality associated with mental illness.

It is hoped that this research will increase the awareness of the torture still being perpetuated in Sub-Saharan Africa and will hence assist organisations helping torture survivors to access funding. This study paves the way for additional research in the field of torture and functional neuroimaging. A larger study that may include individuals, that are survivors of torture from different regions of Africa, could perhaps elucidate on the changes on cerebral perfusion visualised in the group of participants in this study. This would also provide a power that will make the statistical outcome robust enough to predict the presence or absence of PTSD and MDD whenever clinically doubtful of a diagnosis. Pre and post interventional studies using SPECT would also be useful to understand the

neurocircuitary and pathogenesis of PTSD and MDD in torture survivors. Following up the participants for a longer time may also allow us the opportunity to further understand the concept of ‘Delayed onset PTSD’. In addition, it would be useful to look at correlations between traumatic head injuries, functional neuroimaging and psychopathology. Financial constraint should not be a limitation for such studies in the presence of continuous and increased abuse of the powerless by those who are supposed primarily to look after them.

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APPENDIX 1: SUBJECT INFORMATION SHEET

TITLE OF STUDY: FUNCTIONAL NEUROIMAGING IN SURVIVORS OF TORTURE

SUBJECT INFORMATION SHEET

Dear Client

My name is Dr Thriya Ramasar and I work in the Department of Psychiatry at the University of Witwatersrand. I would like to invite you to join this study. Before you agree to take part in this study you should fully understand what is involved. If you have any questions, which are not fully explained in this information sheet, do not hesitate to ask the investigator. You should not agree to take part unless you are completely happy about the procedure involved.

The purpose of this study is to assess if you have any evidence of mental illness and/or brain changes as a result of the torture you experienced. The research involves an interview by a doctor as well as giving you an injection of radiotracer that will capture images of your brain. You will then be put on a machine that takes images of your brain. Little risk is attached to this procedure. Data obtained from this study may help in managing future patients with similar problems.

There will be no cost to you by accepting to participate in this study. Transport arrangements will be made for you to come to the Johannesburg General Hospital for the procedure.

Should you choose not to take part in this study, your treatment will not be affected and your decisions will not influence your future care and continued treatment.

There will be a total of 30 patients in this study. All information obtained during the course of this research is strictly confidential. Data that may be reported in scientific journals will

not include any information which identifies you as a patient in this research. The results of this study may be submitted to the Ethics Committee at their request. Any information uncovered regarding your imaging results or state of health as a result of your participation in this study will be held in strict confidence.

This study will seek approval from the University of Witwatersrand's Human Research Ethics Committee.

Should you have any questions regarding this study, please do not hesitate to contact Dr Thriya Ramasar, on telephone number 011 933 9239.

Thank you for your time.

Thriya Ramasar

APPENDIX 2: WRITTEN CONSENT FORM

TITLE OF STUDY: FUNCTIONAL NEUROIMAGING IN SURVIVORS OF TORTURE

WRITTEN CONSENT FORM

Name of Patient:……..…...

Patient Number:……..

The aims and procedures of this study have been explained to me by the doctor. I have read and understood the subject information sheet provided.

I have had the opportunity to as questions and to consider the answers given to me.

I understand that participation in this study is voluntary, that I may decline my consent and if I choose not to participate, my decisions will not affect my treatment and further care.

I hereby feely give my informed consent to take part in this study.

NAME :……...

DATE :……...

SIGNATURE :……...

I confirm that I have fully explained the nature of the study and the procedure to the above named patient.

NAME :……...

DATE :……...

SIGNATURE :……...

APPENDIX 3: DATA SHEET: Functional Neuroimaging in Survivors of Torture

Number		
Date of Assessment		
Age		
Gender		
Marital Status		
Current living circumstances		
HLOE		
Occupation		
Date of entry to SA		
Handedness		
Type of torture:	1. Physical (to self)	
	2. Psychological (to self)	
	3. Physical (witnessed)	
	4. Psychological (witnessed)	
Head injury:	During torture - blow to head - suffocating - drowning If YES, LOC:	
	Prior to torture	
Multiaxial Diagnosis:	Axis I	
	Axis II	
	Axis III	
	Axis IV	
	Axis V	
SRQ8 Score (Total = 8)		
IES-R (Total = 88)		
MADRS (Total = 60)		
Brain-SPECT findings		

APPENDIX 4: SELF REPORTING QUESTIONNAIRE (SRQ8)

Self Reporting Questionnaire (SRQ8)

Read each statement aloud to the patient. Patients should be asked to respond YES or NO to each question. Try to restrict discussion about each question during testing: you may wish to discuss the answers after the test as a whole has been given.

[NB – these questions relate to the last 7 days]

	YES	NO
1. Do you sleep badly?	…..	….
2. Do you cry more than usual?	….	….
3. Do you find it difficult to enjoy your daily activity?	….	….
4. Do you find it difficult to make decisions?	….	….
5. Is your daily work suffering?	….	….
6. Are you unable to play a useful part in life?	….	….
7. Has the thought of ending your life been in your mind?	….	…..
8. Do you feel tired all the time?	….	….

TOTAL SRQ-8 SCORE: ……

APPENDIX 5: The IMPACT OF EVENT SCALE-REVISED

Below is a list of difficulties people sometimes have after stressful life events. Please read each item, and then indicate how distressing each difficulty has been for you DURING THE PAST SEVEN DAYS with respect to _____,

How much were you distressed or bothered by these difficulties.

	Not at all	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**
1. Any reminder brought back feelings about it	0	1	2	3	4
2. I had trouble staying asleep	0	1	2	3	4
3. Other things kept making me think about it	0	1	2	3	4
4. I felt irritable and angry	0	1	2	3	4
5. I avoided letting myself get upset when I thought about it or was reminded of it	0	1	2	3	4
6. I thought about it when I didn't mean to	0	1	2	3	4
7. I felt as if it hadn't happened or wasn't real	0	1	2	3	4
8. I stayed away from reminders about it	0	1	2	3	4
9. Pictures about it popped into my mind	0	1	2	3	4
10. I was jumpy and easily startled	0	1	2	3	4
11. I tried not to think about it	0	1	2	3	4
12. I was aware that I still had a a lot of feelings about it, but I didn't deal with them	0	1	2	3	4
13. My feelings about it were kind of numb	0	1	2	3	4
14. I found myself acting or feeling as though I was back at that time	0	1	2	3	4
15. I had trouble galling	0	1	2	3	4

	Not at all	A little bit	Moderately	Quite a bit	Extremely
asleep					
16. I had waves of strong feelings about it	0	1	2	3	4
17. I tried to remove it from my memory	0	1	2	3	4
18. I had trouble concentrating	0	1	2	3	4
19. Reminders of it caused me to have physical reactions such as sweating, trouble breathing, nausea, or pounding heart	0	1	2	3	4
20. I had dreams about it	0	1	2	3	4
21. I felt watchful or on-guard	0	1	2	3	4
22. I tried not to talk about it	0	1	2	3	4

Scoring:

Avoidance Subscale = mean of items 5,7,8,11,12,13,17,22

Intrusion Subscale = mean of items 1,2,3,6,9,14,16,20

Hyperarousal Subscale = mean of items 4,10,15,18,19,21

APPENDIX 6: MONTGOMERY- ASBERG DEPRESSION RATING SCALE (MADRS)

Patient's Name: Date:

1. Apparent sadness Representing despondency, gloom and despair (more than just ordinary transient low spirits), reflected in speech, facial expression and posture. Rate by depth and inability to brighten up.	
0 = No sadness	
2 = Looks dispirited but does brighten up without difficulty	
4 = Appears sad and unhappy most of the time	
6 = Looks miserable all the time. Extremely despondent.	

2. Reported sadness Representing reports of depressed mood, regardless of whether it is reflected in appearance or not. Includes low spirits, despondency or the feeling of being beyond help and without hope.	
0 = Occasional sadness in keeping with the circumstances	
2 = Sad or low but brightens up without difficulty	
4 = Pervasive feelings of sadness or gloominess. The mood is still influenced by external circumstances.	
6 = Continuous or unvarying sadness, misery or despondency.	

3. Inner tension Representing feelings of ill-defined discomfort, edginess, inner turmoil, mental tension mounting to either panic, dread or anguish. Rate according to intensity, frequency duration and the extent of reassurance called for.	
0 = Placid. Only fleeting inner tension	
2 = Occasional feelings of edginess and ill-defined discomfort	
4 = Continuous feelings of inner tension or intermittent panic which the patient can only master with some difficulty	
6 = Unrelenting dread or anguish. Overwhelming panic	

4. Reduced sleep Representing the experience of reduced duration or depth of sleep compared to the subject's own normal pattern when well	
0 = Sleep as normal	
2 = Slight difficulty dropping off to sleep or slightly reduced, light or fitful sleep	
4 = Moderate stiffness and resistance	
6 = Sleep reduced or broken by at least 2 hours	

5. Reduced appetite Representing the feeling of a loss of appetite compared to when well. Rate by loss of desire for food or the need to force oneself to eat	
0 = Normal or increased appetite	
2 = Slightly reduced appetite	
4 = No appetite. Food is tasteless	
6 = Needs persuasion to eat at all	

6. Concentration difficulties Representing difficulties in collecting one's thoughts mounting to an incapacitating lack of concentration. Rate according to intensity, frequency, and degree of incapacity produced	
0 = No difficulties in concentrating	
2 = Occasional difficulties in collecting one's thoughts	
4 = Difficulties in concentrating and sustaining though which reduced ability to read or hold a conversation	
6 = Unable to read or converse without great difficulty	

7. Lassitude Representing difficulty in getting started or slowness in initiating and performing everyday activities	
0 = Hardly any difficulty in getting started. No sluggishness	
2 = Difficulties in starting activities	
4 = Difficulties in starting simple routine activities which are carried out with effort	
6 = Complete lassitude. Unable to do anything without help	

8. Inability to feel Representing the subjective experience of reduced interest in the surroundings, or activities that normally give pleasure. The ability to react with adequate emotion to circumstances or people is reduced	
0 = Normal interest in the surroundings and in other people	
2 = Reduced ability to enjoy usual interests	
4 = Loss of interest in the surroundings. Loss of feelings for friends and acquaintances	
6 = The experience of being emotionally paralysed, inability to feel anger, grief or pleasure and a complete or even painful failure to feel for close relatives and friends	

9. Pessimistic thought Representing thoughts of guilt, inferiority, self-reproach, sinfulness, remorse and ruin	
0 = No pessimistic thoughts	
2 = Fluctuating ideas of failure, self-reproach or self-depreciation	
4 = Persistent self-accusations, or definite but still rational ideas of guilt or sin. Increasingly pessimistic about the future	
6 = Delusions of ruin, remorse or irredeemable sin. Self-accusations which are absurd and unshakable.	

10. Suicidal thoughts Representing the feeling that life is not worth living, that a natural death would be welcome, suicidal thoughts, and preparations for suicide. Suicide attempts should not in themselves influence the rating.	
0 = Enjoys life or takes it as it comes	
2 = Weary of life. Only fleeting suicidal thoughts	
4 = Probably better off dead. Suicidal thoughts are common, and suicide is considered as a possible solution, but without specific plans or intentions	
6 = Explicit plans for suicide when there is an opportunity. Active preparations for suicide	

APPENDIX 7: QUALITATIVE BRAIN SPECT IMAGING RESULTS

Patient: 3

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

The right hemisphere demonstrates reduced perfusion throughout.

Evidence of focal absent perfusion in:

1. Right orbitofrontal cortex
2. Right high parietal cortex

Patient: 7

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Right orbitofrontal cortex
2. Right temporal cortex

Patient: 12

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Left temporal cortex
2. Left mid to high parietal cortex

Patient: 19

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

No evidence of focal abnormal perfusion.

Patient: 6

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal absent perfusion in:

1. Right temporal cortex
2. Left basal ganglia

Patient: 11

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Right temporal cortex
2. Left thalamus
3. Right orbitofrontal cortex

Patient: 17

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

No evidence of focal abnormal perfusion.

Patient: 4

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Right anterior temporal cortex
2. Left basal ganglia

Patient: 14

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of increased perfusion in:

1. Right basal ganglia
2. Left mesial temporal cortex
3. Left orbitofrontal cortex

Patient: 21

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

No evidence of focal abnormal perfusion

Patient: 9

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Right temporal cortex
2. Left basal ganglia

Patient: 5

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Left temporal cortex
2. Bilateral mesial temporal cortex
3. Left thalamus

Patient: 13

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Right superior temporal cortex
2. Right mesial temporal cortex

Patient: 20

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

No evidence of focal abnormal perfusion.

Patient: 8

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Left temporal cortex

Patient: 10

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of increased perfusion in:

1. Left high parietal cortex
2. Superior aspect of left temporal cortex

There is associated reduced uptake in the left frontal cortex.

Patient: 18

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

No evidence of focal abnormal perfusion.

Patient: 30

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Right temporal cortex
2. Right high parietal cortex
3. Right thalamus

Patient: 31

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Left temporal cortex
2. Left high parietal cortex
3. Bilateral orbitofrontal cortex
4. Left thalamus

Patient: 34

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Inhomogenous decreased perfusion throughout

Patient: 35

The patient was in a quiet dimly lit room with an intravenous line inserted. The tracer was injected with the patient lying down with eyes open. Symmetrical and better cerebellar to cerebral ratio noted.

Evidence of focal reduced perfusion in:

1. Left temporal cortex
2. Bilateral parietal cortex
3. Right thalamus

APPENDIX 8: ETHICAL CLEARANCE FOR THE RESEARCH PROTOCOL

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ramasar

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M070447**
PROJECT	Functional Neuroimaging in Survivors of Toture
INVESTIGATORS	Dr T Ramasar
DEPARTMENT	Psychiatry/Neurosciences
DATE CONSIDERED	07.05.04
DECISION OF THE COMMITTEE*	APPROVED UNCONDITIONALLY

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 07.06.14 **CHAIRPERSON** .....
(Professors PE Cleaton-Jones, A Dhai, M Vorster, C Feldman, A Woodiwiss)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Subramaney U Dr

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 9: RATING SCALE SCORES

Identification No.	Group	SRQ8 Score	IES-R	MADRS
1	1	6	56	38
2	1	6	42	10
3	1	8	52	18
4	1	6	79	34
5	1	6	60	18
6	1	5	58	28
7	1	6	19	28
8	1	4	9	30
9	1	8	70	12
10	1	4	51	28
11	1	5	59	26
12	1	5	22	10
13	1	6	76	38
14	1	7	67	32
15	1	5	60	26
16	0	5	46	0
17	0	2	9	0
18	0	2	14	4
19	0	3	48	0
20	0	8	42	2
21	0	6	70	8
22	0	5	4	0
23	0	6	11	0
24	0	3	6	0
25	0	5	7	0
26	0	4	9	0
27	0	5	22	8
28	0	3	4	0
29	0	2	7	2
30	0	7	29	2
31	0	3	59	4
32	0	6	16	0
33	0	3	15	4
34	0	3	16	2
35	0	1	20	10
36	0	1	2	2

APPENDIX 10: QUANTITATIVE BRAIN SPECT IMAGING RESULTS

ID Number	Right Hemisphere Actual Count	Left Hemisphere Actual Count	R-L Hemisphere Ratio	Right Temporal Lobe Actual Count	Left Temporal Lobe Actual Count	R-L Temporal Lobe Ratio	Right Thalamus Actual Count	Left Thalamus Actual Count	R-L Thalamus Ratio
3	21528	220580	0,097597	7865	7980	0,985589	778	761	1,022339
4	78868	79803	0,988284	28402	28508	0,996282	2891	2643	1,093833
5	78938	78343	1,007595	29889	30402	0,983126	2605	2537	1,026803
6	27055	26551	1,018982	9318	7939	1,173699	910	907	1,003308
7	34907	33614	1,038466	11792	10946	1,077289	964	1042	0,925144
8	84268	80663	1,044692	32139	30463	1,055018	2614	2910	0,898282
9	39761	40078	0,99209	13492	14874	0,907086	1531	1525	1,003934
10	46087	43057	1,070372	15906	14950	1,063946	1718	1600	1,07375
11	35908	34615	1,037354	11450	10756	1,064522	1481	1341	1,1044
12	52464	50629	1,036244	19515	18057	1,080744	1905	1887	1,009539
13	57924	55028	1,052628	19340	19135	1,010713	1827	1762	1,03689

ID Number	Right Hemisphere Actual Count	Left Hemisphere Actual Count	R-L Hemisphere Ratio	Right Temporal Lobe Actual Count	Left Temporal Lobe Actual Count	R-L Temporal Lobe Ratio	Right Thalamus Actual Count	Left Thalamus Actual Count	R-L Thalamus Ratio
14	33663	34594	0,973088	11577	11212	1,032554	978	1027	0,952288
17	130605	127234	1,026494	53749	48718	1,103268	5102	5255	0,970885
18	164636	159816	1,03016	65807	65049	1,011653	4742	4636	1,022865
19	126485	122953	1,028726	39281	43051	0,912429	4179	4463	0,936366
20	97756	92945	1,051762	31480	32697	0,962779	3163	3156	1,002218
21	76960	76194	1,010053	23325	22510	1,036206	2418	2494	0,969527
30	83597	80791	1,034732	31110	31284	0,994438	3061	3383	0,904818
31	48035	47342	1,014638	16287	16153	1,008296	1727	1640	1,053049
34	34512	34950	0,987468	14314	14030	1,020242	1373	1341	1,023863
35	76773	75901	1,011489	31668	29153	1,086269	2626	2970	0,884175