

# Detecting malingerers.

## Hidden truths?

A systematic literature review on the use of  
Positron Emission Tomography (PET) and 'malingering'

by

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## Executive Summary

- **The literature on Positron Emission Tomography (PET) scanning and its potential role in detecting 'malingerers' is of academic interest only.**
- **At present the science behind this subject in no way meets any scientific standard that would allow its use within a WCB setting.**

## **Detecting malingerers. Hidden truths?**

### **Background.**

The Evidence Based Practice Group (EBPG) was requested to investigate the possibility of using Positron Emission Tomography (PET) scanning to detect malingering by evaluating patterns of brain activity. The request came as a result of an article with the above title that was published in the Economist July 12, 2003 page 73.

The article 'Detecting malingerers. Hidden truths' was written based on research conducted by Oakley DA, Ward NS, Halligan PW and Frackowiak RSJ entitled 'Neuroimaging of feigned and subjectively experienced paralysis'. In the article the authors described a difference in the pattern of brain activity in an individual who was pretending to be unable to move his leg and that displayed by the same person when he was unable to move his leg while under hypnosis. The authors believed that these differences could form the basis of tests that would be able to identify malingerers.

The purpose of this paper is to systematically gather scientific evidence around this issue and review PET scanning may or may not have a validated role to play in the detection of malingerers.

### **Materials and methods.**

A systematic review on the published literature (up to August 8, 2003) was conducted on multiple databases including PubMed, Cochrane Library Database, the UK Database of Abstracts of Review of Effects, National Institute for Clinical Excellence of England and Wales, the US Agency for Healthcare Research and Quality and International Network of Agencies for Health Technology and member countries Assessment (including Canadian Coordinating Office of Health Technology Assessment) for any research on PET scanning or pattern of brain activity associated with malingering or feigning. The search was limited to English language literature (or the availability of English language abstract) and human studies. The search was done by employing keywords: PET scanning or Positron Emission Tomography scan or pattern of brain activity or brain activity combined with malingering or malingerer or feigning. Two articles were retrieved in this manner<sup>(10,18)</sup>. A second systematic search was also done using the keywords hysterical paralysis or conversion disorder and PET scanning or Single Photon Emission Computerized Tomography (SPECT). One other article was found in the second search<sup>(19)</sup>.

A search on PubMed database, by employing authors name (Halligan and or Ward) together with PET scan or malingering or malingerer, was done in order to identify the original article by Oakley et al. However, this article (which was then found entitled 'Neuroimaging of feigned and subjectively experienced paralysis'. Please see below) has not been published in any medical journal nor have the authors suggested it be in the process of being submitted to a peer-reviewed journal.

Because of the small number of scientific articles found via the above search methods, a non-scientific non-systematic search was done on the world wide web in order to identify the original research/manuscript that was the basis of the article 'Detecting malingerers. Hidden truths' published in the Economist. A search on

google.ca provided a link to the authors of the original article 'Neuroimaging of feigned and subjectively experienced paralysis'. The article was listed on the web sites of the Hypnosis Unit, University College London (under the bibliography of the Unit's publication) and the web sites of Reference Web Poster (<http://www.dap.ucl.ac.uk/RIS/RISWEB.ISA>) in a conference proceeding. Apparently the research was presented by Oakley et al at the Joint Conference of the British Society of Clinical and Experimental Hypnosis and the British Society of Medical and Dental Hypnosis in May 2002. At the time being the EBPG has been unable to obtain a copy of the original abstract.

## **Results/Review of the research obtained.**

### **PET Scan.**

Positron Emission Tomography is a minimally invasive method of nuclear medicine imaging that uses short-lived radiopharmaceuticals to detect and assess perfusion and metabolic activity in various organ systems. When compared to anatomical information that is provided by radiological techniques such as radiography, computed tomography (CT) or magnetic resonance imaging (MRI), PET can provide information about function and metabolism of many processes in living subjects that is complementary to the structural/anatomical information provided by these other radiological techniques. It has been shown that PET can measure regional blood flow, rates of substrate use (e.g. glucose, oxygen), rates of protein synthesis, neurotransmitter synthesis, receptor binding and density, enzyme activity and level of gene expression.

PET was introduced in the early 1970s after the emergence of CT as a revolutionary diagnostic imaging tool. As of July 15, 2001, there were 8 centres in Canada where 9 PET scans are operated. These PET scans were installed between 1991 - 2001. In the Vancouver area, there are 2 PET scanners, one at the Vancouver Hospital and Health Sciences Centre (installed in 1999) and one at TRIUMF, University of British Columbia (installed in 1991). PET scanning requires a working relationship with a cyclotron facility that produces the proton emitting radiopharmaceutical tracers that are necessary for the imaging studies. Hence, PET scanners are invariably large/metropolitan centre-based and at present will never be available for widespread use.

PET requires the administration of a positron-emitting radiopharmaceutical to the patient and a tomograph for imaging the patient (the imaging time varies, usually between 30 - 60 minutes). The positrons travel a few millimeters in the tissue before combining with negatively charged electrons and releasing two high-energy photons which are emitted at approximately 180 degrees to each other. The simultaneous detection of these photons by opposing detectors is then used to construct a three dimensional image of these events.

The clinical application of PET scanning is generally seen in three medical disciplines i.e. oncology, cardiology and neuropsychiatric disorders. One major development which revealed the ability of PET to elucidate regional brain metabolism and function was the development of <sup>18</sup>F-fluorodeoxyglucose (<sup>18</sup>F-FDG). Currently, the

most commonly used radiopharmaceutical tracers for neurological PET imaging are  $^{18}\text{F}$ -fluorodeoxyglucose ( $^{18}\text{F}$ -FDG) which measures the cerebral metabolic rates of glucose and  $^{15}\text{O}$ - $\text{H}_2\text{O}$  which measures regional cerebral blood flow. These 2 tracers have been used to investigate a wide variety of neurologic disorders such as dementia and psychiatric illnesses but also have been used to study the effect of various physiologic stimuli on the human central nervous system.

### **Inconsistency in the pattern of brain activity as detected in PET scanning studies.**

#### Normal aging.

PET findings by employing  $^{18}\text{F}$ -FDG tracers in normally aging brain as reported in the literature has been inconsistent. Some experts described diminished regional glucose metabolism in the temporal, parietal, somatosensory and especially frontal region. Others have shown that cortical metabolic rates were reduced in older subjects compared to young subjects with more prominent decrease in the frontal and somatosensory cortices. While other experts suggested that there is an age-related decrease in the temporal lobe activity which appears to be asymmetric and which affects males and females differently.

#### Alzheimer's disease.

Since 1980, large numbers of studies have used PET in the assessment of patient with Alzheimer's disease. So far, although it is possible to make an accurate diagnosis in most patients with severe dementia, it is still very difficult to differentiate between mild Alzheimer's disease patients with dementia due to other causes. Typical diagnostic pattern of biparietal hypometabolism, even though highly predictive of Alzheimer's, is not pathognomonic for Alzheimer's and is found in patients with bilateral parietal subdural haematoma, bilateral parietal stroke, bilateral parietal radiation therapy ports and Parkinson's disease. Further, it is difficult to differentiate between Alzheimer's or non-Alzheimer's dementia patients since both conditions are associated with similar degrees of global dysfunction as is shown in significantly decreased whole brain cerebral metabolic rate of glucose values. Also, these two different groups of patients often have similar types of regional metabolic changes.

#### Primary progressive aphasia.

In primary progressive aphasia, some studies showed markedly decreased glucose metabolism in the left parietal and temporal area of the brain while other showed decreased in the left temporal area only.

#### Parkinson's disease.

PET scanning studies in Parkinson's disease also show contradictory results. Some experts have shown that hemiparkinsonism was associated with hypermetabolism in the contralateral basal ganglia. On the contrary, other experts have shown hypometabolism pattern in the contralateral basal ganglia in hemiparkinsonism.

### Huntington's disease.

PET studies have consistently shown hypometabolism in the caudate and putamen nuclei in Huntington's disease patients. However, some studies reported no cortical changes in glucose metabolism, while others reported cortical hypometabolism in Huntington's disease patients.

### Traumatic brain injury.

There have been a small number of studies using PET in the evaluation of patients suspected of having brain injury. One of the problem with using PET in the case of brain injury is that PET cannot distinguish between structural damage and cerebral dysfunction because these may all show similar image i.e. areas of decreased metabolism. As such, PET studies in brain injury patients need to be done in conjunction with anatomic producing imagers such as X-ray, CT or MRI.

### Alcoholism.

Studies of alcoholic patients with PET have generally found decreased brain metabolic activities. However, some studies found that the hypometabolism disproportionately affecting the parietal area, while other studies found the frontal lobe was more affected.

The inconsistencies in the PET scanned brain activities are also observed in studies of other neuropsychiatric disorders such as obsessive-compulsive disorder and anxiety disorders.

### **Cerebral activation studies in normal participants.**

In order to define specific areas of the brain that are responsible for various aspects of thought, speech, sensation, movement, emotion and other complicated functions, PET scan has been applied in an effort to measure cerebral activation during various physiologic stimulation.

In activation studies, participants usually serve as their own control. They are scanned both at rest and during stimulation (such as the case on the study of paralysis hysteria and hypnotic paralysis) (Spence SA et al<sup>(10)</sup>). There are conflicting opinions on how the 'resting state' should be identified in individuals. Some experts found that when study participants were imaged with both eyes and ears closed, there was no significant difference between the metabolism of the right and left hemispheres. However, other experts found a significant decrease in the metabolism of some areas within the right hemispheres under the same conditions. Further, there was conflicting evidence with regard to the symmetrical aspects of hemispheric metabolism when participants were imaged with both eyes and ears opened with low level ambient light and noise. Other conflicting evidence was also observed when participants were imaged under conditions of listening to a recording of a person telling a meaningful story (in English).

### **Studies of PET scanning on the pattern of brain activity and malingering.**

To date, there are only 2 studies looking into brain activities and feigning/malingering that we were able to identify. Spence SA et al<sup>(10)</sup> published a study

on discrete neurophysiological correlates in the prefrontal cortex during hysterical and feigned disorders of movement. Oakley et al<sup>(2)</sup> (the one used by the Economist) studied neuroimaging of feigned and subjectively experienced paralysis.

Spence et al<sup>(10)</sup> compared the pattern of brain activities among two men with hysterical motor symptoms affecting their left arm and two healthy individuals who were instructed to feign difficulty moving their upper left limbs as well as six healthy individuals who did movement tasks normally. The participants were matched on age and were all strongly right handed. Feigners were required to pretend they had difficulty and were instructed to slow their responses to match participants with hysterical motor symptoms. The authors found that the feigners had hypoactivity of the right anterior prefrontal cortex.

The complete study by Oakley et al<sup>(2)</sup> has not been published in any journals. The EBPG has not been able to obtain the details of this study yet. However, from the information presented in the Economist, it can be concluded that the study was done on a dozen participants. The PET scan in this study<sup>(2)</sup> showed that there was hyperfunction in the prefrontal cortex when the participant feigned paralysis. This is in direct contrast to the previously mentioned study.

### **Level of evidence.**

The evidence of the relationship between malingering and pattern of brain activities as documented in PET scanning is based on two papers - Oakley et al<sup>(2)</sup> and Spence et al<sup>(10)</sup>. In terms of the quality level of evidence as adopted by the WCB of BC Evidence Based Practice Group (Appendix 1), these two papers fall under category level 5 i.e. evidence comes from opinions of respected authorities that is based on descriptive studies. Level 5 is the weakest evidence available in term of quality of evidence.

### **Conclusion.**

The papers reviewed in this short report suggest that the use of PET scanning may prove to be a useful tool in the objective evaluation of some individuals with physical/psychological impairments and disability. However, the nature of the studies suggests that this science is still in the very early research stage. It will undoubtedly be quite sometime before the clinical utility of such scans in proving or disproving 'malingering' will be evident. While the present data on this subject is interesting, it in no way meets any scientific standard that would allow its use within a workers' compensation board framework.

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**Appendix 1.**

**Workers' Compensation Board of BC - Evidence-based Practice group. Grades of recommendations and quality of evidence** (adapted from 1,2,3,4)

**Table 1. Grades of Recommendations**

|          |  |
|----------|--|
| <b>A</b> | Good evidence to support the recommendation that the condition be specifically considered.                       |
| <b>B</b> | Fair evidence to support the recommendation that the condition be specifically considered.                       |
| <b>C</b> | Poor evidence regarding inclusion or exclusion of a condition, but recommendations may be made on other grounds. |
| <b>D</b> | Fair evidence to support the recommendation that the condition be specifically excluded from consideration.      |
| <b>E</b> | Good evidence to support the recommendation that the condition be specifically excluded from consideration.      |

**Table 2. Quality of Published Evidence**

|          |   |
|----------|---|
| <b>1</b> | Evidence from at least 1 properly randomized controlled trial (RCT) or systematic reviews of RCTs.  |
| <b>2</b> | Evidence from well-designed controlled trials without randomization or systematic reviews of observational studies.   |
| <b>3</b> | Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 centre or research group.                                    |
| <b>4</b> | Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments could also be included here. |
| <b>5</b> | Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.   |

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