

Ref: PMK/MT

1st December 2009

Cardiff Crown Court

Dear

Claimant: Maurice Kirk
Date of Birth: 12th March 1945

I have been instructed by Yorkshire Law Solicitors to comment on the SPECT scan images undertaken on the above claimant and also to discuss the role of SPECT brain imaging in relation to the above scenario. In making my report I have to hand the following information:

- Letter of instruction dated 11th November 2009
- A CD with the HMPAO SPECT images of Mr Maurice Kirk.

I must point out that I have not been sent any clinical information pertaining to the neuropsychiatric state of Mr Kirk and therefore my interpretation of these images is in isolation from any medical details.

1. Background

- 1.1 Mr Maurice Kirk is currently remanded in custody at HM Prison, Cardiff and is due to appear in court on 2nd December 2009 in relation to a bail application. However there are concerns by the prosecution at Mr Kirk's sanity and fitness to plead. In particular this claim has evidently been supported by an HMPAO cerebral perfusion SPECT study that has evidently shown reduced activity/perfusion in the frontal lobes. Please note that I have gleaned this information from the letter of instruction by Yorkshire Law Solicitors and I have not seen any formal reports issued by the Radiology Department at the Princess of Wales Hospital, Bridgend.
- 1.2 The letter of instruction notes that 'although Mr Kirk has been involved in air accidents he has not suffered any head injuries'
- 1.3 The letter of instruction states that the MRI and SPECT scans were undertaken on Friday 25th August 2009. Although the SPECT images forwarded to me are labelled 'Mr Maurice Kirk' they appear to have been undertaken on the 18th September 2009.

2. My interpretation of the Tc-99m images of MR Maurice Kirk undertaken at the Princess of Wales Hospital.

- 2.1 I have been provided with a CD of the HMPAO SPECT brain scan. In order to guarantee that the images on the CD are an accurate reproduction of the original data, it would be necessary for myself to sight the images on the radiological viewing systems at the Princess of Wales Hospital.
- 2.2 On the basis of these CD images, I do not believe that there is any convincing evidence of abnormality of cerebral perfusion to either the frontal, parietal, or temporal lobes of the brain. In particular, I believe that the visual appearances of the frontal lobes are within normal limits with no convincing evidence of reduced perfusion to the front part of the brain.
- 2.3 It must be borne in mind that interpreting images from another centre is difficult as there is no standardised way in the United Kingdom of displaying these scans.

3. General Remarks

- 3.1 The American Academy of Neurology recommend that SPECT brain imaging has a clearly defined clinical role in dementia, cerebral vascular disease (stroke) and epilepsy however this learned Academy felt that the role of SPECT imaging in head injury remains a research tool and, as yet, is not proven as an established clinical tool¹. This viewpoint is also shared by the Royal Colleges in the United Kingdom and NICE whereby HMPAO SPECT imaging is only indicated in patients with either dementia, epilepsy, or vascular brain disease. This is exemplified by a review article from Cambridge, UK, titled 'Imaging after brain injury' (2007) which does not advocate HMPAO SPECT brain imaging in this scenario².
- 3.2 Research studies using this type of imaging technique generally agreed that functional brain imaging (SPECT or PET imaging) is more sensitive at demonstrating abnormalities than structural brain imaging (CT/MRI) in patients with moderate to severe head injury. However there is controversy about the role of functional brain imaging in minor head injuries, which, I believe, is a reflection of the considerable overlap between the wide variation of normality and subtle pathological abnormalities³. It would appear that Mr Kirk has not previously suffered from and severe head injuries and if he should have *possibly* suffered from any minor injuries, then the role of SPECT brain scanning in his particular case is highly controversial.
- 3.3 It has been my experience of undertaking SPECT brain scans in healthy individuals that there is a considerable variation in the appearances of normality, not only in elderly subjects⁴ but also noted in younger individuals⁵. Consequently it is important to be circumspect in the interpretation of subtle 'irregularities' on functional brain imaging should they be observed.
- 3.4 In order to remove observer bias in interpreting SPECT brain scans, it is necessary to use sophisticated computer programmes which can compare an individual's brain SPECT study to a normal database of similarly aged healthy volunteers^{6,7}. I would strongly urge that Mr Kirk's brain scan is compared to a normal database. This would indicate whether his scan lies within, or out with, the limits of the normal database and negates the potential subjective bias of a human observer. I am not aware that the Princess of Wales Hospital has a normal control database or utilises such computer programmes in their assessment.
- 3.5 In my role as the National Advisor on functional brain imaging to the British Nuclear Medicine Society, I have a major responsible nationally for improving the reporting quality of HMPAO SPECT scans in patients with suspected dementia. To this end, I strongly encourage all hospitals in the UK that undertake dementia brain imaging to use these sophisticated computer software programmes. In patients with suspected dementia there is clear evidence from two

separate UK studies (Edinburgh⁸ and Southampton⁹) that the use of these programmes reduces the likelihood of "over-calling" i.e. reporting a truly normal scan as being abnormal.

- 3.6 In my routine clinical work in Southampton using HMPAO SPECT imaging, I would not use this technique in patients with head injury. In my national teaching role, I emphasise that HMPAO SPECT has, as yet, no proven clinical role in head injury.

4. Conclusions

- 4.1 My visual interpretation of the HMPAO SPECT scan undertaken on Mr Maurice Kirk does not show any convincing evidence of abnormality, in particular I do not feel there is anything untoward about the appearances of the perfusion to the frontal lobes of the brain. I thus regard this study as being within normal limits by simple visual assessment.
- 4.2 I believe there are major shortcomings in visual assessment of these HMPAO SPECT studies and the interpretation of these scans should be supported by appropriate computer software programmes.
- 4.3 HMPAO SPECT brain imaging is a powerful tool in the investigation of patients with dementia, epilepsy, and vascular brain disease, however it is not advocated as a clinical tool in patients with proven, or suspected, head injury.

Yours sincerely

Dr Paul M Kemp
Consultant and Honorary Senior
Lecturer in Nuclear Medicine

References:-

1. "Assessment of brain SPECT. Report of the Therapeutics and Technology Assessment" Subcommittee of the American Academy of Neurology. *Neurology* 1996;46:278-285.
2. J.P.Coles, "Imaging after brain injury" *British Journal of Anaesthesia* 2007;99:49-60
3. Newberg, A.B., *Neuroimaging in Patients with Head Injury: In a textbook of SPECT in Neurology and Psychiatry* (1997), 409-414. Eds. P.P. de Deyn, R.A. Dierekx, A. Alavi and B.A.Pickut. John Libby & Company Ltd., England.
4. Kemp, P.M. et al. "Tc-99m HMPAO rCBF findings in healthy volunteers' can they be distinguished from early Alzheimer's Dementia?" *Nucl. Med. Commun.* 1999; 20:468.
5. Kemp, P.M. et al. "Cerebral perfusion and psychometric testing in military amateur boxers and controls", *J. Neurol. Neurosurg.Psychiat.* 1995; 59: 368-374.
6. Friston, K.J. et al. "Spatial registration and normalisation of images. *Human Brain Mapping*" 1995; 2: 165
7. Friston, K.J. et al. "Statistical parametric maps in functional imaging: A general linear approach" *Human Brain Mapping* 1995; 2:189-210.
8. Dougall, N et al. "Predicting the accuracy of a diagnosis of Alzheimer's disease with 99mTc HMPAO single photon emission computed tomography", *Psychiatry Research: Neuroimaging* 2004;131:157-168.
9. Kemp, P.M. et al. "The contribution of statistical parametric mapping in the assessment of precuneal and medial temporal lobe perfusion by 99mTc-HMPAO SPECT in mild Alzheimer's and Lewy body dementia". *Nucl Med Commun* 2005;26:1099-1106.

I, Dr PAUL M KEMP DECLARE THAT:

1. I understand that my overriding duty is to the Court, both in preparing reports and in giving oral evidence.
2. I have set out in my report what I understand from those instructing me to be the questions in respect of which my opinion as an expert is required.
3. I have done my best, in preparing this report, to be accurate and complete. I have mentioned all matters which I regard as relevant to the opinions I have expressed. All of the matters on which I have expressed an opinion lie within my field of expertise.
4. I have drawn to the attention of the court all matters of which I am aware which might adversely affect my opinion.
5. Wherever I have no personal knowledge, I have indicated the source of factual information.
6. I have not included anything in this report which has been suggested to me by anyone, including the lawyers instructing me, without forming my own independent view of the matter.
7. Where, in my view, there is a range of reasonable opinion, I have indicated the extent of that range in the report.
8. At the time of signing the report, I consider it to be complete and accurate. I will notify those instructing me if, for any reason, I subsequently consider that the report requires any correction or qualification.
9. I understand this report will be the evidence I will give under oath, subject to any correction or qualification I may make before swearing to its veracity.
10. I believe the facts I have stated in this report are true and that the opinions I have expressed are correct.

**Dr Paul M Kemp
Consultant and Honorary Senior
Lecturer in Nuclear Medicine**

Personal statement for Dr P M Kemp, MBE; MD; MSc; MBBS, B.Med Sci; BSc; FRCP

I qualified in medicine at Newcastle University in 1984 and undertook my post-graduate medical training at St Bartholomew's Hospital, London, Southampton and Portsmouth. My initial consultant appointment in the specialty of nuclear medicine was at Addenbrooke's Hospital, Cambridge in 1995. I commenced at Southampton University Hospitals Trust in 1997 and was appointed Director of the Nuclear Medicine Department in 2001. I am also an Honorary Senior Lecturer for Southampton University.

My major clinical and research interests are brain imaging and, to this end, the Department of Nuclear Medicine at Southampton University Hospitals Trust, was appointed as one of the 15 European "Centres of Excellence" by the European Association of Nuclear Medicine in 2006. The following year I was appointed as the National Advisor on brain imaging by the British Nuclear Medicine Society.

I have published over 120 articles on all aspects of nuclear medicine, the vast majority being on brain scanning. I have also been successful in obtaining large grants for my brain imaging research.