Parkinson's disease

# Sexual wellbeing in Parkinson's disease

S F Farmer

## Parkinson's disease

In this month's issue (***pp 1260–4 and 1323–6***) there are two papers that each address different aspects of wellbeing in patients with Parkinson's disease.[1 2] Their similarity lies in the fact that both relate to aspects of human sexual systems and function. The study by Castelli *et al* finds small improvements in the sexual wellbeing of men with Parkinson's disease following therapeutic subthalamic nucleus stimulation.[1] The study by Ready *et al*[2] draws our attention to a relationship between feelings of apathy and low serum testosterone levels in men with Parkinson's disease.[2]

Although these studies deal with methodologically difficult areas—and as such their conclusions must be treated with caution—they do serve to raise the awareness of practising neurologists to important aspects of their patients' feelings of wellbeing.

The paper by Castelli and colleagues is the first to systematically evaluate sexual function in Parkinson's disease patients following subthalamic stimulation.[1] The effects demonstrated are small, yet positive. Given that subthalamic nucleus stimulation reduced dopamine requirement in their patients and that there is some evidence that dopaminergic medication produces an increase in sex drive, one might suppose that the effects of subthalamic nucleus stimulation are mediated through very complex processes—including an overall improvement in body image as a result of a successful neurosurgical intervention. Disappointingly, no improvements in sexual functioning were demonstrable in women with Parkinson's disease following subthalamic nucleus stimulation.

In a busy general or movement disorder clinic there is little time to explore patients' feelings of self worth, feelings of attractiveness, and drive (including sex drive). Rather, the question concerning sexual potency when asked of men is often little more than a way of screening for the 10–15% of our Parkinson's disease patients who may in fact be suffering from multiple system atrophy. However, it is very common to hear complaints from our patients—often mediated via their spouse and frequently via the Parkinson's disease nurse specialist—that since developing Parkinson's disease they feel apathetic and lack drive and interest in sex even though they are still potent. These feelings, of course, may reflect commonly overlooked coexistent depressive illness, but as pointed out by Ready and colleagues they can exist independently of depression and seem, unlike depression, to correlate with testosterone deficiency.[2]

Ready *et al* report that nearly 50% of the men with Parkinson's disease studied are testosterone deficient.[2] Notwithstanding some difficulties with defining a "normal" testosterone level and our lack of understanding why patients with Parkinson's disease may be apparently testosterone deficient, the idea that dopamine and testosterone deficiencies act as comorbidities—which combine in susceptible patients to reduce frontal lobe system functioning leading to reduced libido, sexual dysfunction, fatigue, mood change, and apathy—is important. Testosterone deficiency is easily reversed and any potential for future treatment to improve some of these very significant non-motor symptoms of Parkinson's disease is to be welcomed.

These two papers will encourage neurologists looking after patients with Parkinson's disease to make themselves even more aware of their patients' overall feelings of wellbeing—including their sexual wellbeing. They encourage us to explore new ways of improving Parkinson's disease patients' wellbeing through psychological, physical, endocrine, pharmacological, and surgical interventions.

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Correspondence to: Dr S F Farmer, National Hospital for Neurology and Neurosurgery, Queen Square, London WC1N 3BG, UK; s.farmer@.ion.ucl.ac.uk

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PPMS

# Primary progressive multiple sclerosis takes centre stage

P M Matthews

## PPMS takes centre stage

Multiple sclerosis (MS) remains an enigmatic disease. Not only is the cause unknown, but the last decade of work has led to uncertainty concerning some of the previously, most strongly held convictions about the disease. Recently, attention has shifted from understanding demyelination to understanding how axons are injured.

It has been attractive to hypothesise that axonal damage occurs with inflammation in white matter lesions. Histopathological and imaging provide clear evidence for axonal transaction in lesions.[1 2] However, rates of progression are independent of relapses[3] and even treatments that prevent new inflammatory lesions[4] do not slow progression of disability—a consequence of the progressive axonal degeneration.

This conundrum contributes to interest in study of primary progressive MS

(PPMS), which is characterised by progression of disease from onset. Progression is related to axonal loss—just as in relapsing-remitting (RR) and secondary progressive MS (SPMS)—but imaging and histopathological studies both show less abundant white matter inflammation in PPMS.[5 6]

In this issue (***pp 1281–6***), Oh and his colleagues use more modern magnetic resonance imaging (MRI) imaging methods to test whether the focal inflammatory lesions can account for white matter axonal loss in patients with RR/SPMS or PPMS.[7] They use magnetic resonance spectroscopy (MRS) to measure relative N-acetyl aspartate (NAA) concentration—one of the most specific non-invasive indices of the density and metabolic integrity of axons in white matter. Diffusion tensor imaging (DTI) MRI provides a complementary measure. DTI is sensitive to the relative rate and preferred directions of diffusion of water in white matter, which provides a measure of axonal water, fibre tract orientation, and integrity. Different indices can be determined from the data. Most accessible are the apparent diffusion coefficients (ADC)—an average measure of water diffusion, and fractional anisotropy—a measure of relative preference of diffusion for particular directions. Assessment of direction of diffusion can be made more specific by calculating values for diffusion tensors (that may be considered just as "vectors" in three dimensions), which provide quantitative measures of the relative rates of diffusion along three orthogonal axes. In white matter, this allows axonal tract anatomy to be inferred.[8] Axonal loss is associated with an increase in relative diffusion values for tensors orthogonal to the major direction of the relevant white matter tract. The three types of measurements, therefore, should show quantitative relations with axonal loss in a tract.

Pelletier and colleagues measured the relative NAA and diffusion properties of water in the corpus callosum of healthy controls and patients with RR/SPMS or PPMS. As expected, the MS patients all showed decreases in relative NAA and increases in diffusion tensor values orthogonal to the fibre tract direction (as well as loss of fractional anisotropy (FA) and increase in ADC) consistent with axonal loss. The relative amount of axonal loss was similar for the two patient groups. However, while there was a strong correlation between the volume of T1 hypointense lesions around the corpus callosum and the measures of axonal loss for the RR/SPMS group, there was no significant relationship (not even a trend) for the PPMS patients. Thus, while axonal injury and transection in the focal lesions might explain distant loss of axons in the corpus callosum for the RR/SPMS group, another process must be dominant in PPMS.

What other processes might be involved? One possibility is that the lesions responsible for axonal injury in PPMS are too small to be imaged or that the inflammation is simply diffuse. Another possibility is that cortical lesions[9]—difficult to image using current methods—are responsible for neuronal injury and axonal transaction in PPMS.

A less popular notion is that PPMS is a *primary* neurodegenerative disease in which (like adrenoleukodystrophy) inflammatory changes may be an epiphenemenon. Spinal cord axonal pathology of MS shares features with hereditary spastic paraparesis, for example, in showing features of "dying back".[10] Prominent callosal axonal loss is not inconsistent with this. For example, a recent diffusion MRI study of amyotrophic lateral sclerosis has shown that, despite predominant clinical involvement of the motor cortex projection tracts, changes in transcallosal paths are most prominent—perhaps as a "trans-synaptic" consequence of motor neurone degeneration.[11]

To the extent that PPMS and RR/SPMS are different expressions of the same disease, this possibility also needs to be entertained for MS more generally. Perhaps neurodegeneration in MS is not secondary to inflammation and chronic demyelination, but is a primary manifestation of the causative pathology. Inflammation then may be a response to the neurodegeneration, rather than the primary pathology.

After being side-lined for so many years by the focus on studies related to anti-inflammatory treatments, PPMS patients now may well take centre stage in the search for the cause and cure for MS.

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Correspondence to: Professor P M Matthews, Centre for Functional Magnetic Resonance Imaging of the Brain, John Radcliffe Hospital, Headley Way, Headington, Oxford OX3 9DU, UK; paul@fmrib.ox.ac.uk

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IFN-β treatment

# Is it time to consider rationalising IFN-β treatment in individuals with multiple sclerosis?

**G Giovannoni**

## Time to rationalise IFN-β treatment

In this issue Antonio Bertolotto and colleagues (***see pp 1294–9***),[1] use MxA mRNA expression in peripheral blood mononuclear cells (PBMCs) to assess the in vivo bioactivity of interferon-beta (IFN-β) treatment in patients with multiple slerosis (MS). MxA transcription and translation is relatively specific for the type 1 interferons, such as interferon-alpha (IFN-α) and IFN-β, and plays an important role in the anti-viral response. MxA protein can also be used as readout for IFN-β but with a longer temporal profile.[2] MxA is therefore a suitable marker to assess the bioactivity of IFNβ—i.e. receptor binding, second messenger activation, gene transcription, and, in the case of MxA protein, gene translation. It appears, however, that quantitative MxA mRNA expression has some advantages over the MxA protein translation. Firstly, it has a wider dynamic range and the RT-qPCR method used to quantify its expression should be easier to standardise.[3] Unfortunately, commercial antibody pairs suitable for an MxA protein enzyme linked immunosorbent assay (ELISA) are not currently available.

Not surprisingly, the majority of subjects (11/13) who did not have a biological response to IFN-β were persistently positive for neutralising anti-IFN- β antibodies (NAbs). Could in vivo MxA induction supplant NAb testing? Probably not, as this assay does not provide any information on the NAb titre, which is important in predicting whether or not NAbs are likely to persist. In general patients with a titre greater than approximately 100 NU are likely to remain NAb positive and those with lower titres are more likely to revert to being NAb negative.[4] NAb titres are therefore likely to be incorporated into future management strategies of NAb positive patients. MxA induction, however, could be a useful initial screen to select patients for NAb testing. Although the overall efficacy of IFN-β in MS is relatively modest, the efficacy in subjects who remain NAb negative is substantially better than in those who become NAb positive. In the pivotal IFN-β-1b trial the reduction in relapse rate in the NAb negative patients was $>$ 50%.[5] This is significantly higher than the oft quoted reduction in relapse rate of 30% for the class of IFN-β preparations.

Interestingly, two patients in the Bertolotto and colleagues study did not have a biological response to IFN-β and did not have NAbs. This indicates that these subjects may be "true" non-responders and it would be interesting to know the mechanism of this lack of response—whether it is due to either a qualitative or quantitative biological trait. Could a qualitative trait prove useful—possibly as part of a battery of markers—to predict who is likely to respond to IFN-β treatment? Could a quantitative trait have the potential to be used to optimise IFN-β dosing in individual patients? Several international studies are currently addressing these questions.

As expected subjects receiving once weekly IFN-β-1a (Avonex®) had lower baseline induction of MxA mRNA compared with subjects receiving either IFN-β-1a thrice weekly (Rebif®), or IFN-β-1b (Betaferon®) every other day. Interestingly, in subjects receiving the more frequently administered IFN-β preparations 18%—or almost 1 in 5—injections failed to induce a biological response. This may relate to the unpredictable bioavailability of subcutaneous IFN-β or is more likely to be due to the lack of functional interferon receptors on circulating PBMCs.[6] Once saturated and internalised it takes time for new functional receptors to be regenerated. These data imply that the current dosing regimens of IFN-β in MS have not been optimised—once weekly injections are not frequent enough, and thrice weekly or every other day injections are possibly too frequent. Twice weekly administration would seem the logical regimen for further investigation.

In conclusion, the therapeutic efficacy of IFN-β and more importantly its cost effectiveness could be rationalised. Future strategies include preventing or treating NAbs, selecting potential responders, not treating patients in whom IFN-β is not bioactive, and optimising IFN-β dosing for individual patients. The in vivo induction of MxA appears to be a promising biomarker in the pursuit of these aims.

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Correspondence to: G Giovannoni, Department of Neuroinflammation, Institute of Neurology, University College London, Queen Square, London, WC1N 3BG, UK; G.Giovannoni@ion.ucl.ac.uk

Conflict of interests: I have participated in meetings sponsored by and received honoraria from pharmaceutical companies marketing treatments for MS. I have or am participating in randomised controlled trials involving IFN-β-1b (Betaferon®, Schering), IFN-β-1a (Avonex®, Biogen), and Natalizumab (Antegren®, Biogen-Idec/Elan) in MS. I have also received honoraria for acting in the capacity as an advisor to various pharmaceutical companies who have drug development programmes for MS.

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