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Now dear, I have a headache! Immediate improvement of cluster headaches after sexual activity

The precise pathogenesis of cluster headaches is unknown, but a hypothalamic generator has been postulated as the cause of the disorder.[1] In two patients with typical cluster headaches, sexual activity alleviated the episodes. This association may shed some light on the pathogenesis and treatment of this incapacitating disorder.

Patient 1: A 61-year-old, previously healthy man presented with excruciating, left-sided orbital headaches appearing in bouts that lasted for 10 weeks. The pain occurred nightly at around 22:00 h, and was associated with ipsilateral ptosis, lacrimation and rhinorrhoea. Neurological examination and brain imaging were normal and he was diagnosed with cluster headaches , according to International Headache Society (IHS) criteria.[2] The headaches always lasted for 90–150 min, except for instances when the patient had sexual intercourse, which at the point of orgasm resulted in instant dramatic improvement in the pain, with complete relief always being achieved within several minutes and no recurrence until the next evening. Orgasm occurred on six occasions between 5–30 min after the onset of the episode and termination of the episode followed in all instances. Prophylactic treatment with verapamil was initiated and he was advised to try oxygen inhalation. Adherence to this regimen abolished the current cluster of headache episodes.

Patient 2: A 47-year-old previously healthy man had episodes of headache appearing in clusters since his teens. Episodes consisted of unilateral orbital pain with lacrimation and rhinorrhoea that lasted for 30–60 min, with a frequency of 1–3 episodes daily for several weeks. His headaches fitted IHS criteria for cluster headache.[2] For two decades, he was treated with triptans and prophylactic indomethacin, and rarely had headaches. Cessation of the treatment was followed by relapse. More than a decade after discontinuing treatment, he consulted a neurologist and reported that over the years he had learnt that sexual intercourse and masturbation were linked with instant relief from the headache at the point of orgasm. Neurological examination and brain imaging were normal. Prophylactic treatment with indomethacin was reinstituted, with no episodes reported over the subsequent 2 years of follow-up.

Discussion

The link between sexual activity and cluster headaches has been discussed before. Patients with cluster headaches (but not healthy controls) respond to testosterone administration by increasing their sexual behaviour, which may suggest a derangement of central nervous system processes associated with libido.[3] The case of a patient who had cluster headaches which disappeared during the period of involvement in a sexual relationship but subsequently relapsed after the termination of the relationship, has been described.[4] Although cluster headaches have been reported to be triggered by intercourse,[4] in our patients the headache was well established before the initiation of sexual activity.

Our observation is novel in that it documents the termination of individual cluster headache episodes by orgasm and could relate to one or more of the processes underlying the pathophysiology of cluster headaches. According to the ''gate theory'', sexual activity may activate inhibitory pain-modulating circuits.[5] This phenomenon occurs in many situations in which there is a survival value in not ''giving-in'' to pain, and may also be responsible for the placebo effect. Related to this process is the possibility that reduction in headache could be related to endorphin excretion, which occurs after sexual arousal and orgasm.[6]

While these pain-reducing processes could equally apply to any nociceptive experience, more specific neuroanatomical relationships between sexual activity and cluster headaches exist. The episodic nature of cluster headaches suggests the involvement of a central impulse generator or oscillator, and a biological clock within the hypothalamus has been implicated.[1] Positron emission tomography scanning showed an intense activation of the posterior hypothalamus during an episode, and refractory patients respond to hypothalamic deep brain stimulation.[7] Intriguingly, orgasm is accompanied by intense hypothalamic activation.[6] Thus, it can be postulated that orgasm terminates cluster headaches by modulating hypothalamic circuits in a manner similar to that which occurs in deep brain stimulation.

Patient 2, although satisfying IHS criteria for cluster headaches, is notable for his response to indomethacin. Although cluster headaches have been reported to respond to indomethacin,[8] this feature usually suggests paroxysmal hemicrania[2] and raises the possibility that this phenomenon may be relevant to the trigeminal autonomic cephalgias (TAC) as a group, all of which are associated with the posterior hypothalamus.[9]

The sympathetic nervous system is believed to be associated with TAC in a passive manner[1]; however, in some cases, there is evidence of sympathetic dysfunction before the onset of TAC,[10] suggesting that sympathetic underactivity may underlie TAC pathogenesis. If TAC pain is dependent on low sympathetic tone, theoretically the episode could be reversed by the increase in sympathetic activity accompanying sexual activity and, specifically, orgasm.

Patients with TAC may be reluctant or unable to engage in intercourse during an episode or disinclined to volunteer such information. Given that other sufferers may potentially benefit from this phenomenon, and as it has relevance to the pathogenesis of TAC, this observation should be verified in a large cohort of patients.

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Informed consent has been obtained for publication of the patient details in this article.

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Novel Olig1-coding variants and susceptibility to multiple sclerosis

Olig1 is a basic helix–loop–helix (bHLH) transcription factor expressed in cells of the oligodendrocyte lineage in the nervous system. Its role during normal development has not yet been fully resolved, but it is known that in adult life the protein is crucial in the process of remyelination after injury.[1–3] Olig1 translocates from the cytoplasm to the nucleus in early remyelinating lesions in rodent models of demyelinating disease as well as in oligodendrocyte precursor cells at the edge of multiple sclerosis lesions.[1] Olig1 specifically regulates the expression of the

Table 1 Individual marker analysis for association with multiple sclerosis susceptibility

	Location	MAF	p*	p_{corr}†
rs928736	−2561	0.306	0.84	–
Ser repeat	230	0.048	0.80	–
707C/T	707	0.066	0.72	–
840C/A	840	0.001	–	–
rs11554599	1311	0.065	0.63	–
rs11554600	1688	0.128	0.15	–
rs7278735	2633	0.180	0.022	0.11

Location relative to transcription start; MAF, minor allele frequency in 3748 independent parental chromosomes; Ser, serine.
*p Value in a TRANSMIT test (http://www-gene.cimr.cam.ac.uk/clayton/software/) with 10 000 bootstrap replicates; †p value after multiple testing correction according to the method suggested by Nyholt (http://genepi.qimr.edu.au/general/daleN/SNPSpD/), which indicates that the six analysed markers behave as five independent ones.

major myelin-specific genes during oligodendrocyte maturation in the brain,[2] and remyelination after injury is impaired in Olig1$^{-/-}$ mice.[1] In patients with multiple sclerosis, remyelinating capacity is limited even though oligodendrocyte precursor cells are often efficiently recruited.[4] These findings raise the question whether genetic variants in the Olig1 gene *(Olig1)* influence remyelinating capacity and vulnerability to the consequences of a demyelinating event.[5]

To investigate this hypothesis, we first aimed at identifying any Olig1-coding variants by resequencing the coding region in 20 patients with multiple sclerosis having at least one affected first-degree relative. Three coding variants were identified: a $(TCC)_n$ repeat between nucleotides 230 and 247, leading to a variable number (3–9) of serine residues starting from codon 43 in the protein sequence; a synonymous C/T single-nucleotide polymorphism (SNP) at position 707 (codon 202); and a non-synonymous C/A SNP at position 840, leading to a substitution of threonine by asparagine at codon 246. Inspection of the public databases showed a further five SNPs in the 3′ untranslated region (3′UTR), but no other variant in the coding region. A robust assay could not be designed for three of these UTR SNPs.

Subsequently, we elected to investigate the novel variants, remaining 3′UTR variants, and the first SNP upstream and downstream of the gene typed in the HapMap project for association with susceptibility to multiple sclerosis. We typed these seven variants in 937 UK trio families (an affected individual and both parents). Patients satisfied Poser criteria for the diagnosis of multiple sclerosis and had typical demographic features, with a mean age of 37.8 years, mean Expanded Disability Status Scale of 4.3, mean disease duration of 11.9 years and a male:female ratio of 1:3. All participants gave written informed consent and the study was approved by the local ethics committee. Four SNPs (707CT, 840AC, rs11554599 and rs11554600) were typed with Taqman Assays-by-Design and two (rs928736 and rs7278725) with Assays-on-Demand (Applied Biosystems). The serine repeat polymorphism was amplified in a polymerase chain reaction and fluorescently labelled fragments were separated on a 3700 capillary sequencer (Applied Biosystems, Foster City, California, USA).

No markers deviated significantly from Hardy–Weinberg equilibrium, and genotyping success rates were >98.5% for all SNPs and 91.8% for the serine repeat polymorphism. For each marker, 166 participants were typed in duplicate. No inconsistency was seen for any of the SNPs and not more than two inconsistent alleles were seen for the serine repeat microsatellite. Only two mendelian errors (one for rs11554600 and rs7278725 each) were observed. The minor allele frequency for the 840C/A coding variant was only 0.1%, thereby preventing a meaningful analysis. For the serine repeat polymorphism, alleles with a frequency of <5% were grouped together. Evidence for association was sought by transmission disequilibrium testing using the TRANSMIT program, with 10 000 bootstrap replicates used to provide an empirical estimate of statistical significance. Marker rs7278735 showed borderline nominally significant evidence for association (table 1).

The data were also analysed by using the Haploview program (http://www.broad.mit.edu/mpg/haploview/). All markers except rs928736 were found to lie in the same haplotype block (accepting the program's default definitions), within which five haplotypes with a frequency of ⩾5% were observed. A haplotype transmission disequilibrium test on these showed overtransmission of the most frequent haplotype, but again this trend was not significant after appropriate correction for multiple testing (table 2).

In conclusion, we have identified novel coding variants in the Olig1 gene, including a trinucleotide repeat, but have found no evidence to support the hypothesis that genetic variation in *Olig1* influences susceptibility to multiple sclerosis.

Table 2 Haplotype analysis for markers serine repeat−707C/T−rs11554599−rs11554600−rs7278735

Haplotype	Frequency	p*
6-C–C–G–C	0.705	0.021
6-C–C–A–T	0.129	0.037
6-T–T–G–C	0.065	0.65
6-C–C–G–T	0.051	0.19
X†-C–C–G–C	0.049	0.73
Global		0.072

*Uncorrected p values in a TRANSMIT test with 10 000 bootstrap replicates; †X, any alternative allele (3, 4, 7, 8 or 9 serine repeats).

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BOOK REVIEWS

Fast facts: multiple sclerosis

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It would perhaps seem a tall order to compress into 89 pages the essence of a puzzling disease—cause unknown and treatment evolving—but I think the two well-known authors of *Fast facts: multiple sclerosis* have largely managed to achieve this. They have been able to carry out this task, from their lifelong experience in managing patients with multiple sclerosis and as a result they have been able to pull out and then elaborate on both the common and the difficult cases, against a backdrop that is well illustrated and fast flowing, interspersed with clinical vignettes. Some examples are as follows: