Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Detection of ionising radiation by the CNS: a case report

The pathophysiological mechanisms underlying olfactory dysfunction are not well known but can be triggered in neurodegenerative diseases and after viral infection.[1] We report a patient whose case could provide interesting insights into the neurophysiology of smell.

A woman aged 35 years was referred in July, 2019, to the Department of Radiation Oncology for radiotherapy of residual tumour tissue located in the olfactory region. Full details of the patient's medical history are in the appendix (pp 1–4).

The patient had previously undergone two surgical procedures to resect olfactory neuroblastoma. The first operation was a frontal craniotomy done 1 year before referral (July, 2018). After this surgical procedure had been performed, the patient reported that she had lost all olfaction, although this loss of sensation was not confirmed objectively. The second operation was done 1 year after the first operation (July, 2019) and entailed transnasal resection of recurrent tumour tissue. At the time of this second surgery, the patient had not recovered any olfaction. The olfactory epithelium was resected completely during these two operations, and the tumour could not be detected on CT 3 months after the second surgery (appendix p 5) or at the 21-month follow-up (appendix p 6).

21 days after the second surgery, we treated the patient with helical tomotherapy, a type of intensity-modulated radiotherapy, administered as 60 Gy in 30 fractions over 43 days. A dosimetric analysis is presented in the appendix (p 7). During radiotherapy sessions, the patient complained of a foul odour. Olfaction was reported when the x-rays were directed through the frontal lobe and the lower part of the nasal cavity outside the olfactory epithelial level (figure).

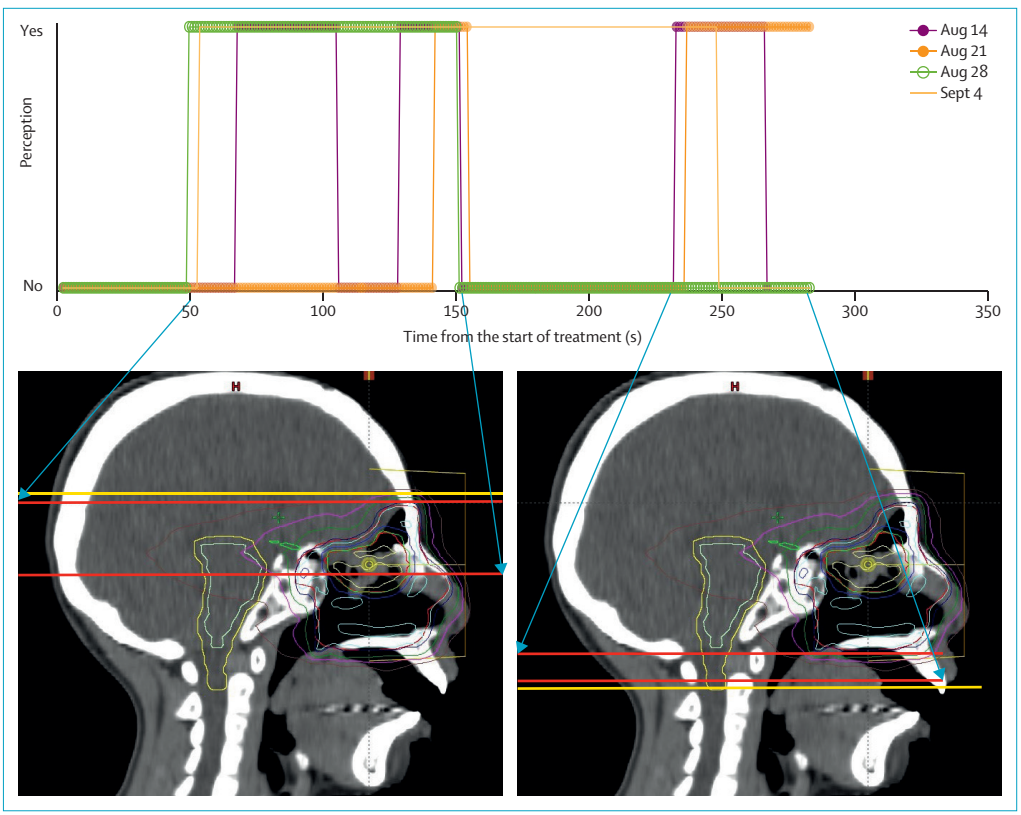

Figure: **Analysis of odour perception in the patient during radiotherapy sessions**
The upper graph indicates periods when the patient perceived the foul odour; the different coloured lines represent results for days in which odour perception was measured. The lower images indicate the beam positions that overlapped the sagittal views of treatment-planning CT: yellow lines indicate the start (cranial; left panel) and end (caudal; right panel) of the full session; red lines indicate the beam positions during the start and end of olfaction for each period of perception. Part of this figure was reproduced, with permission, from Hara et al (2021).[2]

During radiotherapy sessions to treat brain tumours, other patients have also reported experiencing foul smells.[2,3] We did a prospective study in which 13 (34%) of 38 patients who received radiotherapy for brain or near-orbital tumours reported olfactory perceptions.[2] Two (5%) of the 38 patients had no olfactory epithelium, including the individual described here. The cause or causes of these reported olfactory sensations remain undetermined. Patients might have either smelled substances such as ozone generated by the radiation or they might have had phantosmia.[4] Moreover, temporal lobe seizures have been associated with a reported foul odour, such as that of burning tyres.[5]

It is possible that terminal sensors of cranial nerves, such as the trigeminal nerve, can detect the smell of substances generated by radiation. However, the patient we report here perceived an odour when the x-ray passed through the frontal lobe. Therefore, it could be concluded that the CNS of the patient detected the x-rays during radiation sessions, although this hypothesis remains to be proven.

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See **Online** for appendix

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Research priorities to improve stroke outcomes

See **Online** for appendix

The James Lind Alliance (JLA) Stroke Priority Setting Partnership involved stroke survivors, carers, and healthcare and other professionals in setting the research agenda by identifying and prioritising evidence uncertainties.[1] Investment in research to address these uncertainties can ensure that more lives are saved and rebuilt after stroke. Research has identified several interventions that improve outcomes for patients after ischaemic stroke (eg, stroke unit care, thrombolysis, or thrombectomy). However, stroke remains a leading cause of death and disability worldwide.[2] Although age-standardised stroke mortality has decreased,[2] specific interventions for people with haemorrhagic stroke are needed.

By 2035, in the UK, the incidence of stroke is expected to double compared with 2015.[3] Even in people with mild disability or who make a complete physical recovery, fatigue and psychological issues can hugely affect quality of life. Further action is needed to improve interventions for primary and secondary stroke prevention, and rehabilitation to reduce the burden of stroke. However, only about 1·2% of research funding in the UK is spent on stroke,[4] and the COVID-19 pandemic further reduced funding to this sector. Given the need for innovation in stroke care and restricted funds for research, the Stroke Priority Setting Partnership established a consensus on the priority areas to allocate resources that can have the greatest impact. In 2011, a JLA Partnership established research priorities on rehabilitation and long-term care,[5] but priorities across the whole stroke pathway were still needed.

We followed the well established JLA priority setting processes to ensure useful outcomes.[1] In July, 2019, a steering group was set up that could represent people affected, healthcare and other professionals, and third sector organisations in stroke. From February to August, 2020, more than 1400 stroke survivors, carers, and professionals participated in an online survey to collect unanswered questions for research. The submitted questions were checked against the partnership scope, existing evidence, and collated to form uncertainties. From February to March, 2021, stroke survivors, carers, and professionals participated in online surveys to prioritise uncertainties. In April, 2021, online workshops with stroke survivors, carers, and professionals reached a consensus on the top ten uncertainties.

The Stroke Priority Setting Partnership generated two lists with ten uncertainties, ranked in order of importance, one for prevention and acute care and the other for rehabilitation and long-term care (table; appendix pp 2–3). Six of the priority areas address stroke-related impairments. Three areas address stroke prevention, three focus on stroke treatment, and eight relate to delivery and experience of care. Psychological and cognitive effects remain top priorities since the previous JLA Partnership.

We provide a clear roadmap for research investment that can make the greatest impact to improve stroke outcomes. These priorities should inform the activities of funding

	Prevention, diagnosis, and treatment	Rehabilitation and long-term care
1	Best interventions for primary stroke prevention	Assessment of the impact of psychological effects and interventions to reduce them
2	Recognition and early diagnosis of stroke and transient ischaemic attack	Evaluation of cognitive disfunction and interventions to reduce it
3	Evaluation of risks and benefits of intracerebral haemorrhage treatments	Assessment of communication problems and interventions to reduce them
4	New therapies for neuroprotection	Understanding fatigue and how to reduce it
5	Risk of secondary stroke and secondary prevention	Organisation of community stroke services to meet all survivor needs
6	Availability of thrombectomy to more patients with ischaemic stroke	Evaluation of long-term effects on activities of daily living and interventions to tackle these effects
7	Interventions to delay changes in brain function after subarachnoid haemorrhage	Evaluation of the duration, intensity, location, and frequency of therapeutical interventions to achieve long-term outcomes
8	Strategies to reduce complications of stroke	Improvement of carers support
9	Evaluation of risks and benefits, and personalised anticoagulation treatment	Strength and exercise interventions for recovery and secondary stroke prevention
10	Effect of comorbidities and health characteristics on stroke	Improving stroke survivor and carer experience of the stroke pathway

Table: **Top priorities for stroke research**