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FOR THE first time, air pollution has been found to be one of the top risk factors for subarachnoid haemorrhage, a particular kind of brain stroke caused by the rupture of blood vessels between the brain and the tissues covering it. A new global study, published in The Lancet Neurology Journal, has found that about 14% of the death and disability caused by subarachnoid haemorrhage, or SAH, in 2021 could be attributed to particulate matter air pollution. This was similar to the risk posed by smoking.

SAH is one of the three main kinds of brain strokes, the other two being intracerebral haemorrhage and ischaemic stroke. Intracerebral haemorrhage also involves the rupture of blood vessels but bleeding happens within the brain tissue. Ischaemic stroke is the most common type, a result of a blood clot or other blockage in the blood vessels of the brain.

The risks from air pollution on brain strokes in general has been known for quite some time, but its emergence as a main cause of subarachnoid haemorrhage in particular is a new revelation.

"Our study has made an important discovery. It has shown that particulate matter air pollution is responsible for 2.6 million healthy life years lost due to death and disability from subarachnoid haemorrhage in 2021, which is one million more than that from smoking, another major risk factor for SAH," Professor Valery Feigin, Director, National Institute for Stroke and Applied Neurosciences, Auckland University of Technology, New Zealand, and lead author of the study said in an email response to *The Indian Express*.

He said pollutants like PM2.5 damage the arterial cells, thus increasing the chance of rupture. "Just for the illustration of what 2.5 microns is — it is about 30 times thinner than a human hair. It is likely that these tiny particles have an effect on the arterial cells — damaging them directly or indirectly (e.g., via inflammation) with resulting weakening of the arterial wall and its rupture leading to subarachnoid haemorrhage (SAH)," Valery explained.

The study also revealed that the risk of strokes from high temperatures, or heat, had increased by more than 70% between 1990 and 2021, highlighting the role of climate change. It noted that incidents of brain strokes, and deaths caused by it, as a proportion of population had reduced significantly between 1990 and 2021. This trend was visible in India as well with deaths from subarachnoid haemorrhage declining by 34%, those from intracerebral haemorrhage coming down by 29%, and from ischaemic strokes reducing by 13% in this period.

The absolute number of brain stroke cases, however, were increasing. The study found that 84% of brain strokes in 2021 could be linked to 23 'modifiable' risk factors, meaning these risks could be reduced or eliminated. These risks included environmental factors like air pollution, behavioural factors like smoking or diet choices, and metabolic factors like body mass index (BMI), blood pressure, kidney function or cholesterol.

"The burden of stroke is increasing in large part due to population growth and the rise of ageing populations globally, but also due to increasing contributions from preventable environmental, metabolic, and behavioural risk factors," Valery Feigin said.

Risk from high BMI had increased by 88%, for example, and that from blood sugar gone up by 32% between 1990 and 2021, the study said. In 2021, the five leading global risk factors for stroke were high systolic blood pressure, particulate matter air pollution, smoking, high LDL cholesterol, and household air pollution. In India, the top contributing risk factors were high systolic BP, particulate matter air pollution, poor diet, kidney dysfunction, high fasting blood glucose, high LDL cholesterol and smoking, Valery said.

Professor Kalpana Balakrishnan, Dean (Research) at Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai, said the linkage of air pollution to brain stroke has been uncertain till now, unlike in the case of ischaemic heart diseases of chronic obstructive pulmonary disorders (COPD) where the outcome of misclassification or mediation pathways have been better addressed through studies.

"This new attributable burden for stroke is thus very significant for both ambient and household air pollution," Balakrishnan said.