ORIGINAL RESEARCH PAPER

Volume-8 | Issue-6 | June-2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

AIR POLLUTION AND STROKE

Neurology

Dr. Pushpendra N Renjen* Sr. Consultant Neurologist & Academic Coordinator, Institute of Neurosciences, Indraprastha Apollo Hospitals, New Delhi *Corresponding Author

Dr. Dinesh Chaudhari Associate Consultant, Institute of Neurosciences, Indraprastha Apollo Hospitals – 110076

Dr. Abhas Kumar DNB Neurology, Institute of Neurosciences, Indraprastha Apollo Hospitals – 110076

Dr. Kamal Ahamad Senior Consultant Internal Medicine, Indraprastha Apollo Hospitals - 110076

KEYWORDS

India faces the dilemma of both the ambient (outdoor) air pollution which is caused by factors such as vehicular exhaust, road dust, construction dust, burning of agricultural crop residues, industrial emissions, fossil fuel fired thermal power plants ad brick kilns, burning of biomass in households, burning of firecrackers etc. and the household air pollution which is caused by burning of biomass such as wood, coal, dung, kerosene in the chulhas or fireplaces for cooking, heating and lighting purpose. Other factors like burning of mosquito coils, incense sticks, cigarettes, bidis and use of sprays, solvents and fumes from chemicals used in building interiors etc. also contributes to the indoor air pollution.

Air pollution is an invisible insidious problem with several of the pollutants such as particulate matter (PM2.5 and PM10), carbon monoxide (CO), Ozone (O3) black carbon (BC) sulfur dioxide and nitrogendioxide (NOc) being harmful to human health.

The findings are a joint initiative of the Indian Council of Medical Research (ICMR), Public Health Foundation of India and Institute for Health Metrics and were released by the Director General, ICMR, Dr Balram Bhargava, on December 6, 2018.

The study shows that India with 18% of the global population has a disproportionately high 26% of the global premature deaths and disease burden due to air pollution. Over half of the 12.4 lakh deaths in the country attributable to air pollution in 2017 were in persons younger than 70 years.

Neurodegenerative disorders are a very common problem in humans.[1] Stroke is predicted to be the second leading cause of death worldwide. Risk factors for stroke are diabetes mellitus, hypertension, smoking, alcohol consumption, decreased physical activity obesity etc. It has been reported in many studies that pollutants from the environment such as carbon monoxide (CO), ozone (O3), nitrogen dioxide (NO2), sulphur dioxide (SO2),lead (Pb) and particulate matter (PM)are the leading causes of stroke.[2-4] Recent studies have substantiated and established a link between stroke and air pollution.[5] Though the mechanisms of interplay between stroke and environmental pollutants has not yet been fully elucidated, alterations in hemodynamic ,hemostatic factors and autonomic function may be the underlying pathology in debilitating cardiovascular disorders.[6-12] Chronic Obstructive Pulmonary Disease is now the fourth leading cause of death after cancer, heart attack and stroke. Thus stroke was the third leading cause of death.[13]

Exposure to air pollution is now increasingly recognised as a major public health issue and is one of the leading causes of mortality and morbidity, contributing to 6.5 million deaths and 167.3 million disability-adjusted life years (DALYs; a measure of time spent in ill health, disability or premature death) in 2015.[14] More importantly it ranks within the top five risk factors for mortality in emerging economies such as India and China. It was estimated that 99% of deaths attributed to household air pollution and 89% of deaths attributed to ambient air pollution occurred in low and medium income countries (LMICs).[15] Although exacerbation of respiratory conditions is intuitively linked with air pollution, over the last two decades evidence has emerged linking air pollution and cardiovascular mortality and morbidity.[16-17] Recently both epidemiological and mechanistic studies have shown robust associations between air pollution and atherosclerotic cardiovascular diseases, including myocardial infarction[16] and stroke.[18] The Global Burden of Diseases study estimated that in 2015, air pollution accounted for 19% of all cardiovascular death, 21% of deaths due to stroke and 24% deaths due to ischaemic heart disease.[19] Stroke remains one of the leading causes of morbidity and mortality worldwide, accounting for over 118.6 million DALYs and 6.3 million deaths in 2015.[20] It is important to note that this burden of disease varies significantly across different parts of the world. Over the past 20 years, high income countries have experienced a significant decline in age-standardized mortality and DALY rates of approximately 20% to 40%.[20,21] Conversely, the vast majority of strokes (approximately 85%) now occur in LMICs where incidence, deaths and DALYs have increased significantly over this period.[20] It is also in LMICs where air pollution is projected to increase significantly over the next few decades due to rapid industrialisation.[22,23]

What is air pollution?

Air pollution is an expansive term consisting of a complex mixture of thousands of components from a wide range of different sources. The main pollutants currently recognised to pose risk to health include airborne particulate matter (PM) and gaseous pollutants such as ozone (O3), sulphur dioxide (SO2), carbon monoxide (CO), and nitrogen oxides including nitrogen dioxide (NO2) and nitrogen oxide (Nox).

Air pollution and stroke: epidemiological evidence

Patients with cardiovascular disease share many risk factors such as obesity, hyperlipidaemia, hypertension, smoking, poor diet, and inactive lifestyle. Crucially, air pollution differs from other modifiable risk factors because exposure to air pollution, for the large majority of people, is unavoidable. Therefore, even though the individual risk estimates for exposure to air pollution are relatively small compared to the other cardiovascular risk factors, since exposure to (some form of) air pollution is ubiquitous, the overall population attributable risk and subsequent burden is significant.[24]

Long-term exposure Most studies of long-term exposure use air pollution levels at residential addresses over months to years as a proxy for long term accumulated individual exposure. Individual exposure is estimated using residential distance to major roadways, measurements from nearby fixed air quality monitoring stations or advanced modelling using land-use databases, meteorological data, traffic density, and emissions database. The majority of studies looking at the long-term effects of air pollution on cardiovascular disease have been on PM2.5.

Short-term exposure

In the early 1980s, a study in England and Wales investigating the association between fluctuations in meteorological variables and cerebrovascular mortality found an unexpectedly strong correlation with atmospheric particulate air pollution levels.[25] Several years later, a study in China found indoor coal fumes to be a risk factor for stroke,

independent of age, blood pressure, and cigarette smoking.[26] In the United States, a study published in 1994 reported a weak but significant association between daily PM pollution and cerebrovascular mortality (relative risk of 1.15) using cause of death data between 1973 and 1980.[27] Since then, there has been a large number of ecological studies investigating the short-term effects of air pollution (>100).[18]

Even though—with the exception of stroke—definitive conclusions on the neurological effects associated with sustained exposure to air pollution cannot be arrived at from current knowledge, given the broader health issues, implementation of policies that seek to improve air pollution should be a priority for governments. The United Nations and WHO have both been driving forces in improving air quality and have launched several pollution-reducing action plans. For example, WHO has developed indoor and outdoor air quality guidelines, and "the investigation of health impacts of climate and environmental change" is one of the top four WHO health priorities. The United Nations' 2030 Agenda for Sustainable Development—a set of 17 goals established to achieve global sustainable development by 2030—recognises air pollution as the greatest environmental health risk, and it is likely that pollution control will have positive effects on many of these goals and on neurological health.[28,]

REFERENCES:

1. Prabhakar S, Taranjeet K, Ashish T. Role of active components of Medicinal plants in Neurodegenerative disorders and Synaptic Plasticity, International Journal of ChemTech Research, 2014, 6: 982-984.
2. Pope CA, Burnett RT, Thurston GD, Thun MJ, Calle EE, Krewski D, Goldleski JJ. Cardiovascular mortality and long-term exposure to particulate air pollution: epidemiological evidence of general pathophysiological pathways of disease. Circ., 2004, 109:71-77.
3. Pope CA, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K, Thurston GD. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution.JAMA.,2002, 288: 1132-1141.
4. Samet JM, Dominici F, Curriero FC, Jonathan M, Ivan C, Scott LZ. Fine particulate air pollution and mortality in 20 U.S. cities, 1987–1994. N Engl J Med., 2000, 343: 1742-1749.
5. Pope CA. Mortality and air pollution: associations persist with continued advances in research methodology. Environ Health Perspect.,1999, 107: 613-14.
6. Pope CA, Dockery DW, Kanner RE, Villegas GM, Schwartz J. Oxygen saturation, pulse rate, and particulate air pollution: A daily time-series panel study. Am J RespirCrit Care Med., 1999, 159: 365- 3672. 7. Zanobetti A, Canner MJ, Stone PH, Schwartz J, Sher D, Eagan EB et al. Ambient pollution and blood pressure in cardiac rehabilitation patients. Circ., 2004, 110: 2184-2189.
7. Zanobetti A, Canner MJ, Stone PH, Schwartz J, Sher D, Eagan EB et al. Ambient pollution and blood pressure in cardiac rehabilitation patients. Circ., 2004, 110: 2184-2189.
8. Ghio AJ, Kim C, Devlin RB. Concentrated ambient air particles induce mild pulmonary inflammation in healthy human volunteers. Am J RespirCrit Care Med., 2000, 162: 981-988.
9. Schwartz J.Air pollution and blood markers of cardiovascular risk. Environ Health Perspect, 109, 2001, 405-409.
10. Riediker M, Cascio WE, Griggs TR, Herbst MC, Brombery PA, Neas L et al. Particulate matter exposure in cars is associated with cardiovascular effects in healthy young men.Am J RespirCrit Care Med., 169, 2004, 934-940.
11. Gold DR, Litonjua A, Schwartz J, Lovett E, Larson A, Nearing B et al. Ambient pollution and heart rate variability. Circ., 2000, 101: 1267-1273.
12. Creason J, Neas L, Walsh D, Williams R, Shelon L, Liao D et al. Particulate matter and heart rate variability among elderly retirees: the Baltimore 1998 pm study. J Expo Anal Environ Epidemiol.,2001, 11: 116-122.
13. Sanjana T, Lakshmi T. Role of Echinacea purpurea for COPD management –A Mini Review. Int J PharmTech Res., 2013, 5: 1808-1810.
14. GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016;388:1659-1724.
15. Landrigan PJ, Fuller R, Acosta NJR, Adeyi O, Arnold R, Basu NN, et al. The Lancet Commission on pollution and health. Lancet. 2017 Oct 19 [Epub]. https://doi.org/10.1016/S0140- 6736(17)32345-0.
16. Mustafic H, Jabre P, Caussin C, Murad MH, Escolano S, Tafflet M, et al. Main air pollutants and myocardial infarction: a systematic review and meta-analysis. JAMA 2012;307:713-721.
17. Shah AS, Langrish JP, Nair H, McAllister DA, Hunter AL, Donaldson K, et al. Global association of air pollution and heart failure: a systematic review and meta-analysis. Lancet 2013;382:1039- 1048.
18. Shah AS, Lee KK, McAllister DA, Hunter A, Nair H, Whiteley W, et al. Short term exposure to air pollution and stroke: systematic review and meta-analysis. BMJ 2015;350:h1295.
19. GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016;388:1459-1544.
20. GBD 2015 Neurological Disorders Collaborator Group. Global, regional, and national burden of neurological disorders during 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Neurol 2017;16:877-897.
21. Nichols M, Townsend N, Scarborough P, Rayner M. Cardiovascular disease in Europe 2014: epidemiological update. Eur Heart J 2014;35:2950-2959.
22. Lelieveld J, Evans JS, Fnais M, Giannadaki D, Pozzer A. The contribution of outdoor air pollution sources to premature mortality on a global scale. Nature 2015;525:367-371.
23. Kim AS, Cahill E, Cheng NT. Global stroke belt: geographic variation in stroke burden worldwide. Stroke 2015;46:3564- 3570.
24. Nawrot TS, Perez L, Künzli N, Munters E, Nemery B. Public health importance of triggers of myocardial infarction: a comparative risk assessment. Lancet 2011;377:732-740.
25. Knox EG. Meteorological associations of cerebrovascular disease mortality in England and Wales. J Epidemiol Community Health 1981;35:220-223.
26. Zhang ZF, Yu SZ, Zhou GD. Indoor air pollution of coal fumes as a risk factor of stroke, Shanghai. Am J Public Health 1988;78: 975-977.
27. Schwartz J. What are people dying of on high air pollution days? Environ Res 1994;64:26-35.
28. EDITORIAL Air pollution and brain health: an emerging issue The Lancet Neurology VOLUME 17, ISSUE 2, P103DOI:https://doi.org/10.1016/S1474-4422(17)30462-3