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Short essay

STROKE AND AIR POLLUTION. A WORLDWIDE PUBLIC HEALTH PROBLEM

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After myocardial infarction, stroke is now associated with air pollution.

From local data and literature, we report the strength of the association between air pollution and stroke. We try to understand the biological mechanisms between exposure to air pollutants and stroke risk.

The association between air pollution and stroke is strong, confirmed and real. Air pollution and small particulate matter are the most toxic. Patients with classical neuro-vascular risk factors or a history of stroke or transient ischemic attack are at risk of stroke induced by air pollution.

Air pollution is a serious modifiable risk factor for stroke and a silent killer inducing stroke. This new neuro-vascular risk factor is useful for public health policies.

Key words: *ischaemic stroke, hemorrhagic stroke, stroke, air pollution, air pollutants.*

The relationships between air pollution and stroke are now well known and may be introduced in public health policy [1].

We propose to review the data from literature and personal data.

Air pollution. Air pollution is a complex association of air pollutants induced by different sources [2].

Air pollution is the product of small particulate matter (PM) and gaseous pollution with sulfur dioxide (SO_2), ozone (O_3), nitrogen dioxide (NO_2) and carbon monoxide (CO). $PM_{2.5}$ represent close to 70 % of PM measuring less than 10 μm (PM_{10}) [3].

Combustion of fossil products, as well as road traffic, industrial and home heating using coal, oil or wood, mainly produces PM and SO_2. Diesel engines produce high levels of nanoparticles, NO_2 and CO, while O_3 is produced by photochemical reactions [4].

Stroke and air pollution: clinical data. Results and discussion.

Thanks to cohort studies, ecological studies, meta-analyses, case-crossover studies and big data, we can summarize the following evidence-based data [5–15]:

– NO_2 and PM are associated to hospitalization from stroke induced by long-term exposure to air pollution [5, 6];

– Stroke risk is associated to the rise of PM2.5 levels [7];

– Residential proximity to major roadway is associated with a higher risk of ischemic stroke [5];

– The rise of $PM_{2.5}$ levels is associated with the rise of both ischemic and hemorrhage stroke mortality [9];

We have demonstrated the association between ischemic stroke and the number of vascular risk factors (hypertension, tobacco, hypercholesterolemia and diabetes) [13]; the role of SO_2, Co and NO_2 [12] is also demonstrated, as well as PM_{10} [11]; the place of air pollution in stroke onset is very important: 33.7 % in low- and middle-income countries, 30 % in high-income countries [15].

Mechanisms of action of air pollution:

Several mechanisms are well known:

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– translocation of nanoparticles able to cross the alveolar [16];

– capillary barriers towards the circulation [16];

– inflammation of endothelial cells [17];

– increase of endothelial cell permeability [18];

– autonomic dysfunction [1];

– atrial fibrillation [19];

– epigenetic mechanisms, acting on endothelial stem and progenitor cell functions and promoting DNA methylation [20].

Clinical impact.

Thanks to these data, we can identify people at risk (hypertension, diabetes, tobacco), children and elderly [1, 13].

Greater exposure to air pollution in patients having previous neuro-cardio-vascular risk factors is strongly associated with a greater risk of stroke and also myocardial infarction [1, 14].

Therefore, we provide tools to conduct a specific public health policy towards this new problem.

Conclusion. A new modifiable risk factor for stroke is present in the air, after analysis of epidemiological studies. New basic mechanisms suggest urgent effective strategy from public health policy.

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