Commentary

Air pollution and sudden death risk in patients with Parkinson’s disease: Assessing the evidence to date

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Always on the lookout for articles from Public Health journal, one has attracted particular attention, not only for its extremely important results but also for raising worries about the potential impact of such findings on public health. Although more prospective cohort studies with personal exposure measurements are needed [1], Han and colleagues conducted a meta-analysis study to assess the effect of long-term exposure to particulate and gaseous air pollution (AP) on Parkinson’s disease (PD) susceptibility [1]. In brief, the authors clearly demonstrated that long-term exposure to AP, especially particulate matter with aerodynamic diameter <2.5 mm (PM2.5), nitrogen dioxides (NO2), and ozone (O3), might contribute to a higher risk of developing PD [1]. Given the severe epidemic situation of PD and its uncertain relationship with several air pollutants [1], we applaud the authors for pursuing this topic and, in this sense, we would like to draw your attention to the potential long-term effects of exposure to AP on sudden unexpected death in PD (SUDPAR).

PD is one of the most frequent age-related neurodegenerative disorders, which affects millions of people globally. Currently, there is no cure for PD and its prevalence is expected to double by 2030 [2]. Unfortunately, several epidemiological studies are clear in demonstrating that PD is accompanied by high rates of premature death compared with the general population [3–6]. In fact, PD has been considered a malignant disease [4,5] and, therefore, it has to be recognized as a serious public health concern [3–5].

Classically, the main causes of death in PD are pneumonia, cerebrovascular and cardiovascular diseases [3,4,7]. Importantly, SUDPAR is increasingly pointed out to contribute to mortality in PD [4,5]. In a nutshell, SUDPAR is defined as an unexpected death of a patient with PD without any satisfactory cause of death as determined by autopsy [4,5]. Although the causes of SUDPAR remain to be elucidated [4], findings from translational studies suggest that autonomic dysfunction and cardiac abnormalities play an important role in SUDPAR [4]. In addition, several risk factors may be directly associated with SUDPAR such as age of PD onset, disease duration, gender, the severity of motor symptoms, and drug treatment (polypharmacy) [4], but additional experimental and clinical studies are needed to further support such association.

At least in the last decade, it is well argued that long-term exposure to several air pollutants and PD are bad fellows [1,8–11]. Actually, we cannot neglect that long-term exposure to particulate and AP is a serious public health problem. For example, they have the potential to cause cardiovascular abnormalities that may culminate in sudden death [12,13]. Therefore, the discovery and careful evaluation of new risk factors that may contribute to the onset of cardiovascular abnormalities in patients with PD is essential for improving our understanding of how to prevent potentially fatal events (such as SUDPAR) from occurring in these individuals.

Following these lines of reasoning, our research group asks: would it be possible to associate environmental exposure to particulate and AP as
a trigger factor for SUDPAR? To establish a causal relation between long-term exposure to AP and SUDPAR, some points must be discussed. First, several epidemiological studies have shown that even low levels of exposure to AP contributed to the onset and aggravation of cardiovascular diseases [15]. Due to these facts, the American Heart Association (AHA) published in 2004 a statement that focused on providing healthcare professionals and regulatory agencies with a comprehensive review of the literature linking AP exposure to cardiovascular diseases [14]. In that same year, the American Cancer Society published a population-based study that showed the association between long-term exposure to PM2.5 and increased risk of death by ischemic heart disease [15]. In parallel, some studies clearly demonstrated that exposure to high PM2.5 levels attributable to vehicle traffic in urban areas may increase the risk of myocardial infarction significantly in susceptible subjects [16–18]. Furthermore, a recent study provided a comprehensive overview of several detrimental effects on the cardiovascular system induced by both acute and chronic exposure to diesel exhaust [19]. Finally, an increased incidence of ventricular tachyarrhythmias as recorded by implanted cardioverter defibrillators was associated to AP [20–22].

Although the underlying mechanisms of these processes are not fully understood, PM2.5-induced cardiovascular abnormalities are probably associated with inflammatory processes such as oxidative stress initiated by reactive oxygen species (ROS) in affected cells [23,24]. In fact, a recent study clearly demonstrated that the close relationship between oxidative stress and inflammation may contribute to worsening the pathophysiological effects of AP on different organs of the body (e.g. through hypertension, impaired perfusion of organs, alterations in vascular growth, etc.) [19].

Overall, our research group is sure that there is a long way to go. AP is a major public health concern globally [26–28] and, according to the World Health Organization (WHO), ambient AP accounts for an estimated 4.2 million deaths each year, mainly from stroke, heart disease, lung cancer, and chronic respiratory diseases [29]. In this sense, it is clearly evident that certain population subgroups defined by demographic factors (such as ethnicity, age, sex, and socioeconomic status), geographic location (urban vs rural areas), comorbidities, and economic status of the country (developed vs. developing) may disproportionately experience the adverse cardiovascular effects of AP exposure [26], including patients with PD [1]. Therefore, the scientific community must be aware of the strength of the relationship between AP and health outcomes, which includes neurological disorders such as PD.

Now, what should we do in the meantime? First, the AHA recommendations should not be ignored, and, therefore, we should embrace the principles of cardiovascular disease prevention, particularly in populations at high risk for these outcomes as in the case of individuals with PD. Second, because we do not know the mechanisms underlying fatal cardiovascular events in individuals with PD, routine screening strategies for cardiovascular diseases (e.g. ECG, Holter-monitoring, and echocardiography) should be considered in the primary care setting of patients with PD. Such strategy might also be useful in reducing the risk of SUDPAR. Finally, although new and more well-delineated experimental and clinical studies are needed to capture the direct and indirect effects of long-term exposure to AP on PD, we should not cast aside the weight of multiple lines of evidence on AP and health: AP kills and this consensus has been built by the scientific community throughout the years.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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