

MODULATION OF RISK FACTORS FOR SEVERE FORMS OF COVID-19 IN AREAS WITH MINING POLLUTION

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ABSTRACT. Air pollution in mining industrial areas is associated with damage to the broncho-pulmonary structures, likely to influence the way the population manifests with SARS-CoV-2 infection, starting with factors that influence its transmission capacity and continuing with factors that influence its severity. Knowing the elements of risk factors that may be modulated behaviorally can lead to a decrease in the forms given by COVID-19

KEY WORDS: air pollution, COVID-19, risk factors, behavioral modulation

1. INTRODUCTION

The mining energy industry is associated with significant changes in air quality, by generating small dust particles [1], especially in the surface mining areas. The existence of these sources of pollution is long lasting due to the presence of the ash dumps [2, 3, 4] that can be mobilized by the wind. Fixing them by afforestation [5] is desirable, but sometimes is technically and financially difficult.

The usual effects of the air pollution are broncho-pulmonary and consist of chronic inflammation, decreased lung reserve, decreased ability to eliminate

2. THE MAIN CAUSES OF SERIOUS FORMS AND DEATH IN COVID-19

Viral infection with SARS-CoV-2 is accompanied by a multiplication of it in the vascular endothelium [7], with cell destruction and access of blood-soluble coagulation factors to the basal membranes that trigger the coagulation cascade. This phenomenon can occur predominantly at the pulmonary entrance gate, with a significant decrease in oxygen saturation due to the vascular

microparticles silicosis and even cancer [6]. These changes are likely to contribute to the existence of severe forms of COVID-19 in the current pandemic context. Knowing the associated risk factors that may be modulated behaviorally can lead to a decrease in the population in these areas but requires a wide media coverage of them starting with the scientific-academic environment and continuing with the media.

shunt [8] and secondary damage to other organs. In a significant ischemic condition, a multiple organ failure is obtained, which is associated with a reserved medical prognosis. The infection can also affect other vascular endotheliums with thrombosis in areas far from the entrance gate depending on local hemodynamic factors (which slow down the blood speed). Among the most affected areas are the cardiac and cerebral areas due to the ability of these lesions to have a reserved prognosis, respectively the areas of blood stasis due to the action

of gravity and to the lack of mobilization. In the latter case we mention the posterior pulmonary stasis associated with bed immobilization, which favors on the one hand the accentuation of thrombosis in this area, and on the other hand the bacterial superinfections.

Another important factor in the occurrence of severe forms of COVID-19 is the local inflammation caused by the cytokine storm that promotes membrane permeability, acute inflammation with increasing distance between the bronchial and vascular lumens with the consequent and sudden decrease in blood oxygenation [9].

3. INFLUENCE OF ATMOSPHERIC POLLUTION ON COVID-19 TRANSMISSION AND SOME SERIOUS FORMS OF DISEASE

Air pollution in mining industrial areas can be assessed in the context of COVID-19 on two levels.

On a first level, long-term chronic pollution has produced changes in the health of people in these areas with chronic irritant damage by dust or ash particles with an increased risk of chronic bronchitis, silicosis and cancer. These

changes are risk factors for severe forms of COVID-19 by decreasing the lung and therapeutic reserves. Due to its long-term exposure, it does not influence SARS-CoV-2 transmission due to the lack of overlap over time.

On a second level, acute pollution with dust or ash microparticles can lead to their complexation with Pfluger particles responsible for the transmission of SARS-CoV-2, produced by respiration, coughing or sneezing [10]. This complexation has as an effect the increase of the mass and consequently the decrease of the floating time in the air and of their distance of passive movement. Secondly, it can be considered that air pollution in these areas is not an acute risk factor for the transmission of SARS-CoV-2, if there is a degree of distance between people who could transmit this infection. Similarly, in areas chronically affected by fog, sometimes associated with the existence and operation of a power plant, Pfluger particles have a shorter travel distance.

It can be considered that there are slightly divergent effects of the air pollution in these areas on the transmission and the severity of this infection (Table 1).

	Effects on transmission SARS-CoV-2	Effects on gravity COVID-19
Chronic exposure		Microparticles (-)
Acute exposure	Microparticles (+) Fog (+)	

Table 1. The effects of the chronic exposure to pollution in industrial energy mining areas. (-) aggravating factor, (+) protective factor

Among the risk factors for severe forms of the disease, only those that influence the risk of thrombosis have a behavioral component. Influencing pulmonary microvascularization is behaviorally affected primarily by smoking. This leads to a predominant impairment of the small and medium vessels with the production

of chronic inflammation at this level (vasculitis). This phenomenon is relatively ignored in terms of population and medical media factors. Chronic inflammation predisposes to stiffening, increasing peripheral resistance to blood flow, with a low degree of reversibility to smoking cessation due to its dual effect.

Acute smoking can lead to an action on vascular receptors, but chronic exposure results in an irreversible thickening of the vascular tunica media. By combining the risk factors of severe forms of COVID-19, intravascular coagulation and diffuse vasculitis of small vessels of chronic smokers [11], we can explain the existence of severe forms in young people at the level of decreased blood oxygenation and multiple organ failure or even heart attack. Myocardial infarction occurred in the context of an apparently healthy patient is currently understood due to the pre-existing lesions.

Another risk factor for thrombosis is the use of oral contraceptives. They have an intrinsic potential to produce a very small percentage of thrombosis, but in the

context of the SARS-Cov-2 pandemic it is to be assessed whether it is prudent to replace them with other contraceptive measures.

Exercise is a recognized protective factor for preventing the occurrence of severe forms of COVID-19 [12]. In this sense, it is recommended to mobilize patients as soon as possible to prevent venous stasis, bacterial superinfections and their known risks, especially in the elderly.

Vascular changes in obesity are associated with a high risk of thrombosis through stasis that is achieved directly (by compression) or indirectly by limiting movement (sedentary lifestyle).

The summary of protection factors is shown in Table 2.

Protective factors for severe forms of COVID-19
Smoking cessation
Regular exercise
Avoid oral contraceptives
Avoiding obesity

Table 2. Behavioral protection factors against severe forms of COVID-19

4. CONCLUSIONS

Pollution in industrial energy mining areas is not likely to induce an acute risk of severe COVID-19 transmission and cannot be an argument for closing this industry. Chronic pollution of these areas can lead to pathologies that are risk factors for severe forms of COVID-19, but the use of modifiable behavioral factors (smoking cessation, regular exercise, avoidance of oral contraceptives, avoidance of obesity) can reduce the associated risk. It is necessary a media coverage of the lifestyle change for a prediction of the risk of occurrence of severe forms of COVID-19, along with medical actions (vaccination, distancing) for a rapid socio-economic recovery.

REFERENCES

- [1] MORENO Teresa, TRECHERA Pedro, QUEROL Xavier, LAH Robert, JOHNSON Diane, WRANA Aleksander, WILLIAMSON Ben, Trace element fractionation between PM10 and PM2.5 in coal mine dust: Implications for occupational respiratory health, *International Journal of Coal Geology*, 203 (2019)
- [2] POPESCU Luminița Georgeta, ABAGIU Traian Alexandru, BANCIU Adela, *Thermal power plants slag and fly ash - wastes with high reuse potential*, *Annals of 'Constantin Brancusi' University of Targu-Jiu*, 3 (2016)
- [3] POPESCU Luminita Georgeta; GORUN Adrian; RACOCEANU Cristinel, CRUCERU Mihai, *Environmental impact of ash and slag*

- deposit Ceplea Valey of Energetic Complex Turceni*, International Multidisciplinary Scientific GeoConference: SGEM; Sofia, 5 (2012)
- [4] RACOCEANU Cristinel, POPESCU Luminița-Georgeta, POPESCU Cristinel, CRUCERU Mihai, *Research on particulate matter PM10 pollution due to coal burning in Oltenia Energy Complex*, Advances in Environment Technologies, Agriculture, Food and Animal Science, Proceedings of the 2nd International Conference on Energy and Environment Technologies and Equipment (EEETE'13), 1-3 (2013)
- [5] ANEJA Viney, ISHERWOOD Aaron, MORGAN Peter, *Influence of spoil type on afforestation success and natural vegetative recolonization on a surface coal mine in Appalachia*, Atmospheric Environment, 54 (2012)
- [6] KHOJASTEH Davood Namdar, GOUDARZI Gholamreza, TAGHIZADEH-MEHRJARDI Ruhollah, ASUMADU-SAKYI Akwasi Bonsu, FEHRESTI-SANI Masoud, *Long-term effects of outdoor air pollution on mortality and morbidity–prediction using nonlinear autoregressive and artificial neural networks models*, Atmospheric Pollution Research, 12 (2021)
- [7] ZHANG Min, WANG Peng, LUO Ronghua, WANG Yaqing, LI Zhongyu, GUO Yaqiong, YAO Yulin, LI Minghua, TAO Tingting, CHEN Wenwen, HAN Jianbao, LIU Haitao, CUI Kangli, ZHANG Xu, ZHENG Yongtang, QIN Jianhua, *Biomimetic Human Disease Model of SARS-CoV-2-Induced Lung Injury and Immune Responses on Organ Chip System*, Advanced Science, 8 (2020)
- [8] BRITO-AZEVEDO Anderson, PINTO Eduardo Costa, CATA PRETA CORRÊA Gabriel Angelo, BOUSKELA Eliete, *SARS-CoV-2 infection causes pulmonary shunt by vasodilatation*, Journal of Medical Virology, 93 (2020)
- [9] HU Biying, HUANG Shaoying, YIN Lianghong, *The cytokine storm and COVID-19*, Journal of Medical Virology, 93 (2020)
- [10] AHMED Donia, SAMMER-UL Hassan, XUNLI Zhang; LAMIAA Al-Madboly, HABIB Bokhari, *COVID-19 Crisis Creates Opportunity towards Global Monitoring & Surveillance*, Pathogens 10 (2021)
- [11] FUKUMOTO Kazuo, TAKEMOTO Yasuhiko, NORIOKA Naoki, TAKAHASHI Kanae, NAMIKAWA Hiroki, TOCHINO Yoshihiro, SHINTANI Ayumi, YOSHIYAMA Minoru, SHUTO Taichi, *Predictors of the effects of smoking cessation on the endothelial function of conduit and digital vessels*, Hypertension Research, 44 (2021)
- [12] SCUDIERO Olga, LOMBARDO Barbara, BRANCACCIO Mariarita, MENNITTI Cristina, CESARO Arturo, FIMIANI Fabio, GENTILE Luca, MOSCARELLA Elisabetta, AMODIO Federica, RANIERI Annalisa, GRAGNANO Felice, LANERI Sonia, MAZZACCARA Cristina, DI MICCO Pierpaolo, CAIAZZA Martina, D'ALICANDRO Giovanni, LIMONGELLI Giuseppe, CALABRÒ Paolo, PERO Raffaella, FRISSE Giulia, *Exercise, Immune System, Nutrition, Respiratory and Cardiovascular Diseases during COVID-19: A Complex Combination*, Int. J. Environ. Res. Public Health 18, (2021)