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OPINION PIECE

Pulmonary Inflammation and Injury Triggered by Spine Surgery in Recovered COVID-19 Patients Demand Consideration

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Patients with COVID-19, caused by SARS-CoV-2 infection, have presented with fever, cough, dyspnea, pneumonia, acute lung injury, and other respiratory symptoms.[1] An inflammatory overreaction, called a cytokine storm, has also been associated with severe COVID-19.[2] Cytokine storm involves elevated levels of circulating cytokines and hyperactivation of immune system cells.[3] Patients with mild COVID-19 can also produce elevated levels of pro-inflammatory cytokines.[4] Furthermore, those patients present dysregulated expression of genes related to immune functions.[4] Consequently, the immune disorder can hinder a return to homeostasis, leading to multiorgan dysfunction or even multiorgan failure.[3] The pathophysiological consequences of cytokine storm also include circulatory coagulopathy and acute respiratory distress syndrome.[3] In this context, the hyper-inflammatory state and physiological disruption caused by SARS-CoV-2 infection hinder the patient's recovery from physiological stress and injury caused by surgery procedures, for example.

Even those patients discharged from hospitals after successful treatment for COVID-19 require careful evaluation before surgery. High levels of interleukin-6 (IL-6), a central pro-inflammatory cytokine, have been associated with pulmonary fibrosis in discharged patients.[5] Residual pulmonary abnormalities, such as pulmonary fibrosis, can persist for as long as three months after COVID-19 patient discharge.[6] This scenario can contribute to unfavorable surgical outcomes. Spinal surgery appears to be a matter of concern; surgical corrections for spinal deformities, such as thoracolumbar discectomies, can result in acute lung injury in non-COVID-19 patients.[7] Urban *et al.* found that in some patients, spinal surgery induced an acute inflammatory response in the lungs with an elevation of IL-6 and tumor necrosis factor alpha (TNF-α) detected in bronchoalveolar lavage (BAL) fluid.[7] Therefore, increased counts of inflammatory cells and cytokine levels in BAL of surgical patients were associated with increased pulmonary vascular resistance and requirement for mechanical ventilation.

A regulated immune system seems to be a key determinant of recovery following surgery. The inflammatory state in COVID-19 patients with mild or severe disease who have been discharged from the hospital may negatively affect postoperative recovery. Spinal surgery has an additional impact on the lungs, inducing inflammatory reactions in lung tissue and potentially worsening COVID-19 pathogenesis and sequelae. Thus, for many emerging clinically cured COVID-19 patients, it is essential to follow up on lung conditions to ensure complete recovery before scheduling elective spinal surgery.

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