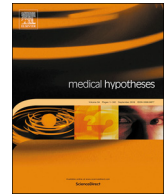




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Intra-abdominal hypertension as a trigger of “gut failure” in SARS-CoV-2 infection: Effect of open abdomen (OA) and negative pressure therapy (NPT) on respiratory and gastrointestinal (GI) function

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ABSTRACT

COVID-19 gastrointestinal manifestations could be attributed to SARS-CoV-2-induced small vessel thrombosis. OA with NPT treatment may have a role in optimization of bowel microcirculation and in the reduction of the endothelial and the systemic cytokine-related damage, improving also respiratory function.

Introduction

Since the beginning of the SARS-CoV-2 outbreak, alongside the most common clinical manifestations such as fever, cough and dyspnea, other clinical presentations have been described [1]. It has been shown that the virus can affect the GI tract and all other possible organs and tissues [2,3,4,5].

This could be linked to the presence of the viral receptor of the angiotensin-converting enzyme 2 (ACE2), into host cells of different tissues, including the GI tract [6,7]. Moreover, several studies demonstrated the presence of SARS-CoV-2 RNA in rectal swabs and stool specimens [8,9]. Indeed, also gastrointestinal manifestations such as abdominal pain, vomiting and diarrhea have been reported [10].

Gastrointestinal manifestations could be attributed to pharmacologic effects, metabolic disorders encountered in ICU patients, other opportunistic colonic pathogens, COVID-19 related “viral enteropathy” but also SARS-CoV-2-induced small vessels thrombosis is a possible pathophysiological hypothesis [11,12].

During this pandemic, we managed several COVID-19 patients presenting with gastrointestinal manifestations, such as colitis (11 patients), bowel perforation (3 patients) and ischaemia (3 patients).

Some of these patients underwent an OA treatment for surgical complications - eg. abdominal compartmental syndrome (ACS) – and showed a rapid improvement of both respiratory and gut disfunction.

Our hypothesis is that OA may have a pivotal role in improving bowel microcirculation reducing the endothelial and the systemic cytokine-related damage in COVID19 patient.

Hypothesis.

The involvement of multiples organs with different severity of clinical manifestations has led several authors to propose that the main damage is not primarily in the pulmonary parenchyma, but at the level of the microcirculation. Therefore, a target therapy, aimed at improving the capillary vascularization, for example low molecular weight heparin, can lead to a substantial improvement of these patients [11,13]. According to Klok et al among 184 COVID-19 patients in a Dutch ICU, 38% had coagulation abnormalities and almost one-third already had clots [14]. In the light of these data, it has been assumed that COVID-19 targets blood vessels and all clinical manifestations start from this type of damage. This is also confirmed by the paradigm brought to attention from many ICU physician that even if SARS-COV-2 patient have a normal or even higher lung compliance, oxygen uptake is altered by constricted blood vessels rather than by clogged alveoli.

In early March, Carvalho et al reported the first case of SARS-CoV-2 gastrointestinal infection causing haemorrhagic colitis that has spontaneously improved by targeted COVID-19 therapy [15].

Bhayana et al. reported radiological vascular abnormalities of a COVID19 patient series, often seen in patients with intestinal ischaemia, such as bowel wall thickening, pneumatosis and portal venous gas [16].

Since the beginning of the SARS-CoV-2 outbreak, the Fondazione Policlinico Universitario A. Gemelli IRCCS (FPG) hospital of Rome has been identified as both medical and surgical hub for COVID19. Among 3200 admissions for suspected COVID-19, there were 682 confirmed patients. We performed 82 surgical consultations (32 for COVID19

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positive patients and 54 for suspected ones). Three of them suffered from megacolon and intestinal pneumatosis. These patients, due to suspected intestinal ischaemia with or without ACS, underwent surgical intervention and benefited of an OA and NPT without intestinal resections.

In our cases, the prompt reduction of the intra-abdominal pressure (IAP) with OA led to a quick improvement of the colonic alteration but also of the respiratory function.

According to the last WSES guidelines, the use of OA should be considered after perfusion restoration in patients with acute mesenteric ischaemia (occlusive and/or non-occlusive) in case of deranged physiology and bowel oedema and/or necessity to perform a second look or a delayed anastomosis [17]. Moreover, it has been suggested by some studies that inflammatory mediators such as cytokines released during intestinal ischaemia-reperfusion damage, increase permeability in the lungs with subsequent pulmonary injury. In the light of this, the control of local cytokines production in the peritoneal cavity may be important in order to prevent worsening of lung failure as well as of all the other organs [18,19].

Based on this concepts, even if just anecdotal, our cases show that as first OA can improve the arterial and venous blood flow in the gastrointestinal tract by reducing IAP. Moreover, NPT allows cytokine clearance leading to a reduction of vascular endothelial damage. Both of these mechanisms might potentially improve microcirculation conditions determining an optimization of systemic perfusion and organ function.

Of course, further studies are needed in order to confirm this possible pathophysiological hypothesis.

Competing interest

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Author contributions

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