Risks of COVID-19 transmission in blood and serum during surgery A prospective cross-sectional study from a single dedicated COVID-19 center

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Nicolò Fabbri*, Eriminio Righini**, Laura Cardarelli***, Luigi Di Marco*, Carlo V. Feo*

**Unit of General Surgery, Azienda Unità Sanitaria Locale di Ferrara, University of Ferrara, Italy*
***Unit of Anaesthesia and Intensive Care, Azienda Unità Sanitaria Locale di Ferrara, Ferrara, Italy*
****Rete Diagnostica italiana, Padua (Limena), Italy*

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The present pandemic caused by the SARS COV-2 coronavirus is still ongoing, although it is registered a slowdown in the spread for new cases. The main environmental route of transmission of SARS-CoV-2 is through droplets and fomites or surfaces, but there is a potential risk of virus spread also in smaller aerosols during various medical procedures causing airborne transmission. To date, no information is available on the risk of contagion from the peritoneal fluid with which surgeons can come into contact during the abdominal surgery on COVID-19 patients.
We have investigated the presence of SARS-CoV-2 RNA in the peritoneal cavity of patients affected by COVID-19, intraoperatively and postoperatively.

KEY WORDS: Covid-19, Laparotomy, Surgery

Introduction

The present pandemic caused by the SARS COV-2 coronavirus is still ongoing, although it is registered a slowdown in the spread for new cases.
Reportedly, the disease could affect several organs that express the angiotensin-converting enzyme 2 (ACE2) receptor such as the lung, heart, kidney, intestine, and endothelial cells [1]. Autoptic investigations have also highlighted the presence of the virus in endothelial cells [2].
The main environmental route of transmission of SARS-CoV-2 is through droplets and fomites or surfaces, but there is a potential risk of virus spread also in smaller aerosols during various medical procedures causing airborne transmission [3]. Moreover, the *Istituto Superiore di Sanità* (ISS – Italian National Institute for Health), has recently warned on the possibility of viral transmission also from feces and urine, as supported by some current evidence [4]. In a later stage of infection, more positive anal than oral swabs have been detected, suggesting shedding and eventual transmission through the oral-fecal route. The clinical relevance of evaluation RT-PCR test in fecal specimens is also emphasized by the recent finding of more than 20% of COVID-19 patients remaining positive on fecal swab test after oropharyngeal swab test turned negative [5]. Several protocols have been developed and established to ensure the lowest risk of contagion for healthcare staff and professionals who manage COVID-19 patients needing urgent or planned surgical procedures. However, the biological hazard associated with surgery on such patients has not yet been adequately investigated.
To date, no information is available on the risk of contagion from the peritoneal fluid with which surgeons can come into contact during the abdominal surgery on COVID-19 patients.

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Correspondence to: Nicolò Fabbri, M.D. Ospedale del Delta, Azienda Unità Sanitaria Locale di Ferrara, Via Valle Oppio 2, 44023 Lagosanto (Ferrara), Italy (e-mail: n.fabbri@ausl.fe.it)

Possibly, the production of vapors resulting from the use of instruments (e.g., electrocautery, ultrasound or radiofrequency dissector) or warm water may increase the risk of aerial spread of the virus if it is present in biological fluids such as the peritoneal liquid.
We aim to investigate the presence of SARS-CoV-2 RNA in the peritoneal fluid, intraoperatively and postoperatively, and a study protocol was recently approved by our local Ethics Committee. Due to the relevance of the topic and urgent need of information we report the results on the first patient of such a study.

Case Report

An 80-year-old woman presented at the emergency room with abdominal pain and diarrhea for about two weeks. She had been treated for the previous 7 days with broad-spectrum antibiotics due to fever, persistent vomiting, and mild cough. Her past medical history revealed obesity, hypertension, and colonic diverticulosis. Laboratory tests showed mild thrombocytopenia (130,000/microliter), lymphocytopenia (760/microliter), high level of C-reactive protein (3.62 mg\dl), slightly elevated D-dimer (0.59 mg\L Fibrinogen Equivalent Units – FEU). Neutrophils were normal and ferritin was at 405 ng\ml. The chest high resolution computerized tomography (HRCT) showed multiple bilateral pulmonary ground glass areolas with thickening of the interlobular septa. A CT of the abdomen was also performedshowing presence of diverticulosis with no complications.
The patient was then admitted to the hospital and the nasopharyngeal swab test resulted positive for SARS COV-2 therefore, therapy with hydroxychloroquine, ceftriaxone, and azithromycin was initiated with progressive clinical and laboratory tests improvement.
The patient was also negative for the QuantiFERON test as well as urinary test for Legionella and streptococcus and serology for mycoplasma and chlamydia pneumonias.
After 14 days, due to improved general clinical conditions, the patient was discharged to a long-term care ward. After 7 days, a new nasopharyngeal swab confirmed persistence of the SARS COV-2 virus infection and she presented diarrhea, loss of appetite, and a skin rash treated with steroids.
After one month since hospitalization, a chest CT scan was performed showing a reduction in size of the multiple bilateral parenchymal ground glass lung areas. Due to the detection of a submandibular abscess, antibiotic coverage was increased by administering Meropenem 1gr QID, Linezolid 600 mg BID, and Clindamycin 600mg TID.
Forty days after the initial hospital admission and first diagnosis of COVID-19 infection, a new nasopharyngeal swab-test showed a negative result. The patient continued to refer lack of appetite and laboratory tests showedlow white blood count (3.99 x10^3/µl), normal hemoglobin level(12.5 g/dl), thrombocytopenia (89 x10^3/µl), lymphocytopenia (1.50 x10^3/µl), normal C-reactive protein (0.55 mg/dl). Three days later,the patient developed acute abdomen with septic shock with normal body temperature. An abdominal CT scan was performed detecting free intraperitoneal air with no intraperitoneal fluid. Laboratory tests indicated an increase in white blood cell count (neutrophils12.00010^3/µl), a decrease in hemoglobin level(9.5 g/dl), platelets(48.00010^3/µl) andlymphocytes(0.1010^3/µl), an increase in C-reactive protein (5.06 mg/dl). D-dimer was 1.74 mg\L.
An urgent exploratory laparotomy was undertaken, revealing a pinpoint perforation of a sigmoid diverticulum with no contamination of the peritoneal cavity nor the presence of fluid.
A first abdominal swab sample was performed at the opening of the abdomen and a second swab sample was collected at the end of the surgical operation, before suturing after washing the abdominal cavity with three liters of warm normal saline solution.
On the first post-operative day, a swab sample on the abdominal drainage fluid was performed as well as a rhino-pharyngeal swab test.
Both the intraoperative swabs as well as the postoperative swab on the abdominal drainage fluid were negative. The rhino-pharyngeal swab test was also negative.The patient passed away in the fifth post-operative day due to multiorgan failure.

Discussion

The most common presenting manifestations of COVID-19 are respiratory symptoms such as fever, dry cough, and dyspnea, similarly to severe acute respiratory syndrome (SARS) in 2003 and Middle East respiratory syndrome (MERS) in 2012, indicative of transmission via droplet and contact. However, less common presentations with diarrhea, nausea, vomiting, and abdominal discomfort have been reported, together with an early and mild onset frequently followed by typical respiratory symptoms [6].
Recently an international, multicentre, cohort study reported that postoperative pulmonary complications occur in half of patients with perioperative SARS-CoV-2 infection and are associated with high mortality. Thresholds for surgery during the COVID-19 pandemic should be higher than during normal practice, particularly in men aged 70 years and older. Consideration should be given for postponing non-urgent procedures and promoting non-operative treatment to delay or avoid the need for surgery [7].
In our case, the patient immediately showed intestinal symptoms related to COVID-19 infection along with evidence of interstitial pneumonia. The presence of SARS COV-2 RNA was not identified in the peritoneal cavi-

ty, but the hypothesis of a systemic spread of the disease or possibility of an inflammatory storm remains, especially for the absence of a severe peritonitis.
The abdominal complications occurred 30 days after the diagnosis of SARS COV-2 infection. Lymphopenia on preoperative tests and severe thrombocytopenia associated with normal C-reactive protein and elevated D-dimer levels could be due to intra-abdominal infection as well as general inflammatory status associated to COVID-19.
It would be also important to evaluate whether different stages of SARS COV-2 disease can lead to a variable risk of the spreading of the virus during surgery and could make it possible to change the rules against the risk of contagion between surgeons and nurses during surgery.
Infact, surgical interventions on positive or suspect patients are burdened by a particular devices that forces the surgeon to operate in non-ideal conditions with the use of masks that often reduce the view and make the operations more complex.
Patients recovering from the infection could present a lower viral load; our patient received her first negative rhino-pharyngeal swab three days before surgery.

Conclusions

Assessments of SARS COV-2-related risk in abdominal surgery needs to be addressed to investigate the possible risk of and to determine the possible role of SARS COV-2 infection in multiorgan failure during acute abdominal complications.

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Riassunto

La principale via di trasmissione ambientale di SARS-CoV-2 è aerea, ed esiste un rischio potenziale di diffusione del virus durante varie procedure mediche attraverso la produzione di aerosol. L'Istituto Superiore di Sanità ha recentemente messo in guardia sulla possibilità di trasmissione virale anche da feci e urine. Infatti, oltre il 20% dei pazienti positivi al COVID-19 rimangono positivi al test del tampone fecale anche dopo la negativizzazione del tampone orofaringeo. Recentemente sono stati adottati diversi protocolli per garantire il minor rischio di contagio per il personale sanitario e i professionisti che gestiscono pazienti COVID-19 che necessitano di procedure chirurgiche urgenti o pianificate. Tuttavia, l'entità di tale rischio non è stato ancora adeguatamente studiato. Ad oggi, non sono disponibili informazioni sul rischio di contagio dal fluido peritoneale con il quale i chirurghi possono entrare in contatto durante la chirurgia addominale su pazienti COVID-19. L'obiettivo del nostro studio è quello di ricercare la presenza dell'RNA virale del SARS-CoV-2 nel fluido peritoneale mediante campionamenti seriati in corso di intervento e nell'immediato post-operatorio. Data l'urgente necessità di informazioni in merito a questo argomento, riportiamo i risultati sul primo paziente di tale studio.
Caso clinico: Presentiamo il caso di una donna di 80 anni con sintomi addominali (algie e diarrea) da circa due settimane e trattata a domicilio con antibiotici ad ampio spettro. Per la persistenza dei sintomi la paziente è stata ricoverata in ospedale dove gli esami hanno posto sospetto di malattia da COVID-19, confermata poi da tampone naso-faringeo mantenutosi positivo nei controlli successivi fino a 40 giorni dopo l'inizio dei sintomi. Circa 3 giorni dopo la negativizzazione del tampone naso-faringeo la paziente ha sviluppato un quadro di addome acuto e shock settico con riscontro TC di perforazione intestinale che ha richiesto una laparotomia esplorativa urgente, senza evidenza di contaminazione peritoneale ma rivelando una piccola perforazione diverticolare. Sono stati eseguiti 2 tamponi addominali per ricerca di COVID-19 in corso di intervento chirurgico ed un terzo tampone è stato eseguito il giorno successivo da liquido di drenaggio addominale, con esito negativo. La paziente è deceduta in quinta giornata post-operatoria per insufficienza multiorganica.
Nonostante la manifestazione più frequente della malattia da COVID-19 sia respiratoria, sono state riportate presentazioni meno comuni con diarrea, nausea, vomito ed algie addominali. Nel nostro caso la presenza di SARS COV-2 RNA non è stata identificata nei fluidi biologici, tuttavia rimane l'ipotesi di una diffusione sistemica della malattia con la possibilità di una tempesta infiammatoria, soprattutto per l'assenza di una peritonite evidenziabile al momento dell'intervento chirurgico.
Sarebbe importante valutare l'esistenza di un rischio variabile di contaminazione in corso di intervento chirurgico nei pazienti positivi, a seconda dei diversi stadi della malattia SARS COV-2. Ciò potrebbe consentire di riconsiderare le norme sul rischio di contagio del personale sanitario durante l'intervento chirurgico. Infatti, gli interventi chirurgici su pazienti positivi o sospetti sono resi più complessi per l'uso dei dispositivi che obbligano il chirurgo ad operare in condizioni non ideali rendendo le operazioni più complesse.

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