

Review Article

Laparoscopy in the Era of COVID-19 Pandemic : Lessons Learned from PIPAC Surgery

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COVID-19 pandemic has created a havoc healthcare problem. Day to day Surgeries specially Laparoscopic Surgeries being aerosol generating procedures are being avoided by majority of Surgeons. But it is time to adopt the 'new normal'. Pressurized Intra Peritoneal Aerosol Chemotherapy (PIPAC) is a technique where aerosol Chemotherapy is instilled into peritoneal cavity via an injector (CapnoPen). Leakage of chemotherapy into the atmosphere is prevented by some special techniques. Here we discuss the principles of PIPAC, which if applied in routine laparoscopic Surgeries, will reduce the chance of aerosol contamination and will make the procedure safe.

[J Indian Med Assoc 2021; 119(10): 47-9]

Key words : COVID-19 pandemic, Laparoscopy, Minimally Invasive Surgery, PIPAC.

The outbreak of Corona Virus (COVID-19) has brought about an unprecedented circumstance leading the entire World in a fight against the pandemic. Similarly, Surgical practice faces challenges in a balancing act between patient care and to minimize transmission among Health care workers. Laparoscopic surgery is no exception.

A genus of the *Coronaviridae* family, Corona virus is an enveloped virus with a large plus-strand RNA genome which is 27-32 kb in size, capped and polyadenylated¹. Peiris *et al*² reported that Novel Corona Virus is the probable cause of Severe Acute Respiratory Syndrome (SARS).

Holmes KV³ proposed that the SARS-associated Corona Virus could have emerged as a genetically modified form of a human Corona Virus that acquired new virulence factors or as a genetic modification of an animal Corona Virus with the capability of infecting human cells. According to the same author, consolidation of two human Corona Viruses or recombination of a single human corona virus and an animal Corona Virus is also a possibility³.

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Received on : 30/03/2021

Accepted on : 14/04/2021

Editor's Comment :

■ Laparoscopic surgery is associated with less pain, magnified vision, less blood loss, less hospital stay. But Laparoscopic Surgery during COVID-19 infection ponders higher risk of viral spread through aerosol. This aerosol spread can be prevented by the adoption of different techniques used during PIPAC surgery.

Mostly three human corona viruses have been studied in detail among which HCoV-229E and HCoV-OC43 were identified in the mid-1960s and are responsible for common cold⁴⁻¹². Similarly, the third type SARS-CoV, the most pathogenic human Corona virus, has been found to cause a life-threatening pneumonia¹³⁻¹⁵.

Federico Coccolini *et al*¹⁶ demonstrated the presence of SARS-CoV-2 in peritoneal fluid in COVID-19 patients. The patho-mechanisms behind the excretion of SARS-CoV-2 remain largely unknown. Federico Coccolini *et al* also demonstrated higher viral load in the peritoneal fluid as compared to the upper respiratory material and are of the opinion that surgical procedures carries a significant risk of transmission of infection. Surgical techniques like electro-cautery, advanced coagulation and cutting devices etc that produce gas and vapor can aerosolize the peritoneal fluid carrying the virus in the surrounding environment. There has been no study till date to show the correlation between respiratory symptoms and the viral load in the peritoneal fluid. Hence all people even with mild respiratory symptoms due to SARS-CoV-2 may harbor a significant viral load in the peritoneal fluid which increases the exposure risk and risk of contagion to

the entire surgical team.

In our innovative technique, we aim to apply the principle of PIPAC therapy and minimize the aerosol exposure to the operating room staff during Laparoscopic Surgery.

PIPAC :

Pressurized Intraperitoneal Aerosol Chemotherapy abbreviated as PIPAC is a procedure where aerosolized chemotherapy is directly injected into the abdomen via a high-pressure injector and appears to be a



Fig 1 — Ports used in PIPAC (balloon port)

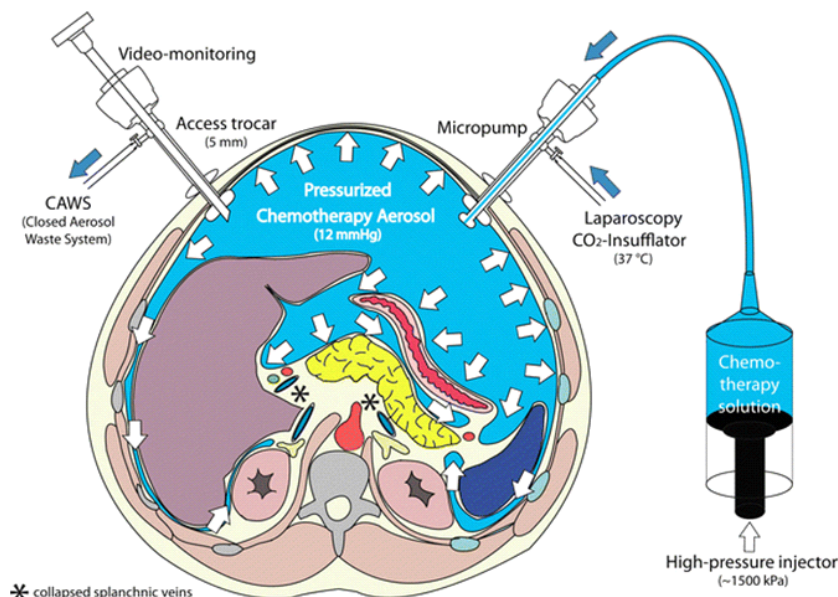


Fig 2 — Schematic representation of PIPAC therapy

[Image taken from Solass W, Kerb R, Mürdter T et al Intraoperative Chemotherapy of Peritoneal Carcinomatosis Using Pressurized Aerosol as an Alternative to Liquid Solution: First Evidence for Efficacy. *Ann Surg Oncol* 2014; 21: 553-9. <https://doi.org/10.1245/s10434-013-3213-1>]

promising approach for patients with peritoneal malignancy.

PIPAC is performed in an operating room equipped with laminar air-flow. To begin with, a normothermic capnoperitoneum with a pressure of 12 mmHg at body temperature is established followed by insertion of trocars (usually 3). Fig 1 shows the port (balloon port) used during PIPAC. Nebulized with a micropump, the chemotherapy solution (about 10% of a normal systemic dose) is delivered into the tightly closed abdominal cavity in the form of aerosol and is usually maintained for about 30 min.¹⁷ The chemotherapy aerosol is then exsufflated via a closed line over two sequential microparticle filters into the airwaste system of the hospital (Fig 2) followed by retraction of the trocars¹⁸.

Repeated intraoperative analysis of the environmental air showed PIPAC to be safe for all staff inside the operation theatre and that it meets the requirements of the German working safety regulations¹⁹.

Application of PIPAC Principle in Laparoscopic Surgery :

The main challenge of Laparoscopic Surgery is the exposure of the surgical team and operating room personnel to aerosol from peritoneal fluid which might occur during cauterization or during exsufflation of the pneumoperitoneum. Hence we thought of applying the principle of PIPAC therapy to Laparoscopic Surgery.

One of the ports (balloon port as used in PIPAC) during Laparoscopic Surgery will be connected to closed aerosol waste system which will be ultimately filtered into the air waste system of the hospital. This will ensure minimum or no exposure of aerosol from peritoneal fluid to the surgical team and other staffs inside the operating room. Fig 3 depicts a schematic model of our proposed system. If applicable this will enable Minimal Access Surgeons to perform Laparoscopic Surgery with minimal risk of exposure during the present COVID-19 pandemic.

Conclusion :

As rightly said the world must move on overcoming all hurdles, so should the Laparoscopic Surgeons continue patient care with minimal

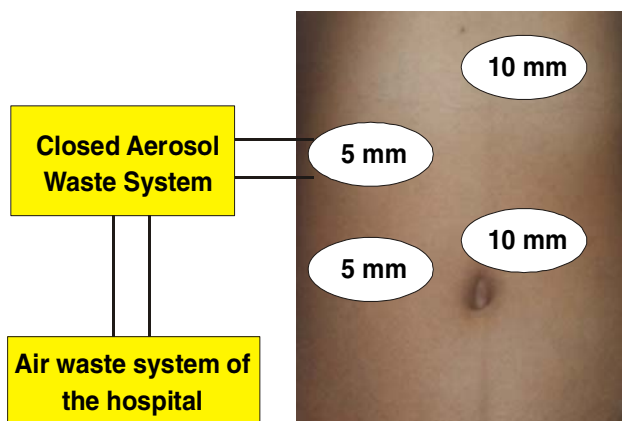


Fig 3 — Schematic representation of laparoscopic surgery procedure with closed aerosol waste system (10mm, 5mm represents the port size)

exposure. Applied properly our proposed model can play a significant role in minimizing exposure to the operating team during the present era of COVID-19.

Limitations : Since this is a proposed model further studies will be required before incorporating it as a practice changing method. Collaboration with centers performing good number of laparoscopic surgeries would help to a great extent in validating our result for the benefit of the large number of Laparoscopic Surgeons Worldwide.

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