



## **A Novel Mechanism for Pneumoperitoneum and Aerosol Diffusion in Laparoscopy during COVID-19**

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### **Authors' contributions**

*This work was carried out in collaboration among all the authors. Author PG conceived the concept. Author DK wrote the first draft of the manuscript. Authors AK and MR managed the analyses of the study. Authors PK and AB managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** In current period of Novel Coronavirus SARS-CoV-2 pandemic, there have been concerns regarding safety of surgeons and operation theatre staff during laparoscopic procedures. Most of the concerns are regarding surgical fumes/aerosol generated during the procedures which may be potentially infective. We propose a simple solution using existing standard equipment to safeguard the medical personnel during Laparoscopic procedures.

**Methodology:** Initial pneumoperitoneum was created with a Veress needle. Gas cable connected to insufflator was attached to the main port. An additional Gas cable was attached to another operating port which was attached to central suction. This was used evacuate surgical smoke whenever needed. Meticulous care while operating ensured that pneumoperitoneum was created during the whole duration of surgery in a closed system thus decreasing the risk of exposure of operating staff to operating fumes.

**Conclusion:** Even though risk of contracting COVID 19 disease via surgical fumes and aerosol generated during laparoscopy is debated, it is advisable to reduce the exposure of surgeon and

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operating room staff to the extent possible. Presently there are many new devices available which have been developed for this specific purpose. We propose a simple solution using existing standard equipment for this purpose.

**Keywords:** SARS-CoV-2; COVID 19; pneumoperitoneum; laparoscopy.

## 1. INTRODUCTION

The pandemic of COVID19 has caused concerns in the practice of surgery worldwide. The practice of laparoscopy has also not been left untouched. The theoretical possibility of transmission of disease via surgical gases and fumes which may contain aerosolization of the virus [1]. There has been evidence of Hepatitis B and Human Pappiloma Virus in surgical smoke [2,3] however it is yet to be established for SARS-CoV-2 virus. Till the time this threat is established or refuted surgeons should take all possible precautions to prevent exposure to the surgical smoke.

Here we describe a simple and easily reproducible method which created a closed circuit of Pneumoperitoneum thus decreasing exposure of operation theatre staff to surgical smoke. It uses existing standard laparoscopy equipment and does not need any major modification to actual surgical steps.

## 2. METHODOLOGY

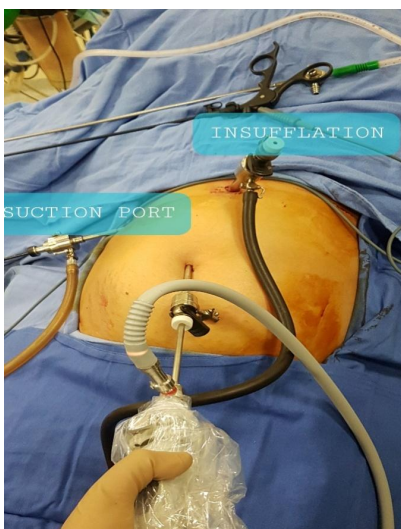
Pre-operative patient preparation and positioning is standard and as per the procedure being performed. Pneumoperitoneum is created via Veress needle via Umbilical or Palmer's point.

Initial Cannula with sharp trocar is inserted and Gas cable is attached to it after removing the trocar. Pneumoperitoneum is created to the desired pressure. Camera scope is inserted in the first Cannula. Care is taken at this point so that no leakage of gas occurs during insertion of first Cannula or while inserting the camera scope. Rest of Ports are inserted in desired position under direct camera vision.

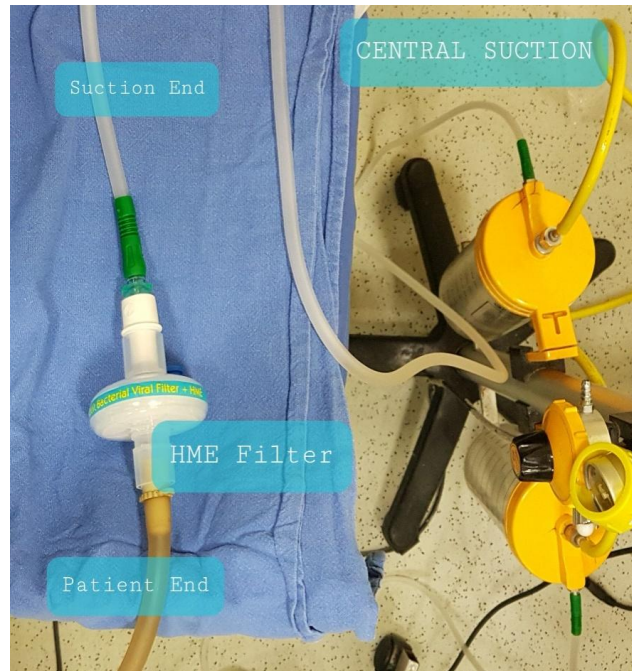
An additional Gas cable is attached to another Cannula with its other end attached to central suction, this acts as a suction tube (Fig. 1). Whenever there is need for removal of gas due to smoke causing obstruction or vision or if required by anaesthetist, this suction port can be used instead of usual practice opening a Cannula which releases the surgical smoke in the operating room.

We also used a standard Inspired™ Heat and Moisture Exchange(HME) Filter on the outlet Gas cable before connecting it to OT suction (Fig. 2)

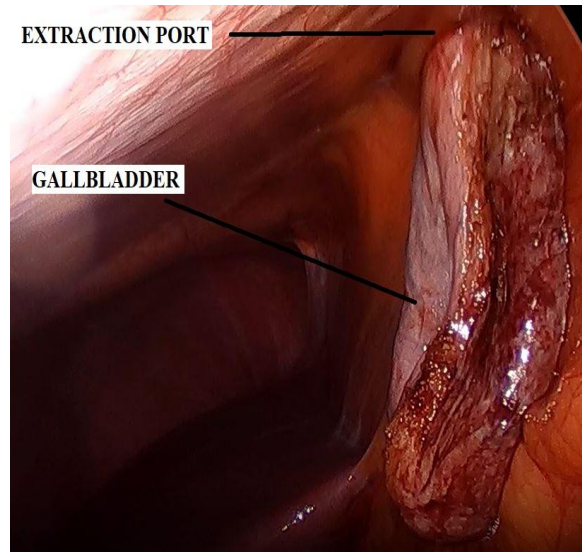
During removal of specimen (e.g. Gallbladder), the specimen should be held with the instrument and placed near the tip of the Cannula from which it is to be extracted (Fig. 3).



**Fig. 1. Cannulas with gas and suction tubes**



**Fig. 2. HME filter between outlet gas cable and OT suction**



**Fig. 3. Gallbladder placed near extraction port before desufflation**

Once specimen has been placed near the Cannula for extraction, Pneumoperitoneum is reduced by opening the suction tube and specimen is removed along the Cannula. The Cannula can be reinserted blindly in the same port without the trocar to reduce the chance of injury. Once the Cannula has been reinserted, Pneumoperitoneum can be created again.

Once surgery is over, Pneumoperitoneum is reduced with the suction Cannula and after that all the Cannulas are removed. The Cables and instruments are sterilised in standard fashion. We have carried out twenty-three laparoscopic procedures with this method and results have been satisfactory without any increased operating time or added difficulty in surgery.

### 3. DISCUSSION

In the current scenario of COVID19 pandemic there are concerns regarding safety of healthcare workers everywhere. Practice of laparoscopic surgery too has not remained untouched by this. Even though it provides benefits over open surgery like minimal spillage of blood and fluids and a closed surgical space, concerns of exposure are there.

There are conflicting reports regarding presence of SARS-CoV-2 virus in peritoneal fluid. One case report did not detect any presence of virus in peritoneal fluid after laparoscopic appendectomy of a COVID19 positive patient [4]. However, in another case of Laparotomy for intestinal obstruction, SARS-CoV-2 was detected in peritoneal fluid with higher concentration than in respiratory tract [5].

Due to these conflicting evidence concern regarding risk of infection via surgically generated aerosol remains. There is evidence of presence of Hepatitis B virus in surgical smoke so the apprehension is not unjustified [2].

There are now some initial recommendations from surgical associations regarding safety measures during laparoscopy. These include using of small incisions for ports and low pressure Pneumoperitoneum to prevent leakage of surgical smoke [6].

They also recommend use of Ultra filtration device and insufflators which have desufflation mode [7]. These devices are costly and not universally available. We describe a method which is simple, effective and can be used if there is central suction system with vacuum filtration which is present in most major surgical setups. At our setup we use Domnick Hunter™ vacuum filtration with central suction.

This requires an additional Gas cable on one working port. As it is a standard cable which is usually attached to one working port for pneumoperitoneum regularly, it doesn't cause any hindrance or excess traction. However, care should be taken that these cables do not cause crowding on operating table and difficulty in surgeon's arm movements during procedure.

In setups without facility of central suction, a standard HME filter or HME filter with additional HEPA filter can be used as demonstrated. These are disposable, cost effective and have up to 99.9% viral filtration rate [8]. These are regularly used in Bain circuit by anaesthetists. Their use

for anaesthesia in COVID19 patients has also been recommended by Royal College of Anaesthetists in their recent consensus guidelines [9].

In our institution all patients who being operated currently undergo RT-PCR (Reverse transcription polymerase chain reaction) test FOR COVID19 before surgery. This is being followed in many institutions, however sensitivity of this test is not 100% and there is risk of false negative report [10]. Therefore, it is advisable to follow all necessary and possible precautions even if test for COVID19 is negative.

We believe with this simple and cost effective modification most Laparoscopic procedures can be carried out in usual manner with minimal risk of aerosol exposure to surgeon and operation theatre staff.

### 4. CONCLUSION

Till the time the risk of contracting COVID 19 via surgical fumes and aerosols generated during laparoscopy is established or disproved, taking all possible precautions is recommended. This technique of closed Pneumoperitoneum circuit does not require any additional equipment and is convenient and simple to use. Proper implementation of this technique along with meticulous care during laparoscopy will minimise the risk.

### DISCLAIMER

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

### CONSENT

It is not applicable

### ETHICAL APPROVAL

All authors hereby declare that the procedure has been examined and approved by the appropriate ethics committee and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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