



Simple Device Design for Plume Management after Pneumoperitoneum in Laparoscopy in COVID-19 Outbreak

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Abstract

The impact of COVID-19 on surgical practice is worldwide. Controversy is there regarding dissemination of coronavirus by surgical smoke during laparoscopic surgery; hence, laparoscopic surgeries are being used with great cautions. We propose the use of a simple device, which can be prepared cheaply with material readily available in our hospitals, to manage the surgical plume generated during laparoscopic procedures. With proper management of the surgical plume with the above-proposed device, the concerns regarding aerosol generation can be alleviated and all the benefits of laparoscopy can be extended to our patient in need of a surgery that cannot be delayed.

Keywords Laparoscopy · Plume · Smoke · Cover-19 · Surgery

Introduction

In the era of coronavirus disease (COVID-19) pandemic, the use of minimally invasive surgery (laparoscopy, robotic-assisted laparoscopy, etc.) is considered controversial. Prime concern is pneumoperitoneum; surgical plume may have coronavirus and release of the same may put operation room personnel at risk of contracting COVID-19. Minimally invasive surgery is key component of a surgeon's armamentarium by virtue of various proven benefits to patients and surgeons and it can be used with few precautions and modifications in current scenario.

pneumoperitoneum. To the best of our knowledge, there are no reports of the presence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the surgical plume generated during laparoscopic surgery as of yet. However, such risks can be extrapolated from previous studies on other viral infections. Literature supports presence of human papillomavirus (HPV), hepatitis B virus (HBV), and human immunodeficiency virus (HIV) in surgical smoke [1–3]. Although there is always a risk of viral transmission through surgical smoke, actual documented cases are rare [4].

Concern

The major concern pertaining specifically to minimally invasive surgery is aerosolization of viral particles via the

Simple resolution

Irrespective of the rarity viral transmission via surgical plume, various measures have been proposed to deal with surgical smoke, i.e., use of smoke evacuation devices, low pneumoperitoneal pressure, minimizing setting of energy device, etc. We propose a simple device in dealing surgical plume to decrease live virus load if any. The picture shows a system in which a tube is connected to a laparoscopic port for controlled release of pneumoperitoneum into two successive sealed jars containing a sterilizing solution like 5.25–6.15% sodium hypochlorite [<https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html>]. Routinely, laparoscopic procedure is performed at intra-abdominal pressure between 8 and 12 mm of Hg [5]; hence, the tube connected for abdominal pressure may be merged in

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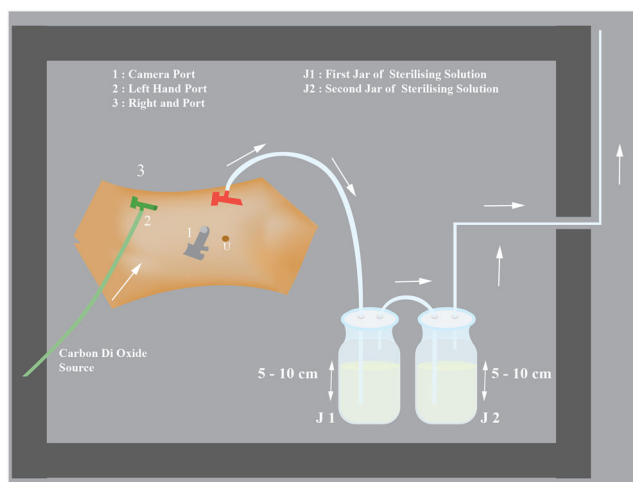


Fig. 1 Diagrammatic demonstration of safe laparoscopic smoke management in COVID 19 outbreak

sterilizing solution up to 8–10 cm of height [<https://www.convertunits.com/from/mmHg/to/cmH2O>]. The jars must be at floor or at quite low level so at any point unwittingly it does not enter into the abdominal cavity. To overcome this issue, tubing with one-way valve can be used. Exit tube from second jar needs to have one-way valve and emerging gas can be collected in a biohazard container for safe disposal. The advantage of this device is that it can be easily assembled from readily available material in a standard hospital setting. In addition to that, it is quite cheap to make and with a proven virucidal activity of solution, it is a safe option. This device provides far superior containment and filtration of surgical smoke as compared with smoke generated during an open procedure. Minimal gas leak during exchange of laparoscopic hand instruments can be managed with sodium hypochlorite-soaked gauze piece at trocar entry. Such a system in conjunction with general measures like tight port placement, keeping insufflation pressures at minimum, surgery in expert hands, and minimal use of energy devices at lowest possible settings, will definitely make laparoscopy safe and patient can avail all the benefits of a minimally invasive procedure [6, 7] (Fig. 1).

Limitations

We tried to propose a simple method of dealing the trail of smoke and pneumoperitoneum-related mixed aerosol on mere theoretical knowledge of authors. This has not applied for animal experimentation and ethical approval for clinical efficacy and, also, it has not been validated by a 3rd party.

Future Scope

Once laparoscopy surgeries resume after COVID19 outbreak and safety of laparoscopy in COVID19 patients considered

safe with proper plume management, scientists may aim to know whether surgical plume has live coronavirus and if such device is effective, though we have not prepared any prototype for the same.

Conclusion

The possible risks for health professionals and the risks from operating on an asymptomatic patient positive for SARS-CoV-2 are still unclear; however, certain measures should be taken to decrease risk. We believe, surgical plume management with abovementioned simple method can alleviate the risk of virus spread to healthcare workers in an operation room if any, safe and reproducible.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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