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Title – How to minimise airborne droplet contamination while performing laparoscopy in the COVID-19 era

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COVID-19  Coronavirus disease 2019

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Introduction

The emergence of COVID-19 pandemic increased the awareness of occupational hazards in healthcare delivery. The operating room environment exposes health care workers to a unique set of biological hazards and risk of transmission. COVID-19 has reinforced the need for availability and appropriate usage of personal protective equipment and developing strategies to reduce the risk of transmissible infection. The presence of aerosolised droplets during open and laparoscopic surgery have been reported, with a presumed increased risk of transmissible infection\textsuperscript{1,2,3,4}. Whilst the exact risk of COVID-19 transmission during surgical procedures has not been quantified, aerosol-generating procedures are known to increase the risk of COVID-19 infection amongst operating room workers\textsuperscript{1}. Several specialty bodies have questioned the use of laparoscopic surgery, due to concern of viral transmission\textsuperscript{5}. The exact transmission risk of COVID-19 during laparoscopic surgery has not been quantified. Risk minimisation strategies are important to help reduce the risk to operating room staff.

The presumed premise of unregulated surgical smoke and positive pneumoperitoneum leading to increased exposure to operating theatre workers. To date, the exact level of COVID-19 transmission in laparoscopic surgery has not been quantified. Despite this the need for appropriate risk-minimisation strategies should be employed.

Over the years, there have been many who have questioned the safety of uncontained surgical smoke. With several studies demonstrating potentially harmful chemicals, including carcinogenic compounds\textsuperscript{2,3}. There are reported, although rare, rates of disease transmission from surgical smoke. This has most widely been reported with Human Papilloma Virus, transmission during anogenital surgery\textsuperscript{4}. The contents of surgical smoke are mostly water vapour with particulate matter containing the carcinogenic and potentially biologically active components\textsuperscript{6}. As the exact transmissibility of COVID-19 through surgical smoke is unknown, it has been urged to treat the smoke with caution\textsuperscript{7}.

A variety of measures are used in operating theatre to reduce the risk of transmission and reduce operating theatre pollution. There are a number of devices available to reduce the release of surgical plumes throughout procedures, including passive and active filter systems. Such measures in laparoscopic surgery include smoke evacuating air filters, closed insufflation circuits and automatic filtered suction systems\textsuperscript{8}. These additional devices although effective, add to the consumable cost of procedures.

Deflation of pneumoperitoneum at the completion of a laparoscopic procedure is an important step, however, also provides an opportunity of increased pollution risk. Uncontrolled deflation of pneumoperitoneum, by removal of access ports or opening of the gas taps, results in rapid release of intra-peritoneal air into the operating room. An appropriate method of containment is recommended to reduce contamination of the operating room.

There have been several methods described for controlling pneumoperitoneal gas pollution. These methods have mostly been developed for intra-operative control of gas and preservation of laparoscopic vision\textsuperscript{5}. The method we describe is simple, safe, inexpensive and effective. It has been designed for the completion of the surgical procedure but can be modified for any stage where pneumoperitoneum would need to be deflated. It can also be used in combination with commercially available filter systems.
Technique

Basic laparoscopic equipment including laparoscope, light source and suction cannula with wall suction is required. Upon completion of laparoscopic procedure or at time pneumoperitoneum deflation the following steps for controlled deflation can be followed.

**Step 1: Insert suction cannula**
The standard laparoscopic suction cannula is inserted via a laparoscopic port.

**Step 2: Withdraw all laparoscopic ports into the abdominal wall layer**
All ports are partially removed such that the port tips are within the layers of the abdominal wall, thereby maintaining the pneumoperitoneum with laparoscope and suction catheter within the peritoneal cavity.

**Step 3: Stop gas insufflation and aspirate pneumoperitoneum under vision then all ports are completely removed, including laparoscope and suction catheter.**
All laparoscopic access port taps are closed, and CO2 insufflation is stopped. Whilst maintaining a view of the peritoneal cavity, the suction cannula is used to evacuate the pneumoperitoneum. Once deflated, the camera, suction catheter and all ports are removed. Routine closure of the fascia and skin is performed, and dressings applied.

Discussion

Laparoscopic surgery offers many benefits to open surgery, including reduced post-operative pain, shorter length of stay and improved recovery. During laparoscopic surgery, the use of electrosurgery, bipolar and advanced surgical dissection devices including ultrasonic dissectors and advanced bipolar devices contributes to the development of a surgical plume. Many laparoscopic procedures routinely use these devices. These devices heat tissue to different temperatures. As such, devices like the Harmonic scalpel do not heat the tissue, thereby creating a cold smoke that may contain more biologically active components and have a higher risk of transmissibility. In laparoscopic surgery, the surgical smoke created from dissection is contained within the abdominal cavity with the use of laparoscopic ports. This smoke obscure intra-operative vision, in addition to the accumulation of surgical plume, which may be released into the operating theatre.

Complete deflation of the abdomen results in reduced intra-abdominal pressure, reduced post-operative shoulder pain and assists fascial and skin closure. On the contrary, uncontrolled deflation of pneumoperitoneum, by removal of access ports or opening of the gas taps, results in rapid release of intra-peritoneal air into the operating room.

The technique can be used in conjunction with a variety of measures are used in operating theatre to reduce the risk of transmission and reduce operating theatre pollution. The method of controlled pneumoperitoneum deflation described, is a simple and safe method to prevent release of surgical and potentially transmissible particulate matter into the operating room environment. The technique, although simple, allows the surgeon to evacuate intra-abdominal gas under vision and protecting visceral and peritoneal structures. The technique utilised common laparoscopic equipment that is routinely used in many centres, thereby reducing the additional cost and financial impact of specialised smoke-regulating systems. In addition, the
technique is versatile and can be adapted for use in other closed cavity, video-assisted surgery.

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