



Carbon dioxide gas leaks during transanal minimally invasive surgery

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Transanal minimally invasive surgery (TAMIS) and transanal total mesorectal excision (TaTME) are mostly performed using a dedicated access device, namely the Gelpoint Path (Applied Medical, Rancho Santa Margarita, CA, USA). The instability or oscillation of the rectal wall due to variance in pneumorectal distension that frustrated early adopters has been addressed by addition of high flow insufflation systems (e.g. Airslea, Conmed, Milford, CT USA) [1] and, more recently, with an insufflation stabilization bag (Applied Medical) [2]. By adding consistency of intrarectal gas volume, these greatly improve precision and fluency in intra- and transrectal surgery.

The fundamental cause of rectal billowing is often considered to be carbon dioxide (CO₂) flow proximally out of the rectum into the colon. CO₂ leakage out of the patient is also possible via the valved access trocars, the Gelseal Cap application or around the access channel. The emergence of coronavirus disease 19 (COVID-19) has focused attention on aerosol risk associated with minimally invasive surgery (MIS), including TaTME [3], especially since pathogen particles have been identified in the stool of infected patients [4].

In this video, we use a sensitive near-infrared optical imaging system specifically attuned to CO₂ detection (FLIR GF 343, FLIR Systems, Ltd, United Kingdom) to dynamically assess for gas effluvium during TAMIS (see video). As seen in the video, CO₂ escapes from the trocar valves with each instrument entry and exit, with the valves becoming increasingly leaky as the procedure continues. Interestingly,

episodic belching of gas via the Gelseal Cap application site occurs intermittently throughout the case, seemingly unrelated to instrument exertion or torque. These leaks occur with or without the associated use of an Airseal device (notably this device itself acts as a chimney for intrarectal gas escape and room air entrainment during suctioning) [5].

Although transmission of COVID-19 via gas aerosolised at MIS has not been proven, we present this video to demonstrate previously undocumented mechanisms of gas escape from the patient into the room during TAMIS procedures. The faces of surgeons are closer to this anorectal gas effluvium at TAMIS and TaTME, than is the case with colonoscopy indicating the importance of wearing appropriate personal protective equipment during, and continuing perhaps after, the current pandemic.

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Compliance with ethical standards

Conflict of interest RC is named on a patent filed in relation to processes for visual determination of tissue biology and receives speaker fees from Stryker Corp, consultant fees from Touch Surgery and Distal Motion and research funding from Intuitive Corp and with IBM.

Ethical approval All procedures were in accordance with the ethical standard of the Institutional Research Committee (Mater Misericordiae University Hospital) and were approved by the hospital in advance including specific consent from the patient participants. Procedures were performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed consent No personal identification is included in the video or manuscript and so the patient has given consent for this recording for teaching/medical research and so fits this requirement.

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