An indigenous in-line metered dose inhaler actuation device

Sir,
Aerosolized bronchodilator therapy is the mainstay of treatment for the management of perioperative bronchospasm in reactive airway disease. Pressurized metered-dose inhalers (pMDIs) are routinely used for this purpose. Even in critical care setting, delivery of bronchodilators and steroids with pMDIs in mechanically ventilated patients has been used increasingly in recent years.\[^1\] The use of pMDIs has several advantages over small volume nebulizers such as cost effectiveness, ease of administration, less time consumption, reliability of dosing, and a lower risk of contamination.\[^2\]

pMDIs were actually never designed for inhalation therapy to mechanically ventilated patients, thus their adaptation for this purpose involved substantial modifications. For pMDIs to be used in ventilator-supported patients, actuation devices that could be connected in closed, pressurized circuits were required.\[^3\] These devices range from simple adaptors with a port, for example, 22 mm male–22 mm female connector with an MDI insert (Intersurgical Ltd, UK) and single nozzle to more complex spacer chambers (Smiths Medical, Portex\(^\text{®}\)).\[^4\]

During a brief period of nonavailability of such commercially available devices in our institution, we decided to create our own indigenous in-line pMDI actuation device. We took a standard 15 mm M/15 mm F elbow connector (which is itself a part of the anesthesia or ventilator circuit) [Figure 1]. We modified it by creating a conical hole (with base of the cone at the surface) in its wall at the angle part, facing the 15 mm F end. This was done using a stainless steel (SS) one inch long, 2.5 mm diameter tapered self-tapping screw [Figure 2]. The elbow adaptor was marked on its convexity diametrically opposite to the 15 mm F end with a No. 11 surgical blade. Then, the “tapered SS screw” was screwed on this mark till its advancing tapered end went through the wall of the elbow connector. The screw was subsequently removed leaving behind a through-n-through conical hole in the wall of the elbow connector [Figure 3].

During aerosol therapy to the patient, this modified elbow connector can be attached between the standard endotracheal tube universal connector and the Y-connector [Figure 4]. The nozzle of the pMDI canister can then be fitted into the conical hole, and the pMDI can be actuated synchronized with inspiration for direct drug delivery to the tracheobronchial tree [Figure 5]. In vitro studies have shown that aerosol drug delivery to the lower respiratory tract ranges from 0.3% to 97.5% with pMDIs.\[^5\] This wide variation in drug delivery can be attributed to various factors such as ventilator mode and settings, heat and humidification of the inspired gas, density of inhaled gas, size of endotracheal tube, and method of connecting pMDI in the ventilator circuit.\[^2\] Thus, a correct technique of administration is essential for successful aerosol therapy using pMDIs. The optimal technique for drug delivery by pMDI in ventilated patients is as follows:\[^1,3\]

1. Assure tidal volume >500 ml (in adults) during assisted ventilation
2. Remove excess secretions
3. Shake pMDI vigorously
4. Place pMDI in adaptor in ventilatory circuit
5. Coordinate pMDI actuation with beginning of inspiration
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6. Allow a breath hold at end inspiration for 3–5 s
7. Allow passive exhalation
8. Wait at least 15 s between actuations; administer total dose.

With the help of our indigenous in-line pMDI actuation device and following the above-mentioned technique of administration, we have been able to manage perioperative bronchospasm successfully as well as deliver aerosol therapy easily and effectively to critically ill patients.

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There are no conflicts of interest.

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Sir,

We read with interest the case report published by Khokhar et al. [1] The entire team did a fantastic job in managing the case successfully and uneventfully. With this communication, we want to take the discussion related to the tricky abnormal placentation cases a little more further.

Bilateral internal iliac artery occlusion is a procedure performed by the interventional radiologist in the cardiac catheterization laboratory (Cath lab). Parturients with abnormal placentation (placenta accreta, increta, percreta, and a few types of placenta previa) are candidates who can benefit with this intervention. Bilateral femoral arteries are punctured under local anesthesia, and balloon-tipped catheters are placed in bilateral internal iliac arteries under minimal fluoroscopic guidance after placing lead shield over the parturient to prevent radiation exposure to the fetus. [2]

The parturient is then anesthetized in the operation theater. The balloons are inflated manually once the umbilical cord is clamped by the obstetrician during lower segment cesarean section. This intervention decreases the uterine blood supply significantly which leads to a reduced blood loss during cesarean hysterectomy, less blood and blood products transfusion, a lesser surgical time, and an overall reduced stay in the Intensive Care Unit and Hospital. In several situations, an obstetric hysterectomy can also be avoided if the placental tissue is removed completely from the uterus. The amount of radiation exposure is minimal. Fetal blood flow is not affected as the balloons are inflated only after clamping the umbilical cord. [3]

The procedure is not devoid of problems. As heparin is not used after catheter insertion due to an urgent surgical intervention, there are chances of thrombus formation. Therefore, the occlusion time has to be minimum. The occlusion does not stop the uterine blood flow completely as there is a rich collateral network which means the intervention is not like a tourniquet which totally stops the blood supply. [3]

Although the radiation exposure is minimal, fetal exposure to radiation might turn out to be excessive in difficult cases as in obese patients, patients with abnormal anatomy and preexisting anasarca. Tan et al. published data of 13 parturients who had a diagnosis of placenta accreta confirmed of ultrasonography, color Doppler, and in indicated cases by a magnetic resonance imaging. They suggested that as the amount of blood loss and transfusion required after a prophylactic internal iliac artery balloon occlusion is significantly less, it should be considered an adjunct in cases of abnormal placentation in the present clinical practice. [4]

We conclude by mentioning that an obstetric hemorrhage team should also have a trained interventional radiologist who can help in such situations by performing minimally invasive balloon occlusion of internal iliac arteries in placenta accreta!

[9]

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