An algorithm for management of intraoperative subcutaneous emphysema during robotic surgery

Sir,

Subcutaneous emphysema (SCE), also called surgical emphysema, is the sudden onset soft tissue swelling arising when gas is forced under pressure into the subcutaneous fascia because of myriad causes (pneumothorax, ruptured bronchus, facial bone fracture, paranasal sinus pathology, playing a wind instrument after dental extraction, vigorous nose-blowing, coughing, or Valsalva maneuver).[1,2] We have encountered different degrees of SCE in more than 30 out of over 3000 patients who underwent robotic surgery (hysterectomies and cystoprostatectomies) at our institution. Despite a high incidence rate (2.3% in laparoscopic vaginal hysterectomies, Murdoch *et al.*),[3] no definite management guidelines exist. The gas used for pneumoperitoneum often dissects into the deeper soft tissues and musculature along the fascial planes. A recent case, where SCE had reached the ipsilateral wrist of the patient starting from the groin (site of surgery), prompted us to develop and present an algorithm [Figure 1] for the management of this condition.

Our patient was a 45-year-old, 60 kg male diagnosed with carcinoma penis. He was posted for partial penectomy and bilateral robotic video endoscopic inguinal lymph node dissection. Half an hour after pneumoperitoneum and docking of the "daVinci Xi" surgical robot, the end-tidal carbon dioxide ($EtCO_2$) started steeply rising. The tidal volume was increased in increments of 50 ml to 10 ml/kg body weight while the respiratory rate was increased to 18 breaths per minute in an attempt to wash away the excess CO_2 by increasing the minute ventilation. Ventilatory settings were in a volume-controlled mode with inspiratory–expiratory ratio of 1:2. The $EtCO_2$ rapidly rose to 67 mmHg. On examination, surgical emphysema was palpable (crepitus) not just over the abdomen, trunk, and neck but also in the axillary region. The pneumoperitoneum pressure was reduced from 15 mmHg to 8 mmHg. When the right radial artery was palpated for obtaining a sample for arterial blood gas analysis, frank crepitus was also observed over the wrist. On applying digital pressure, pitting was observed. The skin could be seen to slowly rise back as it was filled up with gas again. A wide bore needle was used to extract the CO_2 from the infraclavicular region. CO_2 could be seen bubbling through the saline-filled syringe on aspiration. Finally, the surgery was halted and the patient was placed in Trendelenburg position in an attempt to vent out the CO_2 using the Archimedes' principle. The arterial blood gas (ABG) (sampled when $EtCO_2$ was 55 mmHg) showed a partial pressure of CO_2 ($PaCO_2$) of 68 mmHg. The surgery was resumed once the $EtCO_2$ dropped to below 45 mmHg as CO_2 got absorbed from the interstitial tissue. A check laryngoscopy and leak-test were done to make a decision regarding extubation, although crepitus could still be felt in the supramammary area.

Usually, benign and self-limiting, extensive SCE can cause palpable cutaneous tension, abdominal compartment syndrome, dysphagia, dysphonia, palpebral closure, pacemaker dysfunction, airway compromise, and respiratory failure.[4,5] Our algorithm describes four bundles

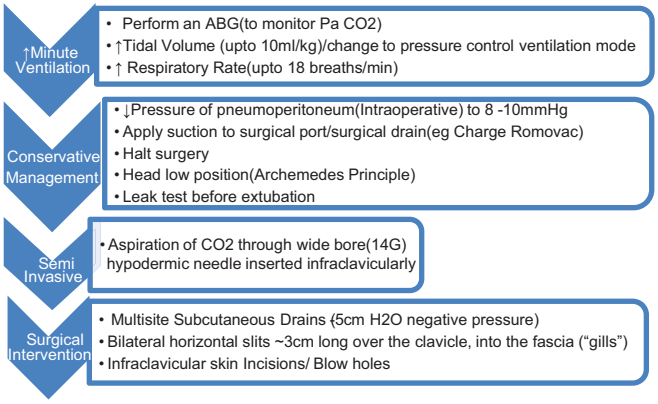

Figure 1: Algorithm for the management of intraoperative subcutaneous emphysema during robotic surgery

comprising both conservative and surgical management techniques, helpful in tackling all degrees and stages of surgical emphysema, which complicate robot-assisted urogynecological surgery.[1,4,5] The first three bundles fall in the anesthesiologists' domain who should be eternally vigilant for SCE during robotic surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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References

1. Ahmed Z, Patel P, Singh S, Sharma RG, Somani P, Gouri AR. High negative pressure subcutaneous suction drain for managing debilitating subcutaneous emphysema. Int J Surg Case Rep 2016; 26:138-41.
2. Aghajanzadeh M, Dehnadi A, Ebrahimi H. Classification and management of subcutaneous emphysema: A 10-year experience. Indian J Surg 2015;77:673-7.
3. Murdock CM, Wolff AJ, Van Geem T. Risk factors for hypercarbia, subcutaneous emphysema, pneumothorax, and pneumomediastinum during laparoscopy. Obstet Gynecol 2000;95:704-9.
4. Theodoros A, Athanasios K. Surgical treatment of subcutaneous emphysema. In which cases? J Surgery Emerg Med 2017;1:8-12.
5. Reed R, D'Alessio F, Yarmus L, Feller-Kopman D. Abdominal compartment syndrome due to subcutaneous emphysema. BMJ Case Rep 2012 2012. pii: bcr1120115089. doi: 10.1136/bcr.11.2011.5089.

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