

CASE REPORT

Open Access



Spontaneous pneumothorax during vaginal hysterectomy in lithotomy with steep Trendelenburg position—a case report

Farah Nasreen^{1*}, Kulsum Sheikh¹, Syed Hasan Amir², Umme Maria¹ and Atif Khalid¹

Abstract

Background Pneumothorax associated with a steep head-down position in vaginal hysterectomy surgery is rare but can cause life-threatening complications.

Case presentation We report a case of a female patient with no obvious lung pathology who suffered intraoperative pneumothorax associated with prolonged steep Trendelenburg position. To the best of our knowledge, this is the first well-documented case of this association. A 53-year-old female, diagnosed as a case of recurrent umbilical hernia with cystocele and rectocele was planned for vaginal hysterectomy with anterior perineorrhaphy and posterior colpoperineorrhaphy along with open mesh repair for umbilical hernia under general anaesthesia. Approximately 90 min after the steep Trendelenburg position, the peak inspiratory pressure increased, while the oxygen saturation decreased. The airway pressures remained continuously on the higher side whole throughout the surgery despite an interrupted propped-up position in between. The patient could not be extubated and shifted to the intensive care unit (ICU) where ultrasonography (USG) of the lung and chest x-ray showed signs of pneumothorax. Intercostal tube drainage (ICTD) was placed, and the patient improved dramatically. It was suspected that a steep head-down position for a prolonged period led to persistently raised airway pressures and the subsequent development of pneumothorax.

Conclusions Pneumothorax can develop in rare circumstances even if airway pressures are under the safety range. So, careful monitoring and immediate treatment are necessary to prevent the condition from worsening and anaesthesiologists must be aware of such potential danger.

Keywords Peak airway pressure, Trendelenburg position, Pneumothorax

Background

Intraoperative pneumothorax is rare but can be a potentially fatal complication. Pneumothorax in intubated patients with normal lungs is uncommon. Steep Trendelenburg position has been shown to affect respiratory parameters significantly (Takahata et al. 2007). However,

a direct correlation between the development of intraoperative pneumothorax and prolonged steep Trendelenburg position has not been established in the literature to the best of our knowledge. We detected this correlation intraoperatively in a patient with no diagnosed underlying lung pathology under general anaesthesia. We emphasise on keeping a high index of suspicion for the development of pneumothorax in prolonged surgeries in steep Trendelenburg positions even in the absence of other significant risk factors.

*Correspondence:

Farah Nasreen
kazmifarah@gmail.com

¹ Department of Anaesthesiology, Jawaharlal Nehru Medical College, A.M.U, Aligarh, UP, India

² Department of Medicine, Jawaharlal Nehru Medical College, A.M.U, Aligarh, UP, India



Case presentation

A 53-year-old female, 156 cm, 54 kg, diagnosed as a case of recurrent umbilical hernia with cystocele and rectocele was planned for vaginal hysterectomy along with open mesh repair for umbilical hernia.

In preanaesthetic evaluation, there were no comorbidities and the patient had a normal physical examination. Routine laboratory investigations were within normal limits. However, a chest x-ray showed a few fibrotic patches in the right mid and left upper lung fields for which no active intervention was required. In the operation theatre (OT), standard monitors were attached, general anaesthesia was given as per standard institutional protocol, and endotracheal intubation was done with an endotracheal tube (ETT) size 7. No attempt at central venous access was taken at any stage. The gynaecologist then proceeded with vaginal hysterectomy surgery with the patient in lithotomy with a steep Trendelenburg position. Approximately 90 min after the surgery started, the Ppeak increased to 36 cmH₂O with a decrease in SpO₂ to 94%. The rest of the parameters were within normal limits. Upon auscultation, the breath sound of the right lung decreased significantly. Endotracheal suction was done to rule out any secretions and ETT was withdrawn back by up to 2 cm with auscultation. However, the breath sound of the right lung was still decreased. FiO₂ was increased to 70% and spo₂ gradually improved to 100%. Surgery was interrupted and the patient was brought to a propped-up position for about 15 min. There was 1 episode of drop in BP up to 82/56 mmHg. The surgery was continued again with peak airway pressures of around 32–34 cmH₂O whole throughout. The total duration of surgery was about 5 h 30 min.

During extubation, the patient developed laboured breathing, decreased air entry to bilateral lung (right > left), and Ppeak was 38 cm H₂O. ABG was sent at this point and the results indicated a pH, PaCO₂, and PaO₂ of 7.09, 72 mmHg, and of 103 mmHg, respectively. Suspicion of pneumothorax was there but it could not be confirmed using ultrasound (USG) as the USG machine of operation theatre complex was non-functional. The patient was not extubated and shifted to ICU. USG was done in ICU which revealed absent lung sliding and the presence of a barcode sign on the right side. Chest x-ray (chest AP view) was performed immediately which confirmed the presence of pneumothorax in the right lung (Fig. 1).

Intercostal Tube drainage (ICTD) was inserted, and a gush of air came out stat. After ICTD insertion, the Ppeak was decreased to 24 cmH₂O and the breath sound of the right lung showed a favourable change. The ETCO₂ was 38 mmHg, and spo₂ was 99% and the ABG findings after an hour improved.



Fig. 1 Chest x-ray AP view shows pneumothorax (arrows) in the right lung



Fig. 2 Chest x-ray AP view shows the improved pneumothorax in the right lung

Chest x-ray was repeated after 6 h which showed satisfactory lung expansion and air entry was bilateral equal (Fig. 2).

The patient was extubated the next morning with ICTD in situ and was maintaining satisfactory oxygen saturation on room air. The patient was discharged to gynae HDU on postoperative day 3.

ICTD was removed on postoperative day 5 and the patient was discharged under satisfactory condition on day 8.

Discussion

Pneumothorax is a rare but potentially dangerous complication, especially during general anaesthesia. The presence of nonspecific changes in haemodynamic and respiratory parameters makes diagnosis quite challenging during the intraoperative period. Moreover, there are high chances of small pneumothorax developing into tension pneumothorax under positive pressure ventilation. Surgical manipulation of areas close to the parietal pleura, including intrathoracic surgeries, as well as central venous line placement are some of the known risk factors for intraoperative pneumothorax (Bacon et al. 2005). In addition, pneumoperitoneum during laparoscopy is a significant risk factor for the development of pneumothorax with a reported incidence of 0.01–0.4% (Phillips and Falk 2011). Rarely, a difficult airway can be a culprit. Masking of signs under general anaesthesia makes recognition difficult and some cases are only identified postoperatively (Chen et al. 2005).

Pneumothorax is frequently related to some underlying lung pathology like chronic obstructive pulmonary disease (COPD) and asthma. To overcome severe bronchial obstruction high airway pressures are required. Correlations between high peak airway pressure and the development of pneumothorax have also been found (Woodring 1985).

Published reports reveal that prolonged steep Trendelenburg positioning increases the risk of postoperative morbidity in patients undergoing robotic surgery for gynaecologic malignancy and urologic procedures (Maerz et al. 2017). Peak and mean inspiratory pressures are increased by pneumoperitoneum and exacerbated after Trendelenburg positioning (Souki et al. 2018). Peak airway pressure (PAP) is generally recognised as the most important risk factor for barotrauma. Although authors dispute the exact level of the safe upper limit, the higher it is, the more likely it is that barotrauma will occur. There is no unique PAP that assures the lack of barotrauma risk. However, it is reasonable to concentrate our efforts on reducing PAP as much as possible (Haake et al. 1987).

In the present case, there was a delay in the diagnosis of pneumothorax intraoperatively as there were no inciting factors for pneumothorax, though there was a presence of nonspecific changes in patient haemodynamic

and respiratory parameters. A retrospective analysis of the case made us think that there could be a possibility of some underlying lung pathology or an anatomical defect that might have got unnoticed, superimposed by prolonged steep Trendelenburg position causing raised airway pressures, all of that jeopardising the pulmonary compliance and could have been the reason for alveolar rupture and development of pneumothorax towards the end of the surgery. This case is rare in the sense that to the best of our knowledge, there is no study which shows the incidence of pneumothorax at pressures less than 40 cmH₂O (Haake et al. 1987) and in our patient at no point of time the airway pressures went beyond 36 cmH₂O. Moreover, in the majority of studies, there was either pneumoperitoneum or some kind of instrumentation that led to pneumothorax which was not in our case.

Ethical statement

Written informed consent was obtained from the patient for publication of this case report.

Conclusions

Anaesthesiologists should always be aware of the risk of intraoperative respiratory complications in the steep Trendelenburg position. Thorough preoperative evaluation to rule out lung pathology and a high index of suspicion should be kept in mind for the possibility of pneumothorax in prolonged surgeries in steep Trendelenburg position.

Abbreviations

ICU	Intensive care unit
USG	Ultrasonography
ICTD	Intercostal tube drainage
OT	Operation theatre
ETT	Endotracheal tube
Ppeak	Peak pressure
SpO ₂	Oxygen saturation
Fio ₂	Fraction of inspired oxygen
ETCO ₂	End-tidal carbon dioxide
AP view	Anteroposterior view
ABG	Arterial blood gas
HDU	Highly dependent unit
COPD	Chronic obstructive pulmonary disease
PAP	Peak airway pressure

Acknowledgements

None

Authors' contributions

(I) Conception and design: FN. (II) Administrative support: KS. (III) Provision of study materials or patients: SHA. (IV) Collection and assembly of data: UM. (V) Data analysis and interpretation: AK. (VI) Manuscript writing: all authors. (VII) Final approval of manuscript: all authors. All authors have read and approved the manuscript.

Funding

Nil

Availability of data and materials

NA

Declarations**Ethics approval and consent to participate**

NA

Consent for publication

Written informed consent was obtained from the patient for publication of this case report.

Competing interests

The authors declare that they have no competing interests.

Received: 29 September 2022 Accepted: 16 June 2023

Published online: 04 July 2023

References

- Bacon AK, Paix AD, Williamson JA, Webb RK, Chapman MJ (2005) Crisis management during anaesthesia: recovering from a crisis. *Qual Saf Health Care* 14(3):e25
- Chen YL, Chen CY, Cheng JK (2005) Delayed tension pneumothorax during surgery. *J Chin Med Assoc* 68(10):491–494
- Haake R, Schlichtig R, Ullstad DR, Henschen RR (1987) Barotrauma. Pathophysiology, risk factors, and prevention. *Chest* 91:608–613
- Maerz DA, Beck LN, Sim AJ, Gainsburg DM (2017) Complications of robotic-assisted laparoscopic surgery distant from the surgical site. *Br J Anaesth* 118(4):492–503
- Phillips S, Falk GL (2011) Surgical tension pneumothorax during laparoscopic repair of massive hiatus hernia: a different situation requiring different management. *Anaesth Intensive Care* 39(6):1120–1123
- Souki FG, Rodriguez-Blanco YF, Polu SR, Eber S, Candiotti KA (2018) Survey of anesthesiologists' practices related to steep Trendelenburg positioning in the USA. *BMC Anesthesiol* 18(1):117
- Takahata O, Kunisawa T, Nagashima M, Mamiya K, Sakurai K, Fujita S et al (2007) Effect of age on pulmonary gas exchange during laparoscopy in the Trendelenburg lithotomy position. *Acta Anaesthesiol Scand* 51:687–692
- Woodring JH (1985) Pulmonary interstitial emphysema in the adult respiratory distress syndrome. *Crit Care Med* 13:786–879

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Submit your manuscript to a SpringerOpen[®] journal and benefit from:

- ▶ Convenient online submission
- ▶ Rigorous peer review
- ▶ Open access: articles freely available online
- ▶ High visibility within the field
- ▶ Retaining the copyright to your article

Submit your next manuscript at ▶ [springeropen.com](https://www.springeropen.com)
