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CLINICAL INFORMATION

Use of bronchial blocker in emergent thoracotomy in presence of upper airway hemorrhage, and cervical spine fracture: a difficult decision



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KEYWORDS

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Abstract Female, 85 y.o., weighting 60 kg, multiple trauma patient. After an initial laparotomy, an emergent thoracotomy was performed using a bronchial blocker for lung isolation (initial active suction was applied). During surgery, bronchial cuff was deflated, causing a self-limited tracheal blood flooding. A second lung isolation was attempted but it was not as effective as initially. Probably, a lung collapse with the same bronchial blocker was impaired in the second attempt because of the obstruction of bronchial blocker lumen by intraoperative endobronchial hemorrhage. Bronchial blocker active suction may contribute to obtain or accelerate lung collapse, particularly in patients that do not tolerate ventilator disconnection technique or lung surgical compression. The use of bronchial blockers technology was a valuable alternative to double lumen tubes in this case of emergent thoracotomy in the context of a patient having thoracic, abdominal trauma, severe laceration of tongue and apophysis odontoid fracture associated to massive hemorrhage, despite several pitfalls that could compromise its use. The authors intend to discuss the advantages and disadvantages of bronchial blockers comparing to double-lumen tubes for lung isolation, and the risks of our approach, in this complex multitrauma case.

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PALAVRAS-CHAVE

Bloqueadores
brônquicos;
Tubos de duplo
lúmen;
Toracotomia;
Fratura cervical

Uso de bloqueador brônquico em toracotomia de emergência na presença de hemorragia das vias aéreas superiores e fratura cervical: uma decisão difícil

Resumo Paciente do sexo feminino, 85 anos, 60kg, com trauma múltiplo. Após uma laparotomia inicial, uma toracotomia de emergência foi feita com um bloqueador brônquico para isolamento pulmonar (sucção inicial ativa foi aplicada). Durante a cirurgia,

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o balonete brônquico foi desinflado, causou um derrame hemorrágico traqueal autolimitado. Reisolamento foi tentado, mas não foi tão eficaz como inicialmente. Provavelmente, o colapso do pulmão com o mesmo bloqueador brônquico foi prejudicado na segunda tentativa devido à obstrução do lúmen do bloqueador brônquico pela hemorragia endobrônquica intraoperatória. A sucção ativa do bloqueador brônquico pode contribuir para obter ou acelerar o colapso pulmonar, particularmente em pacientes que não toleram a técnica de desconexão do ventilador ou a compressão cirúrgica pulmonar. O uso da tecnologia de bloqueadores brônquicos foi uma opção valiosa para os tubos de duplo lúmen neste caso de toracotomia de emergência em paciente com trauma torácico e abdominal, laceração grave da língua e fratura da apófise odontoide associados a hemorragia maciça, apesar de vários riscos que poderiam comprometer seu uso. Os autores pretendem discutir as vantagens e desvantagens dos bloqueadores brônquicos em comparação com os tubos de duplo lúmen para isolamento pulmonar e quais foram os riscos de nossa abordagem neste complexo caso de múltiplo trauma.

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Introduction

Emergency thoracotomy in a patient presenting cervical spine fracture and upper airway hemorrhage is an anesthetic challenge. Bronchial blockers (BB) should be an alternative to double lumen tubes (DLT) in some of these patients.^{1,2}

Case report

A female, aged 85 years old, weighting 60 kg and having controlled hypertension as comorbidity, suffered a road accident. She presented a severe laceration of tongue (associated to abundant bleeding), odontoid apophysis fracture, blunt chest trauma with hemothorax, hemoperitoneum, liver injury, perforated hollow gut, infrarenal aortic dissection without compromising lower limb perfusion, hypovolemic shock and coagulopathy.

Submitted to general anesthesia to approach abdominal trauma, and to drain a hemothorax. It was observed significant diffuse hematic loss during laparotomy. At induction of anesthesia: etomidate 10 mg, fentanyl 0.1 mg and rocuronium 70 mg were given (rapid sequential induction). Tracheal intubation was done after a modified Comarch-Lehane grade 2B laryngoscopy was obtained to avoid cervical extension, using a Macintosh blade no. 3, through a conductive stylet. Fiberscopy and a portable videolaryngoscopy were tried for intubation but they were not effective because of the bloody airway and sudden desaturation. Anesthesia was maintained by a midazolam infusion 10 mg.h⁻¹ and fentanyl 0.1 mg every hour.

Massive transfusion protocol was early activated (8 red cells packs, 6 fresh frozen plasma packs, 1 pool of platelets, 15 g of aminocaproic acid and 2 g of fibrinogen concentrate was administered in OR without point of care monitoring, during the course of the case).

During laparotomy pulmonary compliance worsened (FiO₂ 100%, pressure control ventilation: IPAP 40 mmHg, PEEP 4 mmHg, respiratory rate 18 cycle.min⁻¹; minimum tidal vol-

ume 200 mL, PaCO₂ 72 mmHg, PaO₂ 55 mmHg, SpO₂ 88%), accompanied by respiratory acidosis (minimum pH 7.0; normal serum lactate values) and there was need for emergent drainage of hemothorax. After hemothorax drainage, the compliance ameliorated significantly. A compression packing was introduced in mouth to control tongue hemorrhage and patient was transferred to the ICU, mechanically ventilated, under norepinephrine (16 µg.kg⁻¹.h⁻¹) support.

During initial 30 min in ICU chest tube drained about 2000 mL. Patient returned to OR to be submitted to right-side thoracotomy. Keeping the cervical collar in place, after exchange endotracheal tube (ETT) 7.0–8.0 mm through an exchanger stylet, pulmonary exclusion was performed with a BB (EZ-Blocker[®], 7F) under fiberoptic bronchoscopy (FOB) taking 10 min since BB insertion to thoracotomy incision in lateral decubitus (lung collapse required an initial active suction of –50 mmHg because patient did not tolerate ventilator disconnection technique).

Anesthesia was delivered by midazolam 10 mg.h⁻¹ and fentanyl 0.1 mg every hour. Rocuronium was given 30 mg.h⁻¹, after a bolus of 50 mg.

Patient was ventilated in pressure control mode, under permissive hypercarbia to achieve pH > 7.2 (FiO₂ 80%, pressure control ventilation: IPAP 35 mmHg, PEEP 4 mmHg, respiratory rate 18 cycles.min⁻¹; minimum tidal volume 250 mL, SpO₂ was around 92%, PaO₂ between 55 and 60 mmHg and PaCO₂ between 55 and 65 mmHg). For about 3 h it was performed a partial right lower lobectomy and hemostasis of pericardium, right lung and chest wall. No significant rise of serum lactate level was observed.

After 2 and a half hour from the beginning of surgery, bronchial cuff was deflated to permit bilateral ventilation of the lung. In this moment, ventilation became difficult with sudden worsening of lung compliance and absence capnography was noted.

A significant but self-limited tracheal hematic aspiration was done permitting ventilation. Lung collapse was attempted but it was not as effective as initially probably because of the obstruction of BB lumen by endobronchial

blood after surgery have started in a patient that did not tolerate ventilator disconnection technique (bronchial cuff repositioning was confirmed again by fiberoscopy). As surgical hemostasis was almost completed and bronco-pleural fistula was not present, a collegial decision was made to continue bilateral ventilation until the end of surgery.

After returning to the supine position, the lung compliance and respiratory acidosis improved (pH 7.34). At the end of surgery patient was ventilated in pressure control mode in supine position (FiO₂ 60%, IPAP: 25 mmHg, PEEP 4 mmHg, respiratory rate 14 cycles.min⁻¹; minimum tidal volume 350 mL, SpO₂ was around 95%, PaO₂ 70 mmHg and PaCO₂ 44 mmHg). No significant rise of serum lactate level was observed. The patient was transferred again to ICU, with no further significant coagulopathy or decrease in hemoglobin level, remaining without respiratory acidosis and presenting adequate lung compliance. In ICU patient developed nonhypovolemic refractory shock and marked metabolic acidosis and died 2 days after initial intervention.

Discussion

This case is a complex lung isolation case in a multiple trauma patient, which makes difficult the decision about the best option for lung exclusion.

J. B. Brodsky,³ in 2009, summarized the advantages and disadvantages of BB comparing to double-lumen tubes (DLT) in the context of difficult airway.

The advantages of DLT are: easier and faster to position, which may be done without bronchoscopy; more rapid lung collapse; less likely to be displaced; allows either lung to be ventilated, collapsed, and re-expanded; each lung can be suctioned and inspected with a bronchoscope; continuous positive airway pressure is easily applied to operated lung; enables split (independent) lung ventilation in ICU.

On the other hand, the advantages of BB are: can be used when a tracheal tube is already in place and is not necessary to change endotracheal tube or Univent[®] tube if postoperative ventilation required, allows selective lobar blockade, and it is easier to use in smaller airways.

The decision will be even more complicated in the context of difficult airway originated by uncontrolled tongue hemorrhage, cervical spine fracture, associated blunt chest trauma and probable endobronchial hemorrhage.

In this case the advantages of BB are: placing a DLT is an aggressive maneuver particularly in difficult airway, may require aggressive cervical extension^{2,3} and is more difficult to introduce through an exchanger-tube stylet in the presence of a cervical collar or neck immobilization than a regular ETT.³

The patient would be exposed to a higher risk aspiration of blood from upper airway or gastric content during the exchange to a DLT than to a single-lumen tube, particularly in the context of complex difficult airway.

In theory, modern video laryngoscopes may facilitate placement of DLT in trauma transmitting less force to the C-spine, but glottis visualization will be limited if hemorrhage is present and concomitant blood suction is necessary.

BBs are associated to a lower incidence of airway injury and a lower severity of injury than DLT.⁴ In every repositioning may be necessary some degree of cervical mobilization

and deflation of tracheal cuff can facilitate new entry of blood in trachea from upper airway.

Aspiration may be reduced using BB, because airway was protected sooner and definitely after a single-lumen intubation.

In the context of coagulopathy and thoracic trauma, endobronchial bleeding may be provoked by surgical manipulation in patients that do not have an initial endobronchial hemorrhage. Differently from a DLT, BB may avoid tracheal flooding of blood from bronchus, and eventually contribute to hemostasis or endobronchial bleeding tamponation.¹

In this case disadvantages of BB are: BB placement can take longer than a DLT double lumen tube^{3,4} particularly in less experienced hands, which is relevant in patients suffering from hemorrhagic shock, and, moreover, fiberoptic guidance could be complicated because of the bloody airway.

BB intraoperative mal-positioning may occur more frequently than using DLT³ and FOB for repositioning can be difficult if endobronchial bleeding occurs, particularly in lateral decubitus.²

BB it does not allow removal of secretions or blood from the injured lung prior to deflation.

BB does not permit application of continuous positive airway pressure (CPAP) or high frequency jet-ventilation in the nonventilated lung to improve oxygenation or/and ventilation, but in this case the efficacy of these approaches using DLT could be impaired by endobronchial bleeding. These techniques affect isolation which may complicate surgical exposure and should be used with caution because they may affect hypoxic pulmonary vasoconstriction.

In this case, after deflation of the bronchial cuff it was observed a significant entry of blood into the trachea compromising bilateral ventilation, which obligated to life-saving blood suction, and, at that moment, we cannot ignore that a potential airway loss could have occurred.

An initial active suction may have a role to obtain or accelerate lung collapse⁵ mainly in patients that do not tolerate disconnection technique or surgical lung compression before isolation, but the effectiveness of lung collapse with the same bronchial blocker was impaired in the second attempt probably due to the obstruction of BB lumen by intraoperative endobronchial blood.

Another important issue about this case is that hypoxic pulmonary vasoconstriction reduces shunting of blood to the affected lung, improving the ventilation to perfusion ratio, which may reduce hemorrhage. Avoidance of volatile anesthesia is essential because halogenated anesthetics may inhibit hypoxic pulmonary vasoconstriction, compromising possible advantages of applying CPAP or jet ventilation of the affected lung if DLTs are used.

Conclusion

The use of bronchial blockers technology associated to initial active suction was a valuable alternative in this case of emergent thoracotomy, despite several disadvantages and risks.

Conflicts of interest

The authors declare no conflicts of interest.

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