

Case Report

A witnessed intra-operative blood transfusion-related air embolism under epidural anaesthesia for vesicovaginal fistula repair

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Abstract

The transfusion is a normal life-saving procedure conducted commonly by the nurses at the prescription of the attending physician or the emergency physicians. It is generally a safe procedure if guidelines for processing and administering are carefully followed. Blood transfusion is an independent risk factor for morbidity and mortality and major complications arising from transfusion are generally rare.

We present a case of a mild case of iatrogenic air embolism exacerbated by pressure infusion for a patient who had undergone an exploratory laparotomy for an iatrogenic fistula repair under epidural anesthesia.

Introduction

Blood transfusion is a lifesaving procedure commonly done for acute blood loss especially intra-operative for the patient to support oxygen-carrying capacity and maintain the hemodynamic state [1]. It is commonly guided by planning perioperatively based on the likelihood to transfuse using the allowable blood loss of the patient or loosely calculated as 20% of total blood volume [2]. The likelihood of having a clinically significant embolism is dependent on the rate, volume, route (arterial or venous), and the physiological reserves of the subject to compensate for the complication [3]. Being a relatively simple procedure, it could be associated with acute and delayed complications and major complications are rare [1]. The complication of blood transfusion has been grouped into early complications: Hemolytic reactions (immediate and delayed), Non-hemolytic febrile reactions, Allergic reactions to proteins, IgA, Transfusion-related acute lung injury, Reactions secondary to bacterial contamination, Circulatory overload, Air embolism, Thrombophlebitis, Hyperkalemia, Citrate toxicity, Hypothermia and Clotting abnormalities (after massive transfusions) and the Late complications are: Transmission of infection Viral (hepatitis

A, B, C, HIV, CMV), Bacterial (Salmonella), Parasites (malaria, toxoplasma), Graft-vs-host disease, Iron overload (after chronic transfusions), Immune sensitization (Rhesus D antigen) [4]. Transfusion-related air embolism is an unusual complication of blood transfusion intraoperative [5]. The mechanism behind the development of this complication is a result of suspected air in the blood bag under pressure. We present a case transfusion-related acute air embolism secondary to suspected air in the blood bag under pressure while using a pressure infuser intraoperative for a patient who had undergone a Vesicovaginal fistula repair under epidural anesthesia.

Case report

A 46-year-old female patient, Para 3 all alive, presented for exploratory laparotomy for the repair of iatrogenic vesicovaginal fistula of 3 weeks post total abdominal hysterectomy. The patient had a medical history of suspected deep vein thrombosis post the last total abdominal hysterectomy that was managed as per symptoms and her gynecologist recommended the repair under epidural anesthesia. A history of allergy to pollen grain and asthma being managed with an inhaler. The patient was counseled

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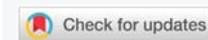
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for postoperative epidural analgesia for postoperative pain control as an alternative mode of analgesia to preclude the likelihood of precipitating an asthmatic attack, deep vein thrombosis, and early mobilization out of bed. Medication history included vitamin supplements along with capsules of omeprazole for peptic pain.

The epidural anesthesia was established as planned; intravenous access with a size 18G canula was secured a day before surgery in the left cubital fossa. The patient was informed and put in sitting on the operating table after taking baseline vitals using a multiparameter monitor with capacity for SPO₂, ECG, Invasive and Non-invasive blood pressure, EtCO₂ and temperature. The baseline vitals are as follows: SPO₂ - 97%, ECG-Normal Sinus rhythm, Heart rate-102beats/min, Non-invasive blood pressure - 157 / 93 mmHg, Respiration-26breath/min, and temperature-36.0 °C. Chlorhexidine solution was used and followed by 70% alcohol for sterilization of the epidural site. The patient was draped and prepped, and an 18 G × 10 cm Tuohy needle facing upwards was used for accessing the epidural space by loss of resistance to air after infiltrating the interspace T12 - L1 with 2 mls of 2% lidocaine with adrenaline. The loss of air resistance was at 4.5 cm and the epidural catheter was passed cephalad at 4cm in the epidural space from point of entry. The patient had 2 mls of 2% lidocaine with adrenaline epidurally without effect after negative aspiration to cerebrospinal fluid and blood. The epidural was activated with 20 mls of 2% lidocaine (200 mg) with adrenaline in a 1:1 dilution with 0.5% plain bupivacaine (50 mg) and 100 ug of fentanyl administered. It was tolerated by the patient with stable vital signs, 5 mg midazolam was administered this was followed by 10 mg diazepam for mild sedation. The epidural was observed to have a loss of sensation up to T6 and an elastomeric pump was attached with 0.125% plain bupivacaine with 2 ug/ml fentanyl at 6 ml/hour.

The patient had significant blood loss totaling about 2.5 l with a preoperative pack cell volume of 32% and hemoglobin concentration of 11%. The hemodynamic was maintained with continuous intravenous ringer lactate, normal saline, and blood to keep pace with the blood loss. A total of 5 l of crystalloid was administered over the 8.5 hour surgery and 2 pints each of whole blood and packed cells.

During the transfusion of the third pint of blood intra-operative pressure infuser was used and at the end of the transfusion of the index blood, the patient shouted that a hissing sound of air getting into her intravenous access. Fortunately, the anesthetist was on-site and promptly diffuse the pressure of the pressure infuser, there was observed air in the entire tubing of the blood transfusion set down to the canula. The blood-giving set was removed and an attempt to milk out air from the upper part of the arm above the level of the canula without any obvious success. The patient experienced some difficulty in breathing without a fall in oxygen, despite that the oxygen administered being administered was increased from 2 l/min to 4 l/min via a

nasal prong, and 100mg intravenous hydrocortisone administered. The patient also had some 3 puffs of her salbutamol on the table, the position of the patient on the operating table was not altered from the spine position, Durant maneuver and Trendelenburg position would have displaced the abdominal content and that would have exposed the surgical site to the risk of aspirating air being above the level of the heart. The vitals of the patient was stable and no drop in saturation. SPO₂ - 99%, ECG-Normal Sinus rhythm, Heart rate-115beats/min, Non-invasive blood pressure - 137/79 mmHg, Respiration-23breath/min and temperature-36.3 °C. The immediate vital signs at the end of surgery qualified for the Aldrete Criteria [6] for discharge to the ward from theatre according to ERAS [7]. Six-hour post-surgery it was observed the line is not flowing hence was substituted with a right subclavian central venous line for intravenous fluid, drugs, and possible blood transfusion. On the third postoperative day, the epidural catheter was removed and had uneventful analgesia. The Anaesthesia and Obstetric team followed up on the patient progress and tolerated feeds and medication about three weeks later when the central line was removed.

We inferred that the patient developed a small volume air embolism intra-operatively. A combination of air in the blood bag and under pressure from the pressure infuser led to this avoidable complication.

Discussion

These complications arising from blood transfusion have been on the downward side with improved investigation and precautions taken to mitigate some of the factors presented earlier. The theatre environment has its challenges, especially in a stressful atmosphere. The goal of treatment is to halt air entry and reduce the volume of air-entrained, and hemodynamic support.

In this study, it was suspected to be due to an inadvertent blood administration with air in the blood bag under pressure. It would have been of no effect if the blood was not under the pressure of the pressure infuser because the air would not have drained down the blood-transfusion set tube in less than a second of exhausting the blood in the blood bag. The use of electronically controlled infusion with the capacity to pick air in line of blood giving set would have been the gold standard for detecting air transfusion/infusion-related air embolism, but this equipment is not readily available, expensive, and time-consuming to establish and maintain.

Furthermore, factors that contribute to the development of air embolism is the exposure of the blood bag content to the atmosphere when the blood bag is vented, it is also a big problem especially when the venous entry of the cannula or catheter is far above the level of the heart this makes the veins lumen to develop negative pressure relative to the atmosphere and hence, suck in the air around it rather than self-stopping transfusion if the bag was intact/not vented [8]. This is also the pathogenesis of air embolism from surgical



sites that are elevated above the level of the heart or supine levels like in prone and sitting position neurosurgery or the like [9].

In addition, the use of firm bottles had also been implicated because it is very difficult to evacuate the air in a firm plastic or glass bottle, although not the case but could have been a culprit had it being it has not been outlawed for blood collection and administration. We still have this problem with the intravenous fluid and drugs being supplied for clinical use, especially in our setting since it is not in the collapsible bag it cannot be devoid of air in it, even to infuse its content the bottle must be vented to the atmosphere, apart from atmospheric impurities, the risk of embolism is eminent.

Moreover, the use of blood transfusion set tube blood warmers has also been implicated in the development of air embolism because heating the stored blood will make dissolved gasses come out of the solution and form bubbles in the giving set before transfusion [10], this could be averted if the blood was warmed in the blood bag and any air trapped is vented out before connecting the blood transfusion set for the transfusion.

The blood filter chamber should completely be filled with fluid devoid of air bubbles throughout the entire blood transfusion set tube up to the connecting hub of the cannula, note only the visualization chamber should be free of fluid to allow determination of transfusion rate. The non-filling of the filter chamber will predispose to the development of air emboli especially when it has blood clots occupying the blood filter chamber and displacing air to flow through the transfusion set tube. The habit of using the blood to prime the transfusion set will displace air into the blood bag and can be a source of air capable of being embolized.

The use of a central line is a well-known source of air embolism, especially when the connecting hub is more than 5cm above the heart or close to the chest as in the subclavian and jugular venous central line where respiration can give a suction effect when the lines are not clipped during removal/attachment of syringes, transfusion and fluid administration set. It is also possible if a defect exists on the catheter [11].

The removal of the central line can be a source of a tunnel that can lead to the entrainment of air into the vessel created by the removed catheter which can be a source of air embolism and can be fatal [12].

Lastly, as the first standard of anesthesia care/monitoring is the continuous uninterrupted presence of an anesthetist, we will advocate for all caregivers administering blood/blood product/fluid to always be available and the vigilance to forestall any deviating from the normal. The effect of the suspected air embolism lasted about five minutes and by the eleventh minute, the patient had stabilized without any feeling of uneasiness or complication.

Conclusion

The transfusion of blood using pressure infusion is safe but care should be taken to avoid warming up the blood in line, avoid venting air into the blood bag if present inadvertently it should be evacuated before establishing transfusion. The dropping chamber containing the filter should be full just above the filter to limit air in the blood-giving set. It is a rare case of witnessed air embolism by the patient and anesthetist. A combination of air in the blood bag/blood giving set under pressure influenced the development of this complication.

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