Case Report

Air embolism through open hub of external jugular vein intravenous cannula

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ABSTRACT

Introduction: Venous air embolism is a catastrophic complication that can result in sudden cardiac arrest and death. Massive air embolism has been reported with central venous catheter through the internal jugular and subclavian veins. Though external jugular vein is a potential site of an air embolism to cardiac chambers and subsequently to vital organs such as brain, heart and lungs but has not been reported yet in literature.

Case presentation: We are reporting a case of sudden pulmonary air embolism in a patient through the open hub of an intravenous cannula, vigilant monitoring and timely action saved the patient from a catastrophic outcome.

Conclusion: We recommend vigilant monitoring and adequate precaution in patients with external jugular venous cannulation in the operation theater, intensive care unit or wards to prevent iatrogenic complications.

1. Introduction

External jugular venous (EJV) cannulation is being increasingly used in emergencies patients for fluid and inotrope administration. Air embolism is a catastrophic complication that can result in sudden cardiac arrest and death. Massive air embolism has been reported with central venous cannulation through the internal jugular and subclavian veins. Although the external jugular vein is a potential site of an air embolism to the cardiac chambers and subsequently to the lungs, in the literature, there is only one case report published. We are reporting a case of sudden pulmonary air embolism in a patient being operated for fracture humerus, through the open hub of an intravenous (IV) cannula in the EJV. However, vigilant monitoring and timely action averted a calamitous outcome.

2. Case presentation

A 48-year old male, BMI-27, ASA grade I, who sustained a bilateral proximal humerus fracture in a road traffic accident 5 days prior to hospital admission was posted for bilateral open reduction and internal fixation. His preoperative investigations were within normal limits, with a hemoglobin value of 14 g/m%. The patient had a 16 Gauge IV cannula in the right EJV which was inserted in the emergency department during initial resuscitation. Before induction of anesthesia, another 16 Gauge cannula was inserted in the right lower limb in anticipation of the additional blood loss during a bilateral surgery. The patient was administered general anesthesia and positioned in the beach chair position. Sterile draping covered the head end of patient and anesthetic machine was shifted back a little to enable two surgical teams to operated simultaneously. The surgery started uneventfully with all vitals in the normal range. An invasive arterial line was secured in the right dorsalis pedis artery for blood pressure (BP) monitoring. During surgery, the anesthetist noticed a sudden drop in end-tidal carbon dioxide (ETCO2) to 26 mm Hg followed by a fall in the oxygen saturation (Fig-1 & Table-1). Immediately, the FiO2 was raised to 100%, flow increased to 6 liter/min, and nitrous oxide (N2O) was switched off. This was associated with tachycardia (heart rate-156/min), sudden hypotension (BP-50/30) and slight ST segment depression on the ECG. An arterial blood sample was taken from the arterial line for urgent arterial blood gas examination. The surgery was stopped and a search for the possible cause of intraoperative hemodynamic and respiratory changes was carried out. Meanwhile, injection adrenaline 100μg IV and ringer lactate bolus was administered. The estimated blood loss was about 400 ml. We found the IV set detached from the EJV cannula and the internal jugular vein distended. The EJV cannula was promptly closed. On auscultation, no clinical murmur was heard.
PaCO2 16 mm Hg, PaO2 60 mm Hg. In about 5 minutes, the patient re-

cleft lateral tilt of the table. The ABG reports revealed a PH of 7.33,

hypotension. The patient was placed in a Trendelenburg position with a

gradient between the external atmospheric pressure and the

the anesthetist realizing this. Air entrainment can occur because of the

caused the disconnection between the IV cannula and IV line without

the neck vein cannulation. As two teams were simultaneously oper-
cannulation and BP monitoring. Draping of the surgical part obscures

3. Discussion

Bilateral humerus fracture surgery poses a restricted area for IV

cannulation and BP monitoring. Draping of the surgical part obscures

the neck vein cannulation. As two teams were simultaneously oper-
ating, the anesthesia machine and the anesthetist moved away from
the operating field. Surgeon’s manipulation of the operative site may have
caused the disconnection between the IV cannula and IV line without
the anesthetist realizing this. Air entrainment can occur because of the
gradient between the external atmospheric pressure and the intravascular low venous pressure, which may be sub-atmospheric at
baseline values in up to 40% of patients. This gradient can be increased
by hypovolemia and patient position, which could be risk for air em-
bolism in our case. Kapoor et al. have described the solitary case train of
air bubbles in the EJV during neck dissection in a patient, which they
were able to manage successfully. Else venous air embolism (VAE) has
been reported more commonly during insertion or removal of central
venous catheter by the interventionist with a rate up to 2% apart from
the surgical procedure per se.6

Even though the many cases may be subclinical and dormant, VAE
remains a medical emergency with reported fatality as high as
50–80%.7 Clinical manifestation of VAE depends on volume of air en-
trainment that manifest mainly as cardiovascular, respiratory, and

central nervous system dysfunction.7,8 In an intubated patient, sudden
decrease in the ETCO2 level should alarm the anesthetist of altered
ventilation - perfusion relation and possible obstruction of pulmonary
arteries.9 Transesophageal echocardiography and precordial doppler
ultrasonography are sensitive tools that can detect air of 0.02–0.05 ml/
kg.10 In the absence of this facility in our trauma operation theatre,
high clinical suspicion remains the mainstay in diagnosis

Fat embolism (FE) is a very important differential diagnosis parti-
cularly in orthopedic scenario for intraoperative hypoxemia and hy-
potension.11 FE is can occur in long-bone fractures and even during
intramedullary nailing but is usually asymptomatic. Few patients do
develop signs and symptoms of multiorgan dysfunction, particularly
involving the triad of lungs, brain, and skin.12 Massive intraoperative
pulmonary FE, leading to fatal outcomes has been rarely reported in the
literature.11 FE however was excluded in this case as the hypoxemia
was easily reversed with positioning and stopping N2O administration.
Moreover, fever and petechiae were absent. The urine fat globules were
also negative there was no neurological dysfunction post operatively.

4. Conclusion

Vigilant monitoring of patients having EJV cannulation for fluid and
vasopressor therapy is of utmost importance in preventing complica-
tions such as VAE. Strong clinical suspicion in absence of intraoperative
echocardiography forms the cornerstone in aggressively managing
these morbid conditions.

Authors contribution

MJ was chief operating surgeon where CM was anesthetist. SA was
help when the episode occurred. MJ and CR followed up patient while
BS and SA reviewed the literature. SA, BS and MJ wrote up the paper.
All authors have read and agree to content of manuscript.

Competing interest

None.

Source of funding

None.

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We acknowledge the patient for permitting us to share this event for
the benefit of medical practice.

References

1. Prasad VSV, Daharwal S, Bahe A. External jugular venous access in children : a low
cost and feasible route for emergency fluid resuscitation and inotropic therapy in

2. Vesely TM. Air embolism during insertion of central venous catheters. J Vasc Interv

Fig. 1. Desaturation, drop in the ETCO2 and hypotension within a span of 5
minutes depicted in the trend of vitals of the monitor.

Table 1

<table>
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