

Massive Extrapleural Hematoma after Attempted Internal Jugular Vein Cannulation

Chen Fun GEE, Koh Kwong FAH and Damien PNG*

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Internal jugular vein cannulation is a common technique of venous access for central venous pressure monitoring. Because of the proximity of the internal jugular vein at the base of neck to the major vessels, brachial plexus, pleura, lung and the heart, complications as a result of the procedure are well described in the literature.¹ Inadvertent puncture of the subclavian artery is recognized by the appearance of pulsatile bright red blood under high pressure, hematoma formation and possibly hemothorax if the pleura is punctured. We present a case of massive extrapleural hematoma as a result of attempted internal jugular vein cannulation in a patient with coagulopathy which resulted in hemorrhagic shock requiring a thoracotomy to secure hemostasis.

Case Report

A 62-year-old oriental male, was admitted for investigation of a palpable epigastric and right hypochondriac mass which was later found to be a hepatoma. He had a past history

of pulmonary tuberculosis which was treated 20 years ago and emphysema from chronic smoking. A fairly uneventful right hepatectomy was done five days after admission. Postoperatively he stayed in the intensive care unit for two days because of paroxysmal atrial tachycardia and associated myocardial ischemia.

Whilst in the ward, he became septic and developed hypotension with a systolic blood pressure of 70 mmHg and oliguria on the 12th postoperative day. He was resuscitated with fluids and an internal jugular vein cannulation was attempted on the right side to monitor the central venous pressure. After location of the internal jugular vein on the second attempt, with a 21G needle attached to a 5 ml syringe directed at the apex of the two heads of the sternomastoid muscle downwards and lateral to the common carotid artery a 14G central venous cannula (Cavafix, B. Braun, Germany) was inserted. In the process, air was aspirated from the syringe attached to the needle and the patient became dyspneic. No blood was aspirated. A diagnosis of pneumothorax was made clinically and a chest tube was inserted at the fifth intercostal space at the mid-axillary line with relief of symptoms. A small amount of air but no blood was

Department of Anesthesia and *Surgery, National University Hospital, Singapore

Address reprint requests to Dr. FG Chen: Department of Anaesthesia, National University Hospital, 5 Lower Kent Ridge Road, Singapore 0511

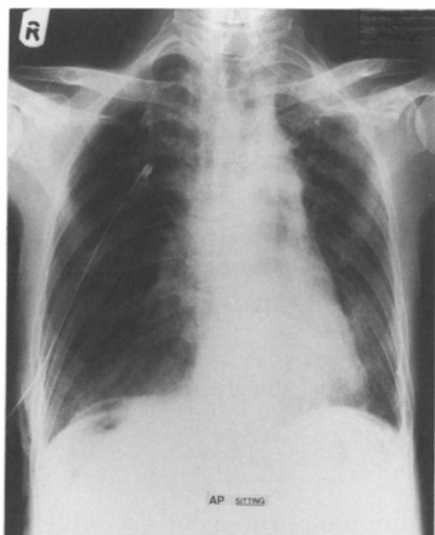


Fig. 1. Chest X-ray immediately after attempted right internal jugular vein cannulation.

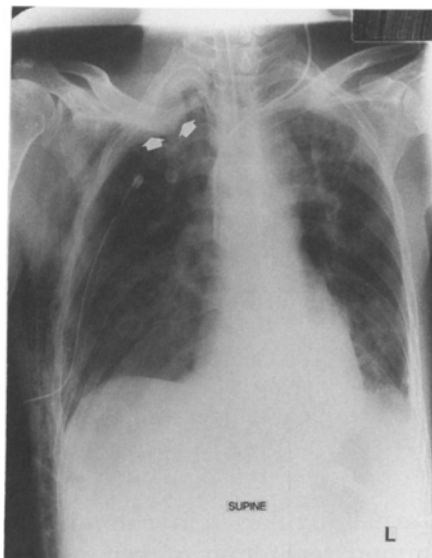


Fig. 2. Chest X-ray 8 hours following attempted right internal jugular vein cannulation showing "apical cap" on right lung (arrows).

expelled in the process. A chest X-ray after the chest-tube insertion revealed a partially re-expanded right lung and no hemothorax (fig. 1).

Because of his hemodynamic instability, he was transferred to the intensive care unit on the same day where he was treated for sepsis. A septic workup and coagulation screening was performed. Platelet count was $87,000/\text{mm}^3$, prothrombin time and partial thromboplastin time more than 100s. One litre of fresh frozen plasma was given with improvement of his coagulopathy. A central venous cannula was inserted in the left side via the external jugular vein. Because of worsening renal function, a scribner shunt was inserted into the left posterior tibial artery and long saphenous vein under general anesthesia for hemodialysis. Postoperatively he was ventilated in the intensive care unit. The following day he developed subcutaneous emphysema around the chest tube insertion site with minimal oscillations in the chest tube bottle and minimal hemoserous blood stained fluid drain-

ing from the chest tube. A chest X-ray (fig. 2) revealed patchy consolidation in both the lower lung fields and evidence of surgical emphysema in the lateral chest wall. A small well defined opacity, an "apical cap" was noticed over the right lung which had itself almost re-expanded. The patient, however, deteriorated and became increasingly dyspneic, hypotensive, tachycardic and unresponsive to pain. The central venous pressure dropped to 0 mmHg and the chest tube drained only 300 mls of hemoserous fluids over a period of 17 hrs. He was resuscitated with colloids, fresh frozen plasma, blood, dopamine and epinephrine. A percutaneous chest tap with a needle and syringe did not reveal a tension pneumothorax. An urgent chest X-ray showed a massive opacity over most of the upper right lung, pushing downwards the first chest tube, suggesting an extrapleural hematoma although massive hemothorax, collapse or consolidation of the right lung could not be excluded. A second chest tube

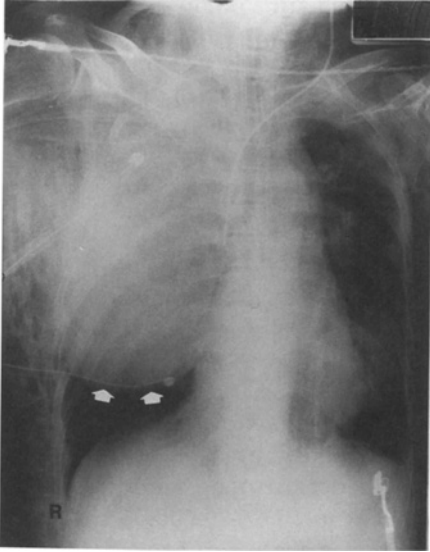


Fig. 3. Chest X-ray 24 hours following right internal jugular vein cannulation after insertion of a second chest tube. The massive extrapleural hematoma has pushed the first chest tube (lower) downwards (arrows).

was inserted at the third intercostal space, mid-axillary line to exclude a hemothorax since the first chest tube was not oscillating well. The chest X-ray (fig. 3) showed essentially the same picture as the previous X-ray, with the second chest tube directed cephalad in what was then thought to be a good position. Over the next 4 hrs 4450 mls of blood was drained from this tube. Arterial blood gas showed P_{O_2} 229 mmHg, P_{CO_2} 45.1 mmHg, pH 7.217 and HCO_3 18.5 $mmol \cdot l^{-1}$ on an inspired oxygen concentration of 0.4 and positive pressure ventilation. Platelet count was 34,000/ mm^3 and his hemoglobin 4 $g \cdot dl^{-1}$ down from 9 $g \cdot dl^{-1}$ 9 hrs earlier. No PT/PTT was done although an earlier sample taken 9 hrs earlier was noted to be slightly prolonged at 19.5s and 36.9s, respectively. The patient was given 4500 mls of blood, 1650 mls of fresh frozen plasma, 300 mls of random platelets as well as 6000 mls of colloids during this

period.

An emergency right thoracotomy was done on the 13th postoperative day, 5 hrs after insertion of the second chest tube because of continuing blood loss via the chest tube and hemodynamic instability. Large amounts of blood clot dissecting the whole extrapleural tissue plane was evacuated. Three small areas of active bleeding sites on the subclavian artery were diathermized and packed with gelform and thrombin powder. The patient subsequently became hemodynamically more stable and was sent back to the intensive care unit with drains in the intrapleural and extrapleural spaces. The following day, the intrapleural and extrapleural drains drained 1460 mls and 1610 mls of blood respectively over 24 hrs. With correction of coagulopathy the amounts tailed off and the chest X-ray showed a much improved picture. Subsequent course in the intensive care unit was complicated by *Streptococcus faecalis* and Methicillin-resistant *Staphylococcus aureus* (MRSA) septicemia. Although he was started on appropriate antibiotics, he deteriorated and died on the 19th postoperative day from refractory septicemic shock, respiratory and renal failure. No postmortem autopsy was performed on the patient.

Discussion

In 1969, English and colleagues² described the technique of percutaneous catheterization of the internal jugular vein which has gained acceptance as one of the most common technique for central venous access. Early experience attested to the relative safety of this invasive techniques, but a growing number of serious complications has since been reported in the literature.³⁻⁶ The complication rate of central venous cannulation has been described in various studies to range from 0% to

11%⁷⁻¹⁰ and this together with the success rate improves with experience of the technique. The most common early complications with internal jugular vein cannulation are arterial puncture, hematoma formation, arrhythmias and pneumothorax.^{7,11} Hematoma formation is most likely due to inadvertent punctures of the common carotid artery. Generally benign in the absence of bleeding diathesis, they are usually managed conservatively without sequelae by applying local pressure for 10 mins.¹² They tend to extend into the surrounding regions of the neck, preventing further cannulation attempts and have been reported to cause partial or complete blockade of the blood supply to the brain or extend into the mediastinum to compress trachea to cause airway obstruction,¹³ requiring surgical drainage and endotracheal intubation. It is the complication of hematoma formation that internal jugular vein cannulation has been reported to be contraindicated in patients with coagulopathies.^{11,14} However, in a prospective study of 1000 attempts at internal jugular vein cannulation in patients with coagulopathies by Goldfarb and colleagues,¹³ the arterial puncture rate was 7% but severe hematoma obstructing the airway requiring surgical drainage occurred only in one patient. In his series, all the patients had bleeding time more than 10 mins, prothrombin time activity less than 50% normal, platelet count less than 50,000/mm³ and or euglobulin lysis time less than 2 hrs.

There has been very few case reports of the complication of extrapleural hematoma from internal jugular vein cannulation¹⁵⁻¹⁷ and none to our knowledge resulting in hypovolemic shock requiring massive blood transfusion and exploratory thoracotomy. The clinical and radiological features of extrapleural hematoma has been described mainly in cases of trauma, rup-

tured aneurysm, parietal pleurectomy and sympathectomy.^{18,19}

The extrapleural space is represented in the normal individual by a potential line of cleavage in the loose connective tissue between the parietal pleura and the thoracic cage.¹⁹ The parietal pleura is adherent to the internal surface of the thoracic wall and is not readily stripped away. However because the extrapleural space is subjected to negative intrathoracic pressure, it is a preferential site for hematoma formation.¹⁵ Lesions involving the extrapleural region depending on its projection produce a characteristic shadow on the chest X-ray.^{16,19} An apical or lateral hematoma will show an extremely well defined convex contour facing the lung because of the displacement of the pleura towards the lung. The pleural cover smoothens out the surface irregularities so that it has a better definition than a pulmonary lesion. Because of the adherence of the parietal pleura to the thoracic wall, the edges of the lesion are usually tapered and may even be slightly concave toward the lung. Posterior or anterior hematoma will show these features on the lateral chest X-ray only. The term "extrapleural sign" has been applied to this combination of a pencil-sharp convex outline and tapering margins.¹⁹

Our case illustrates the dangers of internal jugular vein cannulation in a patient with coagulopathy. There was no evidence of inadvertent arterial puncture, possibly because of hypotension and a small puncture hole. As the blood pressure improved, the bleeding became significant resulting in the formation of an extrapleural hematoma. There was no blunting of the costophrenic angle to suggest hemothorax. The blood gases were excellent and there was no tracheal shift, making the differential diagnosis of collapse or consolidation of the lung unlikely. A second chest tube was

inserted as the first chest drain was not oscillating well. There is a distinct possibility from the chest X-ray (fig. 3) that the chest tube may have been in the extrapleural space. This led to continuing blood loss which resulted in hypovolemia. We were unable to ascertain intraoperatively whether the chest tube was in the interpleural or extrapleural space as they were removed just before the thoracotomy by the surgeon.

The recommended treatment of extrapleural hematoma is conservative with the hematoma usually disappearing within a few weeks. Drainage of the hematoma is not indicated as this may lead to hemothorax.^{15,16} Surgical intervention was necessary in our case because of hypovolemic shock despite correction of coagulopathy and fluid resuscitation.

Conclusion: This case illustrates one possible complication of internal jugular vein cannulation in a patient with coagulopathy. Inadvertent arterial puncture may be undetected and can cause massive delayed extrapleural hematoma identified on the chest X-ray with the "extrapleural, sign". Although expectant treatment is recommended in most cases of extrapleural haematoma, in the patient with coagulopathy, surgical intervention may be required to stop the bleeding. Although internal jugular vein cannulation is not absolutely contraindicated in the patient with coagulopathy, it is prudent to correct the coagulopathy before the procedure or use other routes of access to the central veins such as external jugular, basilic or femoral venous approach.²⁰

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