



Subclavian Artery Laceration Caused by Pigtail Catheter Removal in a Patient with Pneumothorax

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We report a case of subclavian artery laceration caused by the removal of a pigtail pleural drainage catheter in a patient with a pneumothorax. The patient was successfully resuscitated through diagnostic angiography with subsequent balloon occlusion and primary repair of the injured subclavian artery. Although pigtail drainage of a pneumothorax is known to be safe and effective, proper insertion and removal techniques should be emphasized to reduce the risk of complications.

Key Words: hemothorax; laceration; pneumothorax; subclavian artery; thoracostomy.

Although tube thoracotomy is an effective option for most pleural disease, intervention using a small catheter has replaced tube thoracotomy in some selected patients. The small caliber pleural catheter certainly has less pain and lower risk of complication than large-bore chest tube.[1-4] However, any tubes or catheters in the pleural cavity have potential risk of major complications such as lung laceration and cardiovascular injury. Here, we describe a case of subclavian artery laceration caused by pig tail catheter removal.

Case Report

A 38-year-old male visited the emergency department with a 7-day history of cough, sputum and fever. Five months ago from this admission, the patient underwent allograft peripheral stem cell transplantation under the diagnosis of acute myeloid leukemia. A complete blood count showed white blood cells (WBC) count of 2,970/ μ L, hemoglobin (Hb) of 8.7 g/dL and a platelet count of $17 \times 10^3/\mu$ L. Pancytopenia including thrombocytopenia has been persisted since stem cell transplantation. He was taking tacrolimus after stem cell transplantation. After a diagnosis of right middle lobe pneumonia was made, he was hospitalized and was given intravenous antibiotics.

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On the 3rd day of hospitalization, pneumothorax developed on the right side and tube thoracotomy was done with a 12 Fr chest tube. On the 8th day of hospitalization, pneumothorax developed on the left side. The interventional radiologist intended to insert an 8.5 Fr pigtail catheter into the 2nd intercostal space (ICS) in the midclavicular line (MCL) under

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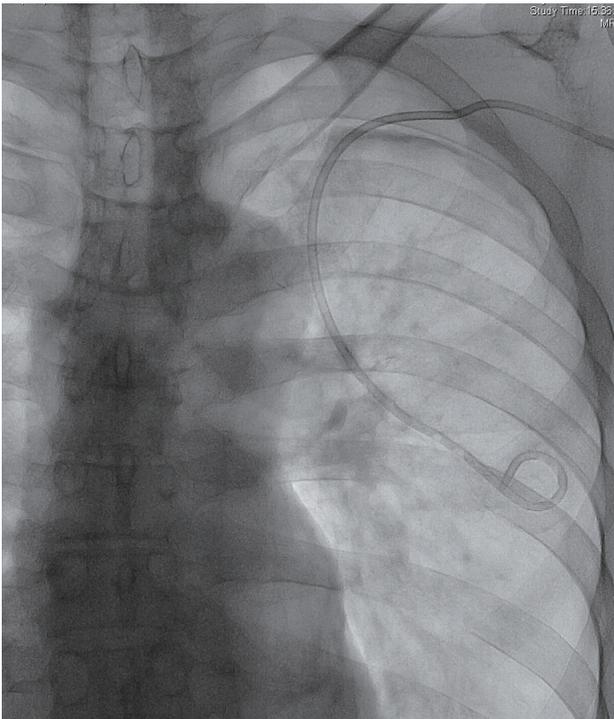


Fig. 1. An 8.5 Fr pigtail catheter was inserted into the 1st intercostal space in the midclavicular line under fluoroscopic guidance using the Seldinger technique for the management of left pneumothorax.

fluoroscopy-guidance (Fig. 1). Aspiration test was done repeatedly while inserting the needle to avoid the intravascular approach. Blood has not been aspirated during the procedure. However, the pigtail catheter was inadvertently placed in the 1st ICS. There was no immediate complication after procedure. There was no suspicious signs of bleeding after the procedure such as hypotension, tachycardia, progression of anemia, or bloody drainage of pleural catheter.

On the next day, there was no improvement in the left pneumothorax so it is determined to remove the pigtail catheter. Immediately after pigtail catheter removal, a massive amount of pressurized blood gushed out from the removal site. Despite of manual compression, massive bleeding persisted. Eight minutes after catheter removal, the patient developed hypovolemic shock (blood pressure 32/21 mmHg, heart rate 101/min). With rapid administration of fluid, systolic blood pressure was scarcely maintained at 80 mmHg. He was transferred to the intensive care unit urgently. A chest tube was placed in the left pleural space and three liters of fresh blood was drained initially. While waiting for emergent angiography, ventricular fibrillation occurred. The patient was successfully resuscitated in four minutes. Angiography showed extravasation of the dye

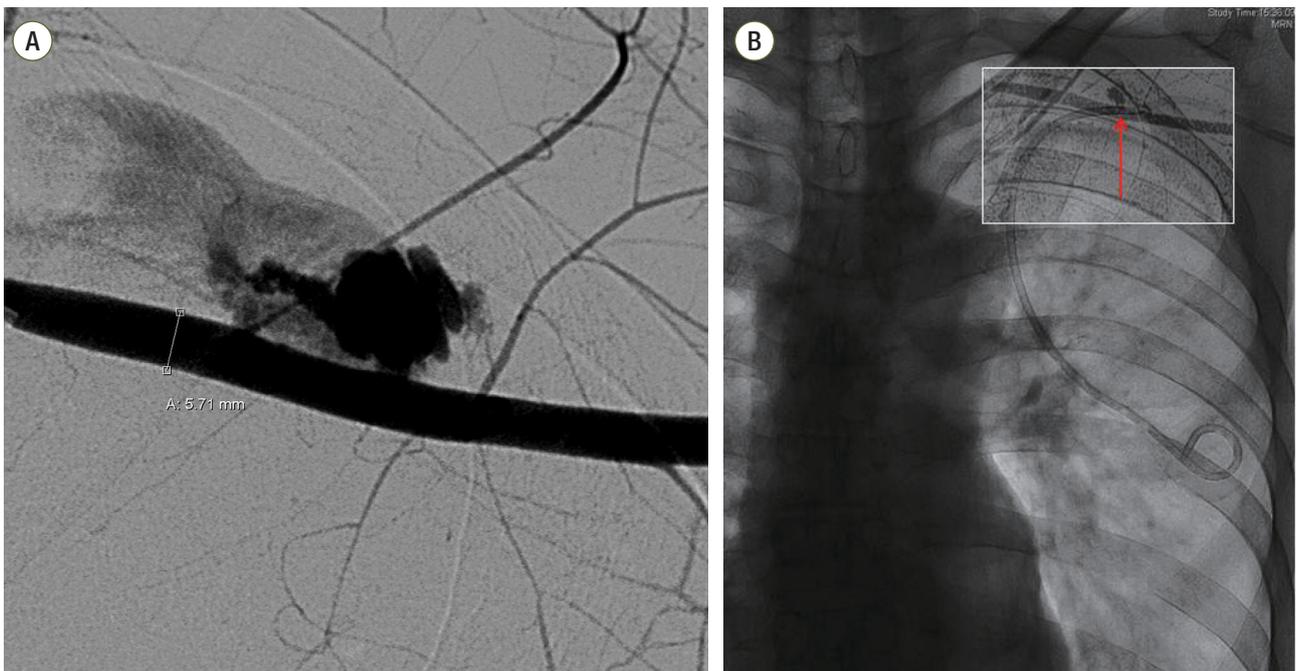


Fig. 2. Angiography showed extravasation of the dye from the left subclavian artery (A). The pig tail catheter seems to be placed over the subclavian artery (reconstructed image, B).



Fig. 3. Occlusion with a compliant balloon (13 mm in diameter) was done at the level of the left proximal subclavian artery. When radiocontrast dye was injected into the proximal subclavian artery, dye did not pass distal portion from the balloon.

from the left subclavian artery (Fig. 2A, B). To reduce blood loss before surgery, occlusion with a compliant balloon (13 mm in diameter) was made at the level of the left proximal subclavian artery. Following balloon occlusion, the bleeding decreased and the patient was stabilized (Fig. 3).

Primary repair of the left subclavian artery was attempted under general anesthesia in the operating room. A left infraclavicular incision was made and a careful inspection of the subclavian artery was performed. On inspection of surgical field, the proximal portion of the thoracoacromial artery has been transected. A small hole of the left subclavian artery on the anterior side, at 5 mm apart from the thoracoacromial trunk, was also found and primary suture repair of the injured subclavian artery was performed. Other site which was presumed to be damaged including needle hole were not found on the surgical inspection.

A total of 21 units of packed red blood cells, 23 units of fresh frozen plasma and 40 units of platelet concentrates were transfused. After the repair, the vital signs were stabilized without vasopressors. The patient still had coagulopathy with low platelet count ($31 \times 10^3/\mu\text{L}$) and high INR (1.61). On the next day of operation, the drain from the wound was increased up to 100 mL per hour and reexploration was performed. There was only diffuse oo-

ing from the soft tissue. No active bleeding focus from the subclavian artery was found. After successful hemostasis, he was transferred to the general ward on the following day after the 2nd operation. On the 19th day of hospitalization, right side video-assisted thoracoscopic bullectomy was performed due to recurrent right pneumothorax. The patient was discharged 31 days after the 1st operation.

Discussion

Tube thoracotomy is recommended for the management of symptomatic pneumothorax. Using a small bore pigtail catheter is associated with reduced pain and cosmetic advantage, with no other differences in clinical effect nor insertion-related complications compared with conventional large bore chest tubes. Recently small bore pigtail catheter has been reported as an effective alternative treatment option instead of large bore chest tubes for the 1st episode of spontaneous pneumothorax.[1-4] However, little is reported on the risk of removal related complications comparing pigtail catheters and conventional chest tubes.

In this case, hypovolemic shock developed during the removal of the pigtail catheter. We suspect the initial procedure did not directly injure the subclavian artery, because there was no sign of bleeding during and after pigtail catheter insertion. During the procedure, the radiologist performed aspiration test frequently to exclude the vascular puncture. Catheterization has been proceeded after rechecking the negative sign of blood aspiration. It could be strongly assumed that blood might be aspirated if the subclavian artery has been punctured. However, it is obvious that the catheter was not properly positioned. Because there was injury around thoracoacromial artery, the catheter must be placed over the subclavian artery rather under the vessel. As a result, the side holes and catheter possibly injured the vessel. In our case, the interventional radiologist planned to advance the pigtail catheter in the 2nd ICS in the MCL, However, chest radiograph showed that the catheter was probably in the 1st ICS. Moreover the pigtail catheter seemed to be placed over the subclavian artery in the reconstructed image (Fig. 2B).

It is especially possible, whether the anchoring suture in the catheter lumen was not cut before removal. Pigtail

catheters must be uncoiled by cutting the anchoring suture which release a grapple-hook prior to removal.[5] To prevent fatal complications like this case, physicians should be fully aware of the removal method prior to the implementation of procedure.

The British Thoracic Society (BTS) recommends cannulation via 2nd ICS MCL for the management of tension pneumothorax.[6] The 2nd ICS MCL could be an easily available site of insertion in emergent situations. However, life-threatening hemorrhagic complication associated with the needle decompression as well as pigtail pleural drainage catheter removal in the 2nd ICS MCL have been reported previously.[7,8] The cause of hemothorax was presumed to be due to the injury of either the internal mammary artery or the subclavian vessels. Judging from our case including previous case reports, 2nd ICS MCL could be related to increased risk of major vessel injuries associated with insertion of pleural drainage catheters. BTS proposed the “triangle of safety” as the insertion point of intercostal drain.[9] The triangle is bordered by the anterior margin of the latissimus dorsi, the lateral margin of the pectoralis major muscle, a line superior to the horizontal level of the nipple and apex below the axilla. The 3rd ICS in the MCL, or the 5th ICS in the anterior axillary line (ALL) could be alternative sites of approach in case of spontaneous pneumothoraces because major blood vessels could be secured.[7,8]

In conclusion, the pleural pig tail catheter should be placed in the proper position. The 3rd ICS in the MCL, or the 5th ICS in the ALL can be considered for the safer site of pleural drainage catheterization in case of spontaneous pneumothorax. The pigtail catheter also should be gently removed after cutting the anchoring suture which release a grapple-hook. The temporary balloon occlusion of proximal subclavian artery seems to be helpful in such a case.

References

- 1) Kulvatunyou N, Erickson L, Vijayasekaran A, Gries L, Joseph B, Friese RF, et al: Randomized clinical trial of pigtail catheter versus chest tube in injured patients with uncomplicated traumatic pneumothorax. *Br J Surg* 2014; 101: 17-22.
- 2) Kuo HC, Lin YJ, Huang CF, Chien SJ, Lin IC, Lo MH, et al: Small-bore pigtail catheters for the treatment of primary spontaneous pneumothorax in young adolescents. *Emerg Med J* 2013; 30: e17.
- 3) Chen CH, Liao WC, Liu YH, Chen WC, Hsia TC, Hsu WH, et al: Secondary spontaneous pneumothorax: which associated conditions benefit from pigtail catheter treatment? *Am J Emerg Med* 2012; 30: 45-50.
- 4) Tsai WK, Chen W, Lee JC, Cheng WE, Chen CH, Hsu WH, et al: Pigtail catheters vs large-bore chest tubes for management of secondary spontaneous pneumothoraces in adults. *Am J Emerg Med* 2006; 24: 795-800.
- 5) Hayes D: Pigtail drain tubes: a guide for nurses. *Aust Nurs J* 2005; 12: 19-20.
- 6) MacDuff AI, Arnold A, Harvey J; BTS Pleural Disease Guideline Group: Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010; 65 Suppl 2: ii18-31.
- 7) Makris D, Hatthabi M, Scherpereel A, Lafitte JJ, Marquette CH: Haemothorax after pig-tail catheter removal in a patient with primary spontaneous pneumothorax. *Emerg Med J* 2007; 24: e17.
- 8) Rawlins R, Brown KM, Carr CS, Cameron CR: Life threatening haemorrhage after anterior needle aspiration of pneumothoraces. A role for lateral needle aspiration in emergency decompression of spontaneous pneumothorax. *Emerg Med J* 2003; 20: 383-4.
- 9) Laws D, Neville E, Duffy J; Pleural Diseases Group, Standards of Care Committee, British Thoracic Society: BTS guidelines for the insertion of a chest drain. *Thorax* 2003; 58 Suppl 2: ii53-9.