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Case report

Accidental placement of an infusaport into the pulmonary artery: Case report and review of the literature

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ABSTRACT

Background: Misplacement of central venous catheters (CVC) may have devastating consequences.
Patients and methods: Placement of a CVC into the pulmonary artery (PA) and management of the complication is described. Literature search for accidental direct placement of CVCs into the PA was performed.
Results: A 46 year old morbidly obese female required an infusaport for chemotherapy. She was anaesthetized and placed in Trendelenburg. Three attempts to access the left subclavian vein (LSCV) using landmarks failed. In steeper Trendelenburg, a blood vessels was accessed. Non pulsatile dark blood was aspirated, a guidewire was easily advanced. Fluoroscopy projected the guidewire tip over the right atrium; infusaport placement was without difficulties. Postoperative chest x-ray showed the tube initially pointing caudally, then traversing the midline with the tip projecting over the right atrium. Emergent angiogram showed placement of the tube into the mainstem of the PA. The tube was removed; CT-angiogram showed no extravasation but a 3cm left mediastinal hematoma. Transfer to an ICU in a facility offering emergent cardiothoracic surgery was done. She remained stable, repeat CT-scan showed decreased hematoma size and she was retransferred. The infusaport was placed under ultrasound guidance into the left jugular vein. Six additional cases of direct puncture of the PA were reported; in all except one the LSCV had been targeted. No patient died directly from the complication, all catheters were removed, four patients required surgery or interventional procedures.
Conclusions: Accidental placement of CVC s into the PA is a rare complication. The catheter should be removed. Patients should be urgently transferred to a center with access to interventional radiology and cardiothoracic surgery.

1. Introduction

More than seven million central lines are inserted every year in the USA. Reducing infections associated with placement of central venous lines has been a major focus and is included in quality measurements [1,2]. At the same time other complications of CVL placement such as pneumothorax and hemothorax as well as malpositioning of the line and thromboembolic events must be recognized as they may have hazardous outcome [2]. The left subclavian vein access is preferred by many surgeons for several reasons including easy access, infection prevention, patient comfort and greater distance from the superior vena cava [3]. Pneumothorax due to puncturing of the lung is still the most common immediate surgical complications but faulty placement of the CVL poses an even greater risk for major complications. Placement into the arterial system is a well described and feared complication; placement into the pulmonary artery has thus far only been described in very few cases [4–9].

We report a case of malpositioning of a CVL into the PA and discuss the treatment options of this complication. A literature review using PubMed was performed to find additional cases of PA injury during CVL placement [4–9].

2. Case report

A 46 year old obese female was referred to general surgery for placement of a port a cath for chemotherapy of her breast cancer. After consent she was brought to the OR and provided with a larynx mask and anaesthetized. She was prepped and draped in the usual fashion and placed in slight Trendelenburg. The area below the left clavicle was injected with 1% lidocaine and using anatomical landmarks it was attempted to access the left subclavian vein close to the junction with the jugular vein. The vein could not be accessed and the patient was positioned in steeper Trendelenburg. Again the central venous system

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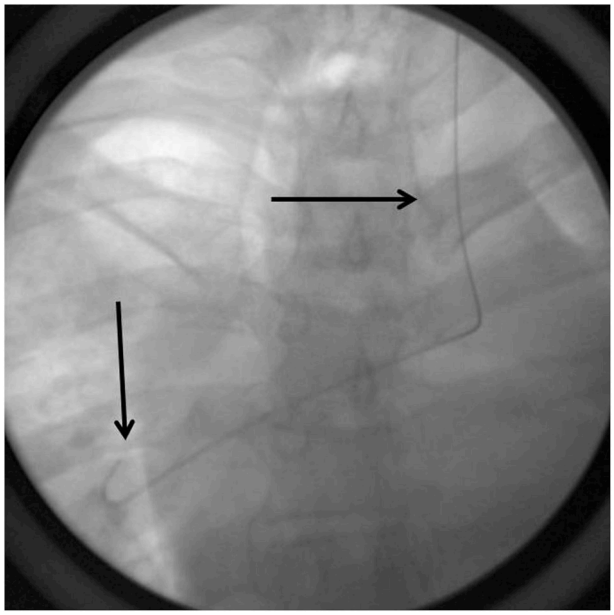

Fig. 1. Intraoperative fluoroscopy: Unusual course of the guidewire on the left side then traversing across the midline with the tip projects over the right atrium (arrows).

could not be accessed on 3 attempts including a more medial approach. The patient was now placed in very steep Trendelenburg and on the first pass, dark blood was aspirated and on removal of the syringe it was not pulsating. The guidewire was advanced without any problems and thereafter a chest x-ray was taken (Fig. 1). It was of suboptimal quality due to the patients obese habitus but it showed the guidewire passing the midline and the tip projecting over the right atrium. The sheet was advanced and then the port a cath was implanted in the usual fashion with the tubing being cut at 22cm from the capsule. The system flushed without problem and aspirated blood. Another chest x-ray was taken and again the tip of the tubing system projected in the right upper chest but also it was seen that the tubing went straight caudally on the left side and then traversed below the clavicle level to the right side. The patient was now brought in good condition to the wake up room. She was hemodynamically stable but upon waking up she complained about moderate chest pain. She had no signs of arrhythmia. Another chest x-ray was taken with the patient sitting up and again it was realized that the tubing came straight down on the left side but then traversed to the right side projecting the tip over the right atrium. Due to unclear course of the tubing it was contemplated that an internal mammarian vein had been accessed. The patient underwent a port a cath angiography in the interventional radiology suite and it was planned to potentially reposition the tubing in an appropriate anatomical way. However, upon injection of contrast the pulmonary artery filled (Fig. 2). After discussion, it was decided to pull the tubing out of the PA and a chest CTA was performed. There was no active bleeding observed; however, a 3cm hematoma in the left upper mediastinum was seen (Fig. 3). Due to ongoing chest pain the patient was transferred to an ICU at a higher care facility with access to emergent cardiothoracic surgery. She remained stable over-night and a chest CT scan the next day showed that the hematoma size had reduced to 2cm. The patient was hemodynamically stable and had no more chest pain and was transferred back to our facility. A new port a cath was then placed into the left subclavian area with the tubing inserted into the left jugular vein under ultrasonic guidance. No additional complications and no long term sequaelae developed.

3. Discussion

Complications of CVL may occur in up to 2–10% of patients and multiple risk factors have been determined [2]. Obesity, cachexia, anatomic variations, previous radiation and surgery amongst other factors have been identified to increase the risk for malpositioning of CVLs. Positioning into the arterial system, the pleural space and mediastinum are well known complications, whereas only few cases of CVL placement into the PA system such asherein described have been reported [10]. Table 1 summarizes the six additional cases we found on our literature search and our case [4–9]. There were four female and

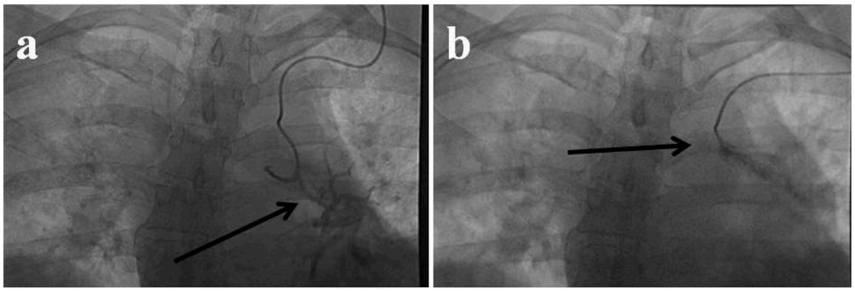

Fig. 2. Angiography: **2a:** The tube is positioned within the pulmonary artery (arrow). **2b:** The catheter is slowly pulled back and out of the pulmonary artery (arrow).

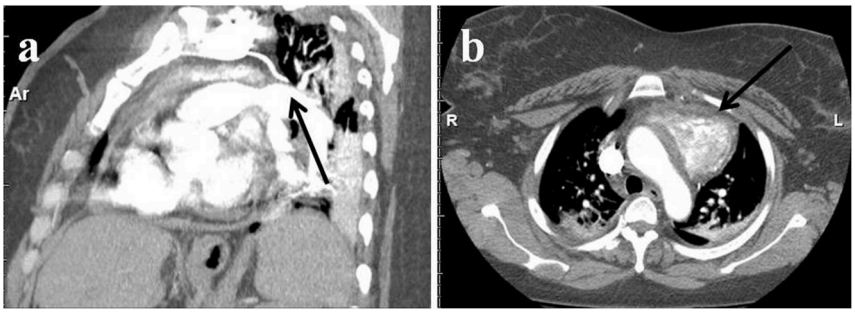

Fig. 3. CT Angiography: **3a:** sagittal view: The tip of the catheter is outside of the PA, no active extravasation of contrast is seen (arrow), **3b:** transverse view: 3cm mediastinal hematoma (arrow).

Table 1
Summary of published cases of accidental direct access of the pulmonary artery during central venous line placement.

Author	Year	country of origin	age	sex	underlying disorder	risk factors	type of CVL	puncture site	recognition	management	intervention	comment	outcome
Hirsch et al.	1984	United Kingdom	56	f	renal failure	none reported	16-g, 14-cm Abbocath	(presumed left) subclavian	cardiac tamponade; cxr negative	Open heart surgery, evacuation of hemopericardium; lesion oversewn	Surgery	clinically worsening after several hours	favorable
Reid et al.	1995	Canada	14	f	kyphoscoliosis	distorted chest, impaired pulmonary function	Cook 5.0F single lumen	left subclavian	cxr, angiography	PA pressure measured; catheter removed with injection of contrast	no	patient intubated; 3 puncture attempts into left jugular vein failed	favorable
Gu et al.	2009	Richmond, VA USA	30	m	sickle-cell disease; MRSA line sepsis	previous infected catheter	long term line	left subclavian	missed on cxr& CT-scan; found on TEE	after recognition on TEE contrast was injected showing direct placement into right main pulmonary artery; removed and track embolized	Interventional radiology	had been in place and used for 8 months before recognition	favorable
Truong et al.	2009	Houston, TX USA	66	f	multiple myeloma	obese	double lumen	left subclavian	portable ultrasound	catheter removed (no blood return), progressive hypotension; US: hemothorax: emergent thoracotomy: repair of left upper lung lobe and PA branch laceration	Surgery	none	favorable
Moriceua et al.	2012	France	79	m	MRSA pneumonia	st/p CABG, interstitial pneumonitis	plastimed Seldiflex 20cm, Prodimed, FR	left subclavian	cxr, angiography	aberrant course on CXR and angiography: removal of catheter without complications; CT-scan: no hematoma	no	puncture by inexperienced junior resident under 3rd rib	favorable
Daniel et al.	2014	Australia	71	m	laryngeal mass	COPD, HTx of sternotomy, HTx of lung lobectomy	8.5-F four lumen	right subclavian	cxr, CT-scan, angiography	elevated PA pressures (35 mm Hg); interventional radiology with balloon occlusion of bleeding puncture site	Interventional radiology	none	favorable removal; died next day from pulmonary failure
current case	2017	Easton, MD USA	46	f	breast cancer, HIV infection	morbid obesity	port a cath 4	left subclavian	cxr, angiography, CT-scan	removal of catheter, observation on ICU with access to emergent cardiothoracic surgery	no	none	favorable

three male patients with a median age of 56 (range 14–79) years. Reports came from North America [4], Europe [2] and Australia [1] and multiple different lines had been inserted. In all but one case the insertion site was the left subclavian vein. In the vast majority risk factors could be identified and in addition, difficulties with immediate access to the venous system occurred in almost all cases. When finally dark non pulsatile blood was aspirated, the guidewire was advanced and in most cases the insertion of the catheter was reported without difficulties. However, either initial chest x-ray showed an unusual path of the catheter or hemodynamic pressures suggested positioning of the catheter tip in the PA. Once the complication was detected, initial management included in most cases exact location of the injury by CT-scan and/or angiography. As most patients developed hemodynamic instability, supportive measurements with fluid resuscitation were initiated. Our patient had no previous thoracic surgeries but she was morbidly obese, which has been identified as a risk factor for CVL complications. After two unsuccessful attempts the patient was placed in very deep Trendelenburg and the needle was directed steeper, which resulted in access of the PA. The intraprocedural chest x-ray projected the guide wire tip over the right atrium but image quality was suboptimal due to morbid obesity. The insertion of the catheter was without any effort or resistance. Chest x-ray in the wake up area showed again an unusual course and insertion of the catheter into an internal thoracic (mammary) vein or an anatomical variation such as a persistent left superior vena cava were contemplated [11]. Once positioning into the PA was determined during angiography, it was decided to remove the tube. As the PA is a low pressure system this should be safe based on most cases of incidental PA catheter perforation although hemoptysis and pseudoaneurysm formation requiring intervention have been described [12]. Due to the small diameter port a cath catheter, only a minor injury to the vessel occurred and on CT scan no active bleed but a hematoma was detected. In cases with large bore catheters placed into the PA, significant bleeds have been observed and even occlusion of the perforation using an angiography balloon has been described in one case [4]. We transferred our patient to a hospital with emergent access to thoracic surgery [6,9]. Repeat CT-scan showed no active bleed and the patient was transferred back to our hospital in stable condition. Two days later a port a cath into the left jugular vein was placed without problems using ultrasound guidance. Ultrasound guidance seems to be of benefit in jugular vein access but not in subclavian vein puncture [13,14].

To summarize, placement of a CVL into the PA is a very rare complication. Transfer of patients to a center with access to angiography and cardiothoracic should be done and the catheter should be removed.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rmcr.2018.11.003.

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