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Intravascular knot as a complication of tortuosity at innominate-arch junction unravelled by counter-clockwise rotation- simple solution to complex problem

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Abstract

Transradial approach scores over transfemoral approach as it is associated with less complications, mortality, and morbidity. Though right sided approach is more convenient for manipulating catheters and devices, aorto-subclavian tortuosity may result into looping, entrapment, kinking, and rarely intravascular knot formation. Here, we describe a case of a 60-year old female which had gone transradial catheterization from right side. Due to aorto-innominate tortuosity, excessive clockwise torque was applied to the catheter to cannulate right coronary artery which resulted into pressure damping, and *intravascular knot* formation in brachial artery. It was unravelled by counter clockwise rotation of catheter, and thus completing the procedure.

Key words: Aorto-innominate tortuosity; Transradial approach; Intravascular knot

Introduction

Transradial approach scores over transfemoral approach as it is associated with less complications, mortality, and morbidity [1, 2]. Most operators prefer doing procedure from right side as it is more convenient for manipulating catheters and devices [3]. The disadvantage of right over the left is that one may encounter aorto-subclavian tortuosity which may result into looping, entrapment, kinking, and rarely knot formation which may be in radial, brachial, axillary, subclavian, or aorto-subclavian junction. Regular manoeuvres and manipulations to disengage the catheter might be unsuccessful sometimes due to the narrow diameter of the artery, which may require surgery in extreme cases.

Case report

A 60-year old female presented with chronic stable angina- Canadian Cardiovascular Society (CCS) class-III of two years with recent worsening. She was diabetic, and hypertensive. Blood pressure was 136/78 mmHg in right arm while pulse rate was 76/minute. Electrocardiogram suggested left ventricular hypertrophy with strain pattern. Echocardiography suggested mild left ventricular hypertrophy, diastolic dysfunction, and normal ejection fraction (EF = 68%). Transradial catheterisation was performed from the right radial route. Right radial artery was accessed with 5F sheath, and cocktail containing nitro-glycerine, diltiazem, and heparin was injected. 5F tiger diagnostic catheter could be advanced beyond the innominate- aorta junction (Fig.1A). The wire was removed, and contrast injection showed the extreme tortuosity and dilatation at aorto-innominate junction (Fig. 1B). 0.035" Terumo wire (Terumo, Japan) was manipulated by slightly pulling the diagnostic catheter, and as it entered the ascending aorta, the catheter was pushed into ascending aorta (Fig. 1C, D). While performing angiography, hair-pin loop at innominate-aorta junction was seen (Fig. 2A). The catheter was pulled, left main artery was cannulated, and angiogram of left system was performed. During cannulation of right coronary artery, catheter was pulled, and torqued clockwise with little difficulty. During injection of the contrast, it could not be injected, and severe damping of pressure was recorded. When probed under fluoroscope, an intravascular knot in brachial artery was seen (Fig. 2B). This knot was removed solely by gentle counter clockwise manipulation (Fig. 3,4). Once the knot was unravelled, monitor started showing the pressure trace. Following this, her angiogram was completed with another tiger catheter as further torque transmission was not possible. This time, right coronary artery was cannulated by keeping the metallic 0.035" wire just inside the tip of tiger catheter to prevent any knotting of catheter. Once cannulated, wire was gently removed to complete the procedure.

Discussion

Catheter knotting during coronary angiography is a recognised, but a rare complication [4]. It usually occurs through excessive manipulations of a catheter in an attempt to cannulate the coronary artery, especially right coronary artery (RCA) [4]. There are several different methods for the removal of intravascular knot which are gentle traction of the catheter, anticlockwise or clockwise rotation, and guide-wire advancement to the catheter's tip. However, guide-wire advancement to the catheter's tip may turn futile for complete knotting and carries further risk of perforating the catheter, blood vessel or cardiac chamber. Another

approach is to pull the knotted device against the introducer sheath if the site is too proximal (in the vicinity of tip of introducer sheath). Patel et al have suggested that the most common cause of a radial knot is over torquing while trying to rotate anteriorly towards the ostium of RCA during radial catheterisation. They recommend fixing the catheter so as to unknot it. For this, they recommend inflating a sphygmomanometer cuff to above 200 mm Hg. This is supposed to fix the catheter so it can be turned in the other direction [5]. Minor looping of the coronary catheter is common during left heart catheterization and is usually the result of excessive torquing of the catheter, especially in a tortuous subclavian artery. It usually can be managed with gentle rotation in the opposite direction, and thus goes unnoticed without complications. Sometimes a guidewire can be advanced to the knot and with gentle traction of the catheter the wire may pass through and open the knot. However, more complex knots may rotate in the direction of torque adding further problems. This looped/kinked catheter can get entrapped and may require surgery for retrieval. Furthermore, perforating the catheter is of risk if excessive force is used.

Therefore, during transradial catheterization, one should always look for knots if difficulty is experienced entering the vessel. It should be too looked for if patient complains of pain, which may mean some intravascular structure is touched, as a normal catheter does not do, unless there is spasm. Spasms can be recognised by the inability to move the catheter. Therefore, pain and being able to move the catheter should make one suspect an intravascular knot. Another pointer towards intravascular knot is dampening of pressure.

Conflict of interest

None

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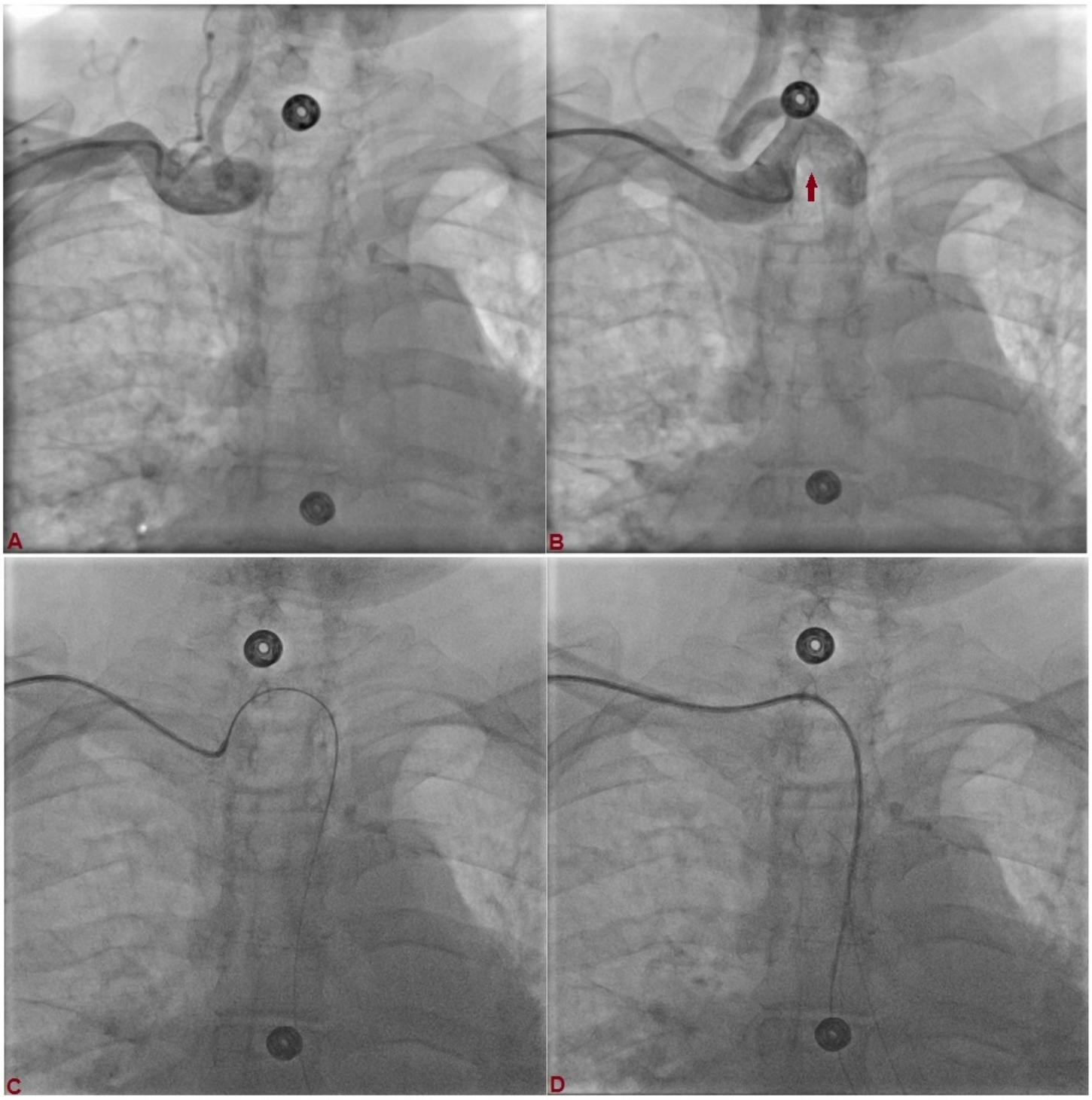
Figure legend

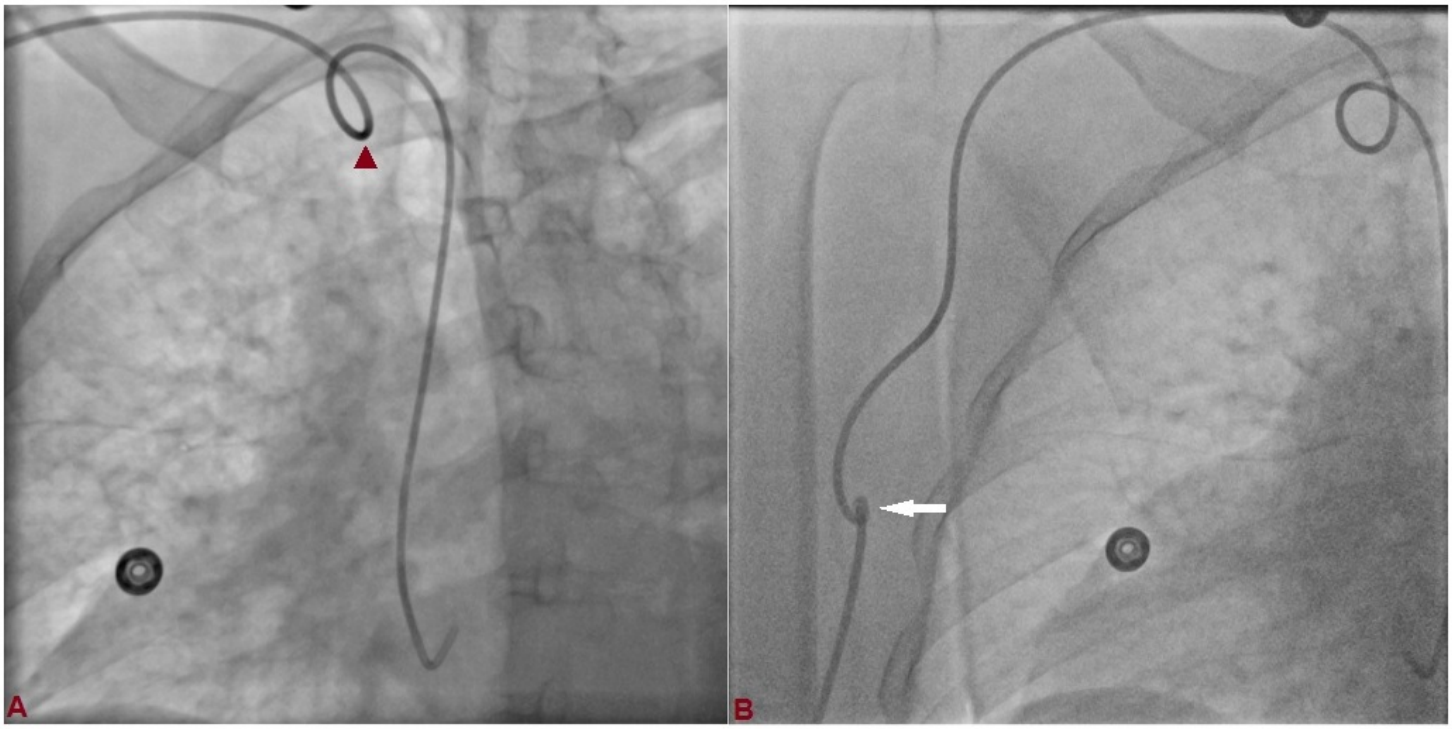
Figure 1. Severe tortuosity at aorto-innominate junction (A; B). Tortuosity negotiated and catheter was directed to ascending aorta (C; D)

Figure 2. Hair-pin loop (red arrowhead) of tiger catheter at innominate-aorta junction indicating tortuosity (A); When probed under fluoroscope, an intravascular knot (white arrow) in brachial artery was seen (B)

Figure 3. Intravascular knot gradually unravelled with gentle counter clockwise manipulation (A; B)

Figure 4. Intravascular knot gradually unravelled with gentle counter clockwise manipulation (A; B; C)


A
B
C
D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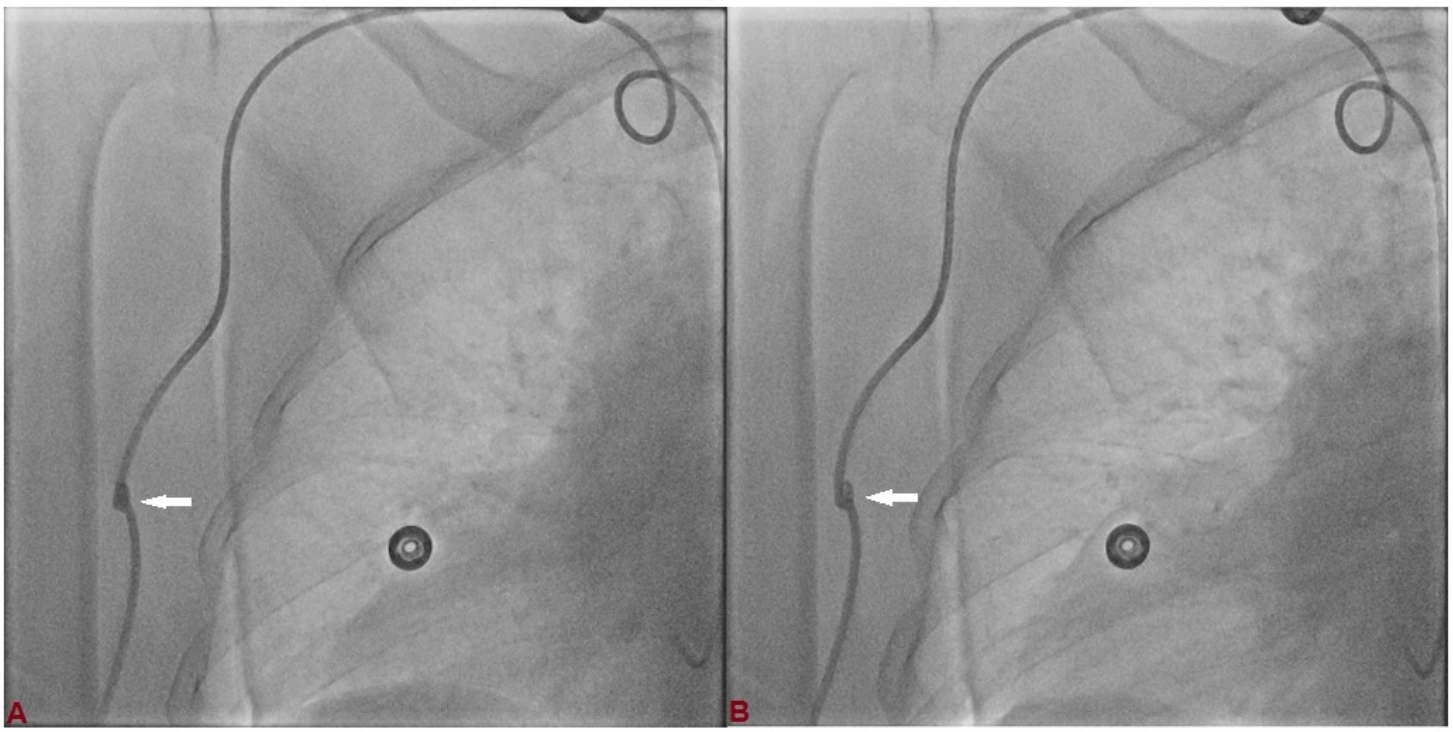
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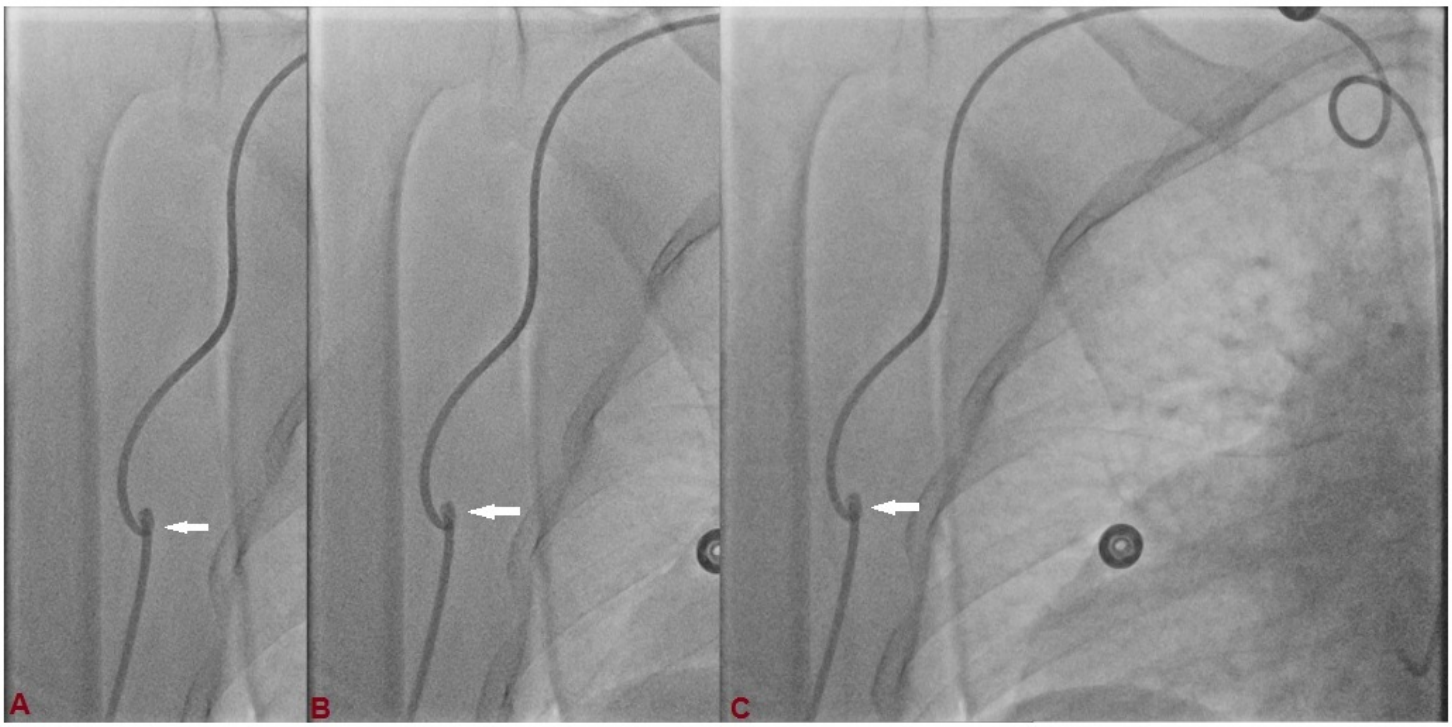
A
B
C