CASE REPORT

Yet more knots in the radial artery, unravelling purely by counter clockwise rotation

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SUMMARY

We describe here two more radial knots that could be unravelled by counter-clockwise rotation alone. We and others have previously described radial knots that occur when trying to engage the right coronary artery (RCA). Here, we show two knots that were unravelled purely by counter-clockwise rotation. One occurred during RCA catheterisation and the other occurred during left coronary angiography via the radial route. In one of the patients, severe pain occurred in the right shoulder. This occurred even though the artery was not in spasm. We were able to move the catheter. Therefore it is possible that pain combined with the ability to move the catheter may be a marker of an intravascular knot.

BACKGROUND

We had previously reviewed radial knots.¹ We had previously reported that most radial knots are produced by over-torquing during clockwise rotation to engage the right coronary artery. Here, we show two cases of knots we recently saw in whom we could remove the knots purely by counter clockwise rotation alone. No other manoeuvre was required. But in one of the patients, the knot occurred when attempting to enter the left coronary artery. Therefore, knots can also occur during radial catheterisation of the left main coronary artery.

CASE PRESENTATION

The first patient was a 35-year-old woman who had class II effort angina with moderate aortic stenosis and symptoms out of proportion to the aortic gradient (13 mm Hg peak systolic gradient) was taken up for coronary angiography. Her valve was calcified. So, a left heart catheterisation and a coronary angiography were planned as we thought she might have a myocardial bridge or a coronary anomaly to account for the symptoms.

Catheterisation was performed from the right radial route (we usually prefer radial route first unless we suspect left main disease or during primary angioplasty with heart failure or cardiogenic shock). The right coronary artery was normal. While trying to get into the left coronary ostium, the patient reported of severe right shoulder pain. At first we thought it was angina, however on fluoroscopy (figures 1 and 2) we saw the following picture: there was a complex knot in her right subclavian artery. In retrospect, we were unable to hook the left main coronary artery in spite of repeated attempts. We also noted mild pressure damping. This knot was removed solely by

Figure 1 The knot in the subclavian artery, the patient complained of right shoulder pain, hence the fluoroscope was moved to observe this knot.

counter clockwise rotation (videos 1 and 2). Once the knot was unravelled, the pain in the arm subsided immediately.

The second patient was a 64-year-old woman who had suffered coronary artery disease acute coronary syndrome inferior posterior wall myocardial infarction on 24 October 2012. She was being

Figure 2 The catheter was pushed into the ascending aorta and rotated counter-clockwise. It straightened.

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Video 1 The angiogram of patient number 1.

taken up for an angiogram because of postinfarction angina. During her coronary angiogram, we found a severe pressure damping and on fluoroscopy found the following (figures 3 and 4). She had a knot in the radial catheter. This was unravelled by twisting counter clockwise. Following this, she had another angiogram and finally stenting to the LAD and RCA (videos 1 and 2).

TREATMENT

Both knots were unravelled by counter-clockwise torque.

OUTCOME AND FOLLOW-UP

Both patients are doing well. The second patient had two vessel angioplasty through the femoral route later.

Video 2 The angiogram of patient number 2.

Figure 3 The knot in the Tiger catheter during radial artery coronary angiography in patient number two.

DISCUSSION

Catheter knotting during coronary angiography is an uncommon, but a recognised complication.¹ It usually occurs through excessive manipulations of a catheter in an attempt to cannulate the right coronary artery (RCA).¹ Despite being an important complication, there is little reported literature regarding its best management. There are only a few case reports of percutaneous catheter unknotting in the literature.

There are several different methods for the removal of knotted intravascular devices. These include gentle traction of the catheter, anticlockwise or clockwise rotation, and guide-wire advancement. If the catheter is hollow, a semiflexible steel guide wire may be inserted and advanced to the catheter's tip. However, this is not effective for complete knotting and carries a theoretical hazard of perforating the catheter, blood vessel or

Figure 4 The partially unraveled knot of the second patient, unraveled by counterclockwise rotation.

cardiac chamber. Another approach is to pull the knotted device against the introducer sheath.

Patel *et al*² and others have described a new method to tackle knots during radial catheterisation. They have suggested that the most common cause of a radial knot is overtorquing while trying to rotate anteriorly towards the RCA ostium. 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.

Knotting of RCA catheter during the transfemoral approach (TFA) is a recognised complication and has been previously reported. It is usually the result of excessive torquing of the RCA catheter, especially in the setting of a tortuous aorto-iliac system.

Chinician *et al*³ described a technique that involved the introduction of a second catheter through the contralateral femoral artery. The second catheter was passed alongside the knotted catheter and directed through the loop of the knot. The knot was then pulled back to the bifurcation of the aorta and moved gently to and fro, enabling its reduction. Unfortunately, the aforementioned techniques have their limitations in the form of dependence on significant knot laxity and bigger arterial lumen to work with. Hence, there are higher chances of failure in cases of tighter knots and small arterial lumens.

Tanner *et al*⁴ described a knot reduction by fixing the catheter distal to the knot using the W grabber device from the contralateral femoral route. Once the catheter was fixed in the segment distal to the knot, simple counter-clockwise rotation from outside was sufficient to unravel the knot. They reported a series of five cases and showed that fixing a knotted catheter distally obviated the need for passing the guidewire through the knot or passing another catheter through the loop.

Skinner and Burroughs⁵ also discussed the possible causes of pain during knots. They described a 38-year-old man admitted as far back as 1959 for a suspected pulmonary arteriovenous fistula. He was trying to put a Cournand catheter into the pulmonary artery. He could not see a knot, but attempts to pull the catheter back out caused runs of ectopics and pain. Subsequently, it was found at thoracotomy that the catheter had entangled in the chordae tendinae at the antero-medial commissure of the tricuspid valve. The knot was cut surgically and removed. The reason pulling on the catheter caused pain is not exactly known to the authors.⁵ However, they believe that it was due to traction or the displacement of mediastinal structures or the shifting or stretching of the superior vena cava.

In this day and age, when we use adequate local anaesthetics, pain during routine procedures should make us proceed with caution.

The other classical sign of pain after angiography is of course retroperitoneal haematoma. This usually occurs during femoral angiography, but is not relevant here.

Learning points

- ▶ During radial angiography, always look for knots if difficulty is experienced entering the vessel (coronaries).
- ▶ If there is pain, it may mean some intravascular structure is touched, which 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.
- ▶ Our previous case of a knot also had pain when the knot got unravelled. Possibly, the catheter touching or stretching the arterial walls causes pain.
- ▶ If there is catheter pressure damping, knots should be suspected.

Contributors PNG wrote the report and helped in unravelling the knot in the second patient. URM and SP were involved in the coronary angiograms and knots and PV unravelled the knot of the first patient. All authors have contributed to the paper significantly.

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