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Cobra loop of catheter at innominate-arch junction during transradial catheterisation: the fluoroscopic marker of arteria lusoria

Wygięcie cewnika typu „pętli kobry” w obrębie odejścia tętnicy bezimiennej od łuku aorty w trakcie cewnikowania z dostępu przez tętnicę promieniową — fluoroskopowe wskaźniki tętnicy błądzącej

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Abstract

The retro-oesophageal right subclavian artery (ROSRA or arteria lusoria) is one of the anatomical abnormalities encountered at innominate-arch junction during transradial catheterisation by right route. Here, we report the case of a 49-year old female who presented with chronic stable angina (Canadian Cardiovascular Society class III) despite guideline directed medical treatment. Coronary arteries were cannulated with difficulty showing critical lesion of proximal left anterior descending artery (LAD). During angiography, diagnostic catheter had a peculiar cobra loop in the ascending aorta. As the left subclavian artery also had critical lesion at the proximal part, percutaneous coronary intervention of proximal LAD artery was successfully performed with a 3.5 × 23 mm Xience Prime Everolimus eluting stent (Abbott, USA) through right femoral route. Multidetector computed tomography contrast aortography showed the origin of the right subclavian artery in the right posterior side of the horizontal aorta with a tortuous course, proximal stenosis of left subclavian artery, and a bicarotid truncus. This abnormality can be easily detected by angiographic visualisation, in the anteroposterior projection, of the angle of the catheter when it engages the ascending aorta, and by manual angiography at the ostium of the right subclavian artery. In such a case, selective catheterisation of both coronary arteries may be very difficult, time consuming, and require more catheters. In such cases, one should not hesitate in switching to a transfemoral route if the left radial route cannot be used.

Key words: arteria lusoria, bicarotid truncus, cobra loop, innominate-arch junction, retro-oesophageal right subclavian artery (ROSRA), transradial catheterisation

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Introduction

Following the first transradial percutaneous coronary intervention (PCI) by Kiemeneij et al in 1992, there has been increasing use of transradial access (TRA) around the world [1]. It scores over the transfemoral approach because of lower access site bleeding, patient preference and satisfaction, early ambulation, reduced morbidity and mortality, and lower procedural cost, to name but a few advantages [2–5]. However, it has certain limitations which include

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a steep and significant learning curve, increased although insignificant X-ray exposure time for coronary angiography, difficulty in adequately cannulating the coronary arteries, increased pain during the procedure, radial artery spasm, and difficulties due to anomalies of innominate-arch junction such as the retro-oesophageal right subclavian artery (RORSA, also known as arteria lusoria) [6]. These factors, in combination, are responsible for an access crossover rate which has been reported to be 4–7% in various studies [7].

Case report

A 49-year old female with a past history of hypertension, diabetes and dyslipidemia presented with chronic stable angina (Canadian Cardiovascular Society — class III) despite guideline directed medical treatment. Her physical examinations and biochemistry were all unremarkable, except for a significant difference of blood pressure between arms (right arm 142/80 mm Hg; left arm 120/78 mm Hg) though there was no history of arm claudication. Electrocardiogram revealed mild ST-T changes in precordial leads. Echocardiography revealed normal ejection fraction (EF 60%), mild concentric hypertrophy, and diastolic dysfunction. Her treadmill test was strongly positive for reversible ischaemia. She was taken for coronary angiography after proper consent. Right radial artery was punctured by a 21 G needle, a 0.021" guidewire (Cordis Corp, USA) was inserted and a 6 F sheath was placed. After sheath replacement, a cocktail containing 200 μg nitroglycerin, 2.5 mg diltiazem, and 2,500 IU unfractioned heparin were injected. While pushing diagnostic catheter, great difficulty was encountered to enter ascending aorta as guidewire was repeatedly slipping into descending aorta. Contrast was administered through the diagnostic catheter while it was in innominate artery by pulling the guidewire which opacified only descending aorta, which raised the possibility of its origin distal to left subclavian artery (Figure 1A). A 0.035" standard guidewire was then parked into proximal part of descending aorta and catheter was pushed over it. Once the entire assembly was there, it was pulled up and the patient was asked to take a deep breath to facilitate its entry into ascending aorta, but this failed. The guidewire was exchanged with a 0.035" curved tip, hydrophilic terumo wire (Terumo, Japan) which was once again parked in proximal part of descending aorta. The entire assembly was slightly pulled. A gentle clockwise torque was applied to guidewire to flip it into ascending aorta while patient was asked to take a deep breath. Once wire slipped into ascending aorta, catheter was further slid over the wire to advance it into ascending aorta. The terumo wire was exchanged with a 0.035" standard wire to garner a better support when the whole assembly was further pushed into ascending aorta down to aortic sinus. Once there, the wire was a little pulled to keep it inside the catheter and the catheter was rotated anticlockwise to bring it close to left coronary ostia. The shaft of the catheter assumed a 'cobra' shape in the aortic sinus, the sine qua non of arteria lusoria (Figure 2). With gentle traction, it successfully cannulated left coronary ostia which showed a critical lesion of proximal left anterior descending artery (LAD) (Figure 2). Similarly, a gentle clockwise traction helped to cannulate right coronary ostium which was normal. As the nonselective aortogram showed a critical lesion in proximal part of left subclavian artery (Figure 1B), and great difficulty was encountered while

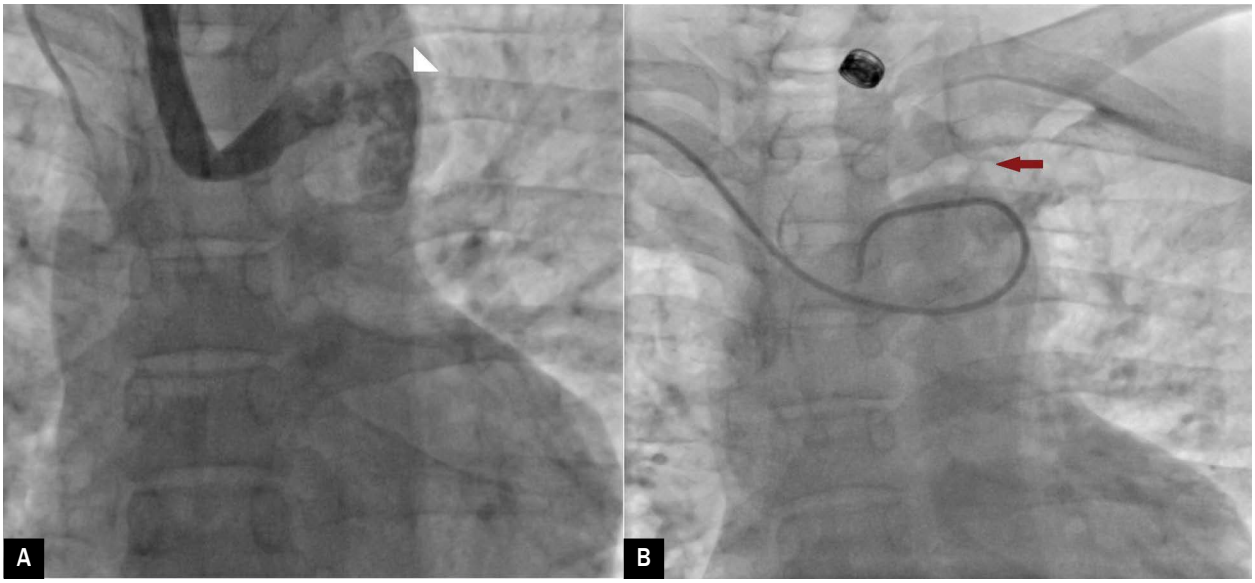

Figure 1A, B. Contrast injection through diagnostic catheter showing opacification of only descending aorta, raising the suspicion of its origin distal to left subclavian artery (**A**), arch aortogram showing proximal stenosis (red arrow) of left subclavian artery (**B**)

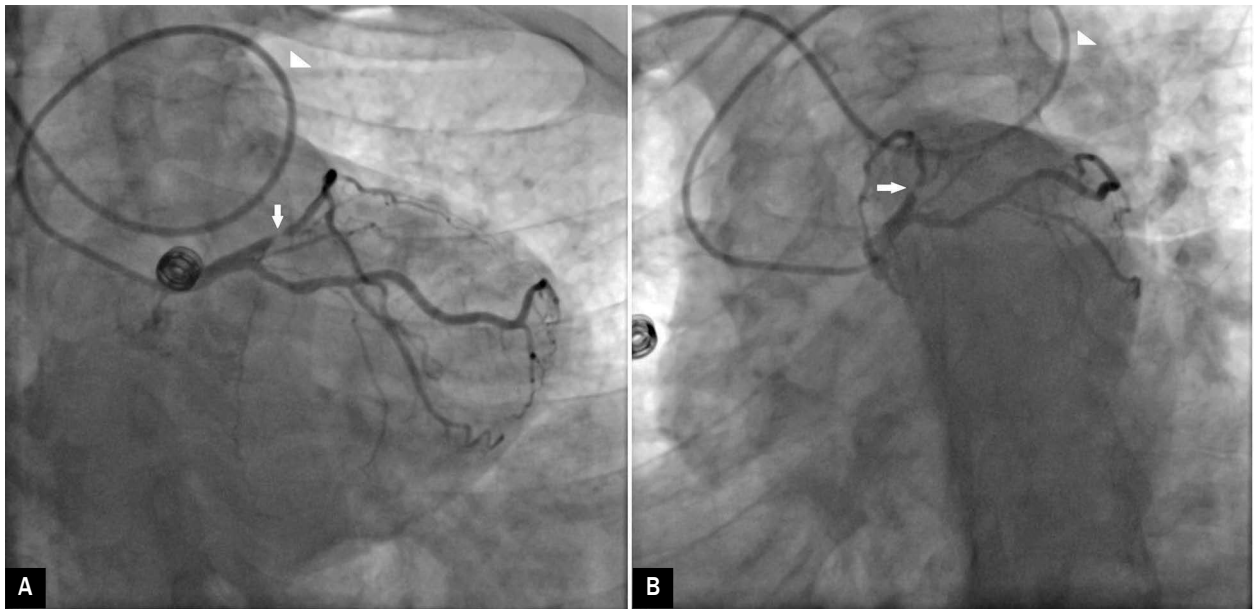

Figure 2. Proximal left anterior descending artery showing critical lesion (white arrow) with characteristic cobra loop (white arrowhead) of diagnostic catheter in the ascending aorta: **A.** Antero-posterior caudal view; **B.** Left anterior oblique caudal view

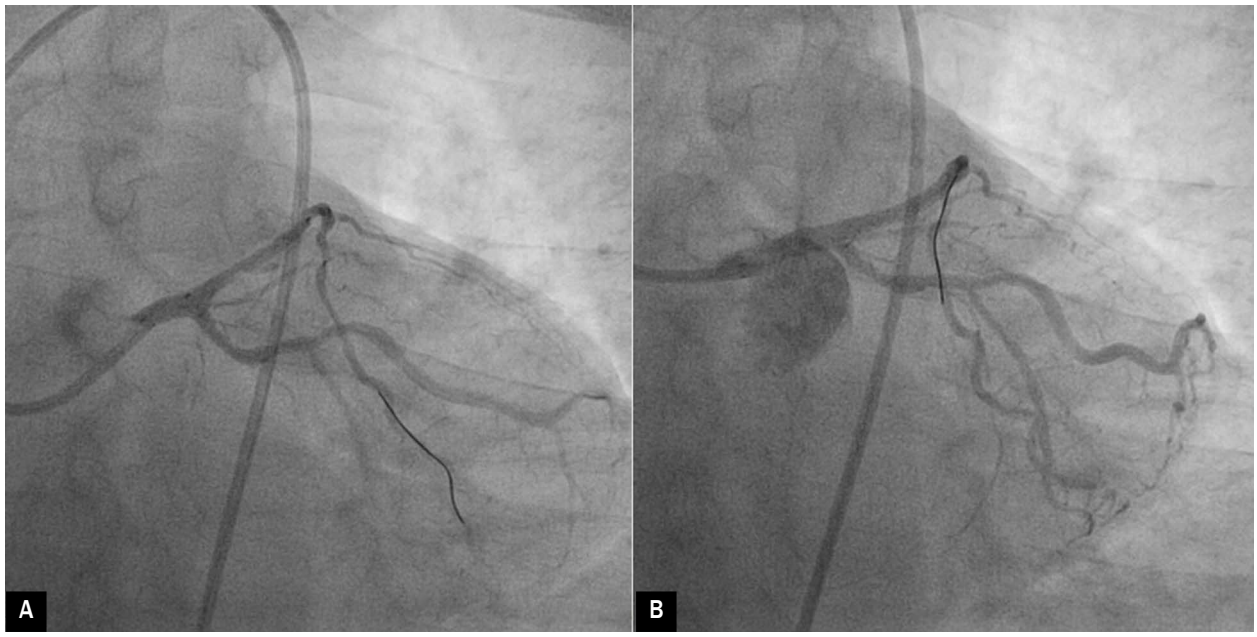

Figure 3A, B. Proximal left anterior descending artery stented with 3.5 × 23 mm Xience Prime everolimus-eluting stent

cannulating the coronaries through the right radial route, we switched to a right transfemoral route for percutaneous intervention with further administration of 7,000U. Left main trunk was cannulated with a 6 F extra back up (EBU; Medtronic, USA) guiding catheter and a 0.014" runthrough guidewire (Terumo, Japan) was parked in distal LAD (Figure 3). Lesion was pre-dilated with 2.5 × 10 mm Minitrak balloon (Abbott, USA) to 12 atm and stented by deploying 3.5 × 23 mm Xience Prime stent (everolimus drug-eluting stent, Abbott, USA) up to 13 atm pressure and further post dilated by 2.75 × 10 mm Minitrak non-compliant balloon up to 20 atm pressure achieving TIMI 3 flow (Figure 3). Radial sheath was removed and compression was performed for 2 h with a radial compression device (TR band; Terumo, Japan) using the 'patent haemostasis' protocol. TR band was removed two hours after sheath removal, and a light

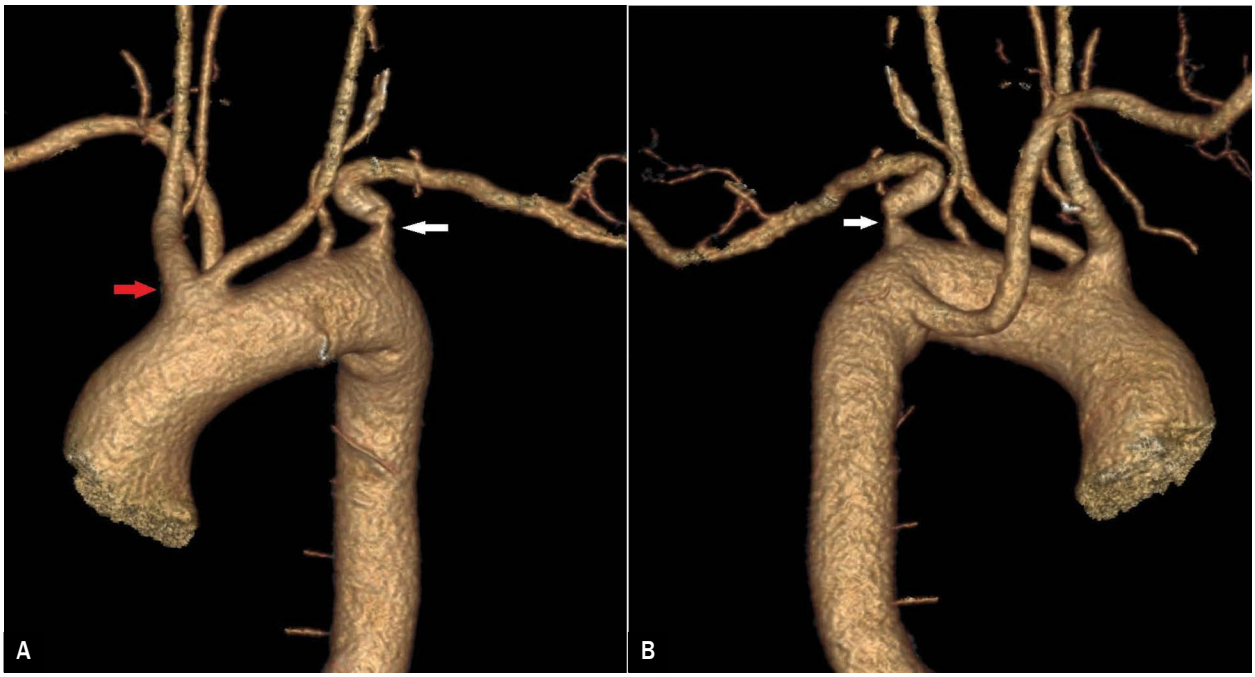

Figure 4A, B. MDCT contrast aortography showing the origin of the right subclavian artery in the right posterior side of the horizontal aorta with a tortuous course, proximal stenosis of left subclavian artery, and a bicarotid truncus (red arrow; **A**: anterior surface of aorta; **B**: posterior surface of aorta)

pressure bandage was applied which was removed the next day. Multi detector computed tomography (MDCT) contrast aortography showed the origin of the right subclavian artery in the right posterior side of the horizontal aorta with a tortuous course, proximal stenosis of left subclavian artery (LSC), and a bicarotid truncus. **Bicarotid truncus** was the common origin of both the left and the right carotid arteries (LCC, RCC) (Figure 4). Intervention of left subclavian artery was planned in a staged manner. She was discharged with aspirin 150 mg/day, prasugrel 10 mg/day, atorvastatin 80 mg/day, metoprolol 100 mg/day and ramipril 2.5 mg/day. She has been doing well since then, with regular follow-ups at our institute.

Discussion

The RORSA, the most common congenital aortic arch anomaly which was first reported by Hunald in 1735, has a prevalence of 0.4–2% [8]. Involution of the fourth vascular arch, along with the right dorsal aorta, leaves the seventh intersegmental artery attached to the descending aorta. It is an outcome of persistence of seventh intersegmental artery which assumes a retro-oesophageal position as it proceeds out of the thorax into the right arm. This condition is usually asymptomatic, but can present as dysphagia lusoria because of tracheoesophageal compression. The presence of a RORSA should be suspected in cases in which catheterisation of the coronary arteries appears difficult as it arises from the distal and posterior aspect of the horizontal part of the aortic arch at its junction with the descending aorta, favouring entry of guidewire into the descending aorta. Challenges are encountered at two particular stages: while entering the ascending aorta through arteria lusoria, and while cannulating coronary arteries. Catheter and guidewire have a tendency to enter the descending aorta. In the antero-posterior (AP) projection, the catheter in the RORSA at its origin is more toward the left and engages the ascending aorta with a peculiar angulation which gives it a 'cobra loop' (Figures 5, 6). Since the brachiocephalic trunk is the first branch of the aortic arch, access to the ascending aorta is usually easy through the right radial approach. In some difficult cases, especially those with tortuous subclavian arteries, anticlockwise rotation of the catheter while the patient holds his breath in deep inspiration facilitates access to the ascending aorta. In the presence of a RORSA, this manoeuvre alone is insufficient, necessitating the use of catheter support and anticlockwise rotation and a 0.035-inch wire in order to engage the ascending aorta [9].

Firstly, the guidewire should be pushed to proximal part of descending aorta over which catheter should be pushed. Then, catheter and guidewire as an assembly should be withdrawn. After asking the patient to take a deep breath, the 0.035" standard guidewire should be

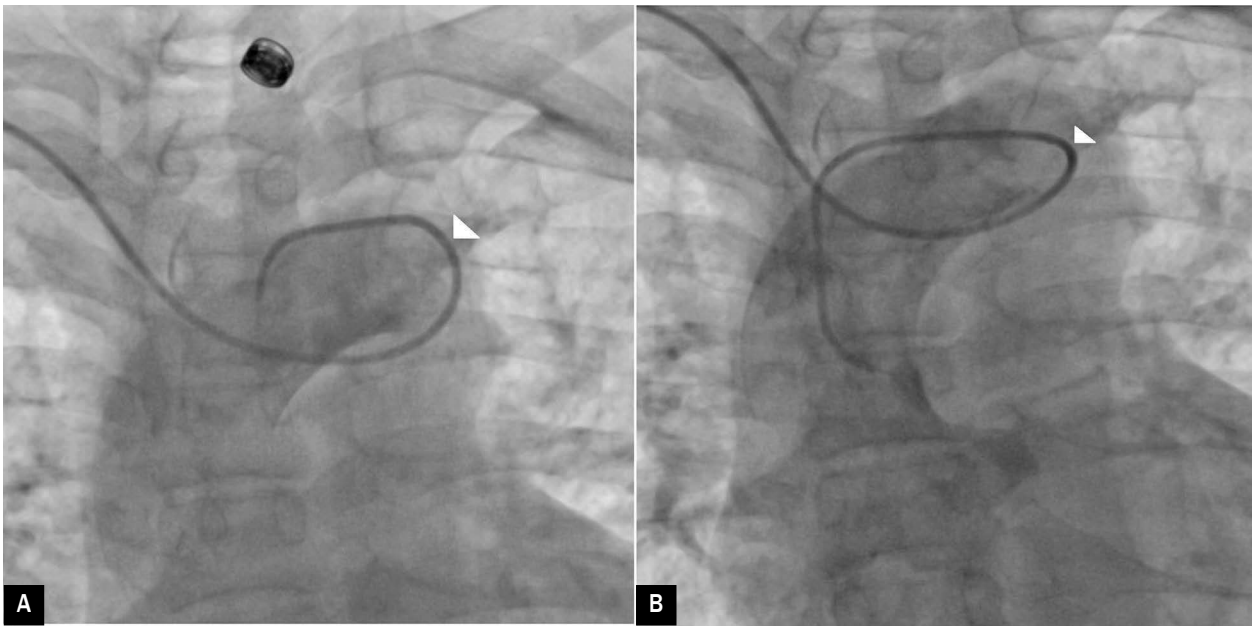

Figure 5. Characteristic cobra loop (white arrowhead) of diagnostic catheter in the ascending aorta in antero-posterior projection which is the sine qua non of **arteria lusoria**

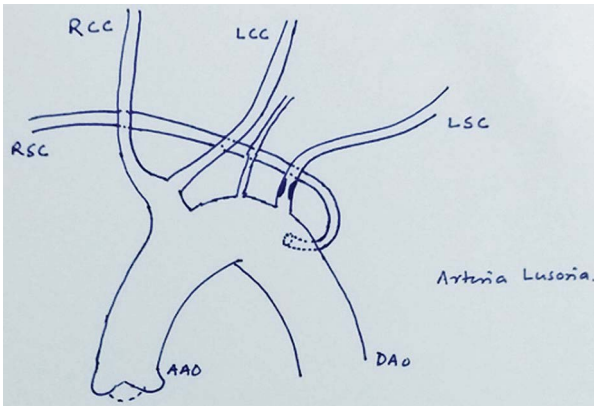

Figure 6. Artist's impression of **arteria lusoria** with bicarotid truncus

gently pushed. If guidewire enters the ascending aorta effortlessly, the catheter should be pushed over the guidewire. If this is not successful, the guidewire should be kept in the descending aorta and the catheter (Judkins right/left, TIG) should be changed to a left internal mammary artery (LIMA) catheter which should be again put into descending aorta and the same manoeuvres tried, which should bring success. If the 0.035" standard guidewire fails to facilitate its entry into ascending aorta, it should be replaced with a 0.32" or a 0.25" hydrophilic Terumo guidewire which facilitates its relatively easy entry into ascending aorta. Left anterior oblique view is a better view compared to straight AP view. Once the catheter and guidewire are in the ascending aorta, coronaries can be cannulated in the usual fashion, which sometimes is easy. In a case of failure, standard wire should be changed to super-stiff guidewire, a loop of it to be made in ascending aorta, and the catheter should be slowly slid over it so that an assembly of catheter and guidewire can be formed. This assembly should be slowly pulled back while pulling the tip of the wire into mouth of the catheter. This will facilitate the cannulation of left coronary ostium. Right coronary artery should be cannulated while pulling and a giving a clockwise rotation. For diagnostic purposes, JL, Optitorque TIG, Amplatz left (AL) catheter and Amplatz right (AR) catheter should be the default choice for left and right coronary ostia respectively. At any stage during cannulation, it should not be pushed too much because the assembly may flip into the descending aorta. Furthermore, all catheter exchanges should be performed over a long exchange wire.

Although it can appear somewhat complicated, arteria lusoria is very rare. Its cannulation requires a little patience to complete the procedure. If the first few attempts to enter the ascending aorta are unsuccessful, one should switch to a right transradial route. In most cases, the abovementioned manoeuvre will be helpful, but beginners should avoid working through the transradial route in such a situation, switching instead to the transfemoral route.

Conflict(s) of interest

The authors declare no conflict of interest.

Streszczenie

Zaprzełykowa prawa tętnica podobojczykowa (ROSRA, inaczej: tętnica błądząca [*arteria lusoria*]) to jedna z nieprawidłowości anatomicznych napotykanych w obrębie odejścia tętnicy bezimiennej od łuku aorty w trakcie zabiegu cewnikowania z dostępu przez prawą tętnicę promieniową. W niniejszej pracy opisano przypadek 49-letniej kobiety z objawami przewlekłej stabilnej dławicy piersiowej (III klasa wg *Canadian Cardiovascular Society*) utrzymującymi się mimo zgodnego z wytycznymi leczenia farmakologicznego. Kaniulacja tętnic wieńcowych była utrudniona; stwierdzono krytyczne zwężenie w proksymalnym odcinku tętnicy przedniej zstępującej (LAD). W trakcie angiografii cewnik diagnostyczny w aorcie wstępującej wygiął się w dziwny sposób, przybierając kształt pętli „typu kobra". Ponieważ w proksymalnym odcinku lewej tętnicy podobojczykowej również znajdowało się krytyczne zwężenie, skuteczną przezskórną interwencję wieńcową w proksymalnym odcinku LAD z umieszczeniem stentu uwalniającego ewerolimus 3,5 × 23 mm Xience Prime (Abbott, USA) przeprowadzono z dostępu przez prawą tętnicę udową. W wielorzędowej tomografii komputerowej ze środkiem cieniującym stwierdzono, że prawa tętnica podobojczykowa odchodzi w prawej tylnej części poziomego odcinka aorty i ma kręty przebieg. Uwidoczniono również zwężenie w proksymalnym odcinku lewej tętniczy podobojczykowej oraz dwunaczyniowy pień tętniczy. Tę nieprawidłowość można łatwo wykryć w angiografii, w projekcji przednio-tylnej na podstawie kąta wygięcia cewnika, kiedy wchodzi do aorty wstępującej, a także w angiografii manualnej w punkcie odejścia prawej tętnicy podobojczykowej. W takim przypadku wybiórcze cewnikowanie obu tętnic może być bardzo trudne oraz czasochłonne i wymagać użycia dodatkowych cewników. Jeśli w takich przypadkach nie można wykorzystać dostępu przez tętnicę promieniową, to należy bez wahania zmienić dostęp na przezudowy.

Słowa kluczowe: tętnica błądząca, pień tętniczy, pętla „typu kobra", połączenie tętnica bezimienna–łuk aorty, zaprzełykowa prawa tętnica podobojczykowa (ROSRA), cewnikowanie z dostępu przezpromieniowego

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