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Clinical Case Update

Transradial Intervention for STEMI: Complex Anatomy and Solution

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The benefits of using the transradial approach for diagnostic and interventional coronary procedures are well established and documented in the literature. Its use in more time-limited situations such as a ST-segment elevation myocardial infarction (STEMI) requires that physicians be able to deal not only with access issues but also the range of clinical presentations. Because acute coronary syndrome (ACS) and STEMI patients require aggressive anticoagulation requiring dual anti-platelet therapy, bleeding risk is substantial when therapy is coupled with the parental anticoagulant (intravenous UFH, bivalirudin, enoxaparin, and fondaparinux).[1]

Several studies — including ACUITY and HORIZONS-AMI — have examined bleeding implications and found major bleeding to be a powerful independent predictor of 30-day mortality in patients whose ACS had been managed invasively.[2,3] Based on this information, the use of bivalirudin to prevent bleeding has gained increasing favor. However, bleeding remains an issue because use of the transfemoral approach predominates.

Certainly, many inexperienced operators facing an urgent situation such as STEMI might assume the transfemoral approach is preferable, as it minimizes door-to-balloon (D2B) time. However, D2B time does not vary by approach in the hands of an experienced transradial operator.[4]

Case Report

A 58-year-old unemployed male reported abrupt onset of 4 hours of increasing chest pain that intensified during the 30 minutes before a call to 911. It was described as pressure located in the central chest area without radiation and, at its maximum, was described as moderate in intensity. The patient complained of nausea, dyspnea, and diaphoresis.

At the time of the fire rescue team's assessment, blood pressure was 208/110, pulse 90, respiration 22, and O2 saturation 99% on room air. Fire rescue treated and transported the patient to our facility — a tertiary care and flagship hospital for Baptist Health South Florida with a comprehensive, 124-bed cardiovascular center — arriving at the emergency department door within 30 minutes of having received the 911 call. The patient had been given ASA 81 mg x 4 and sublingual nitroglycerine, per STEMI protocol.

Upon arrival, an EKG showed ST elevation in the inferior leads and reciprocal changes in the lateral leads consistent with acute inferior-wall STEMI. The STEMI team was notified, and treatment progressed pending transport to the cath lab.

Patient history was significant for poorly controlled Type II diabetes, hypertension, and prostate cancer (treated surgically). The patient stated he was a nonsmoker, did not use alcohol or recreational drugs, was not under the care of a physician, and was on no medications.

Per STEMI protocol, the patient was given 600 mg of clopidogrel orally and 4000 units of heparin intravenously. This was followed by additional nitroglycerin 0.4 mg sublingually x 2, metoprolol 5 mg IV x 3, and morphine 2 mg IV. When the STEMI team arrived, BP was 110/63, HR 70, RR 26, and O2 saturation 100 percent on nasal cannula at 2 liters/minute. The patient continued to report his pain as 4/10. Transport to the cath lab took place within 35 minutes of arrival at the ED.

Procedure

The integrity of the right palmar arch of the radial artery was evaluated via modified Allen test and was assessed to be normal. It was prepared along with the bilateral groin access site. After lidocaine administration, a 6 Fr introducer was placed in the right radial artery, followed by administration of a

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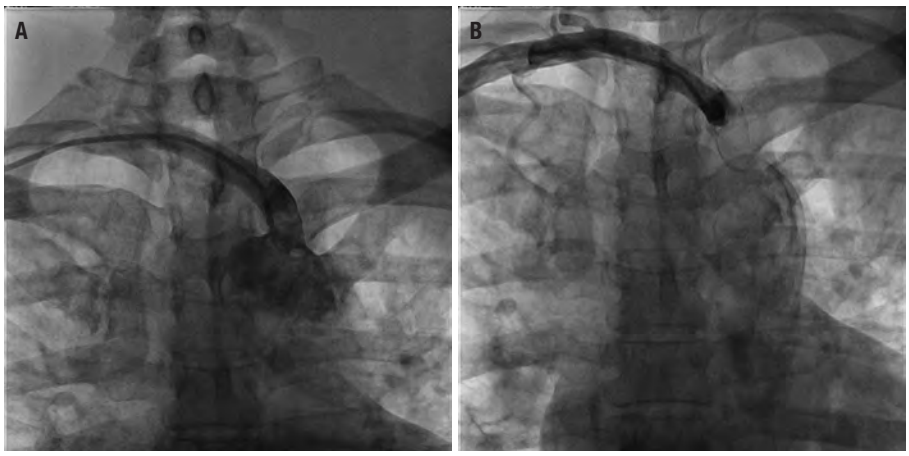

Figure 1. Angiographic injection was performed to determine whether the patient exhibited bovine arch. Review of the angiograph revealed arteria lusoria.

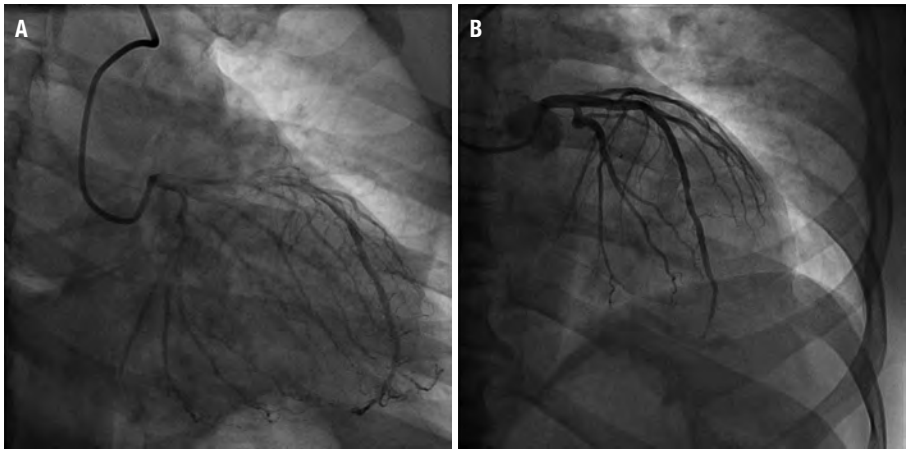

Figure 2. Once in the ascending aorta, the pigtail catheter was exchanged for the Kimny guide, and coronary cannulation was performed.

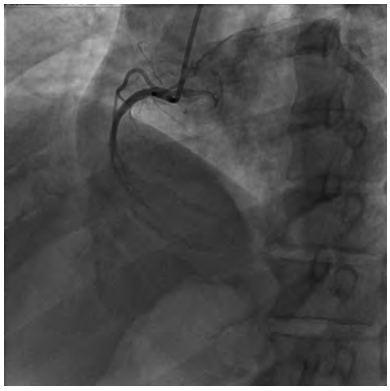

Figure 3. The distal RCA was totally occluded with TIMI flow 0; aspiration thrombectomy was performed.

Figure 1) while the staff started to prep the left radial for possible use. Review of the angiograph revealed that the patient had an aberrant right subclavian artery (arteria lusoria) originating from the descending thoracic aorta, creating a 70° angle into the ascending aorta. Reaching the coronaries would require that the wires double back from the descending aorta into the ascending aorta. There would be, of course, a risk of dissection from using a stiff wire to attempt to negotiate this angle.

To avoid prolonging D2B time, a change of access site was considered. This idea was rejected after it was determined it would be possible to use an angulated pigtail catheter with a soft-tip floppy wire, such as the Benson wire, to access the ascending aorta. Thus the Kimny guiding catheter was exchanged for a 6 Fr pigtail catheter. This was successfully advanced over the soft wire into the ascending thoracic aorta.

Once in the ascending aorta, the pigtail catheter was exchanged for the Kimny guide, and coronary cannulation was performed (see **Figure 2**). The culprit vessel was the right coronary artery (RCA). In most cases, a single Kimny guide catheter is used to cannulate both coronary arteries. However, due to the angulation created by the anomaly (arteria lusoria), the Kimny catheter did not provide proper coaxial engagement of the right coronary ostium. It was exchanged for a JR 4.0 6 Fr guide over a .038 J exchange wire.

The distal RCA was totally occluded with TIMI flow 0 (see **Figure 3**). It was crossed with a 180 cm 0.14 Prowater coronary wire. Aspiration thrombectomy was performed with an Export catheter; a large amount of thrombus was removed from the vessel, reestablishing TIMI flow 3 with a residual 90% focal stenosis before the bifurcation of the distal RCA. This lesion was treated with a 3.0 x 12 mm bare-metal stent at 14 atmospheres with excellent final results (see **Figure 4**) and a D2B time of 59 minutes.

verapamil-lidocaine cocktail to reduce vasospasm. A bilvalirudin bolus of 0.75 mg/kg was given (53.75 mg), with infusion of 1.75 mg/kg/h (127.75 mg) at 5 mg/ml concentration.

A 6 Fr radial guiding catheter was advanced into the right subclavian artery and appeared to go directly into the descending aorta, despite repeated attempts to access the ascending aorta. At first it was thought this was a case of bovine arch. Angiographic injection was performed (see

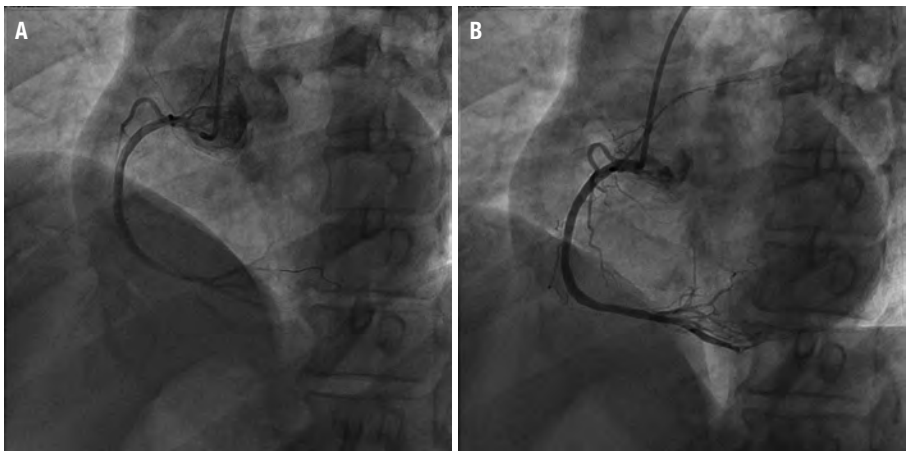

Figure 4. The lesion was treated with a 3.0 x 12 mm bare-metal stent at 14 atmospheres with excellent final results and a door-to-balloon time of 59 minutes.

Figure 5. The right subclavian artery originates directly from the descending thoracic aorta distal to the left subclavian, creating approximately a 70° angle into the ascending aorta.

Discussion

This case report illustrates the importance of maximizing best practices in an urgent STEMI presentation. The patient had no insurance, no regular healthcare provider or care, uncontrolled diabetes, and cardiovascular disease, and is unlikely to return to our facility for regular wellness visits. It was important to intervene and gain the best benefit from that intervention for the patient's ongoing wellbeing. Accommodating the anatomic variation without resorting to transfemoral access was important to avoid a bleeding complication and a negative outcome at 30 days.

Particularly in STEMI, reducing the likelihood of bleeding events is essential. Pairing the transradial approach to coronary cannulation with the use of bivalirudin ideally addresses this need to limit the possibility of post-procedure access-site complications. The HORIZONS-AMI trial documented the overall reduction in bleeding through the use of bivalirudin. At the 3-year follow-up, the value of having used bivalirudin was still apparent.[5]

When interventionalists who are comfortable with transradial access use it to treat STEMI, D2B times are not extended. Brodie et al[6] looked at the HORIZONS-AMI and CADILLAC trials and noted that D2B time under 90 minutes was of particular importance in high-risk patients presenting early. Determination of the risk for bleeding and mortality in ACS patients was quantified by a risk score to predict events.[7] Applying Mehren's risk score to this patient is as follows:

- Gender — male = 0
- Age years — 50–59 = +3
- Serum creatinine 1.4 = +5
- WBC count 14 = +5
- Anemia — no = 0
- Presentation — STEMI = +6
- Antithrombotic medications — heparain plus a GP = 0
- Use of bivalirudin = –5
- Total score for this patient = 19.

The patient was assessed to be at high risk (scores of 15–19) for incidence of non-coronary artery bypass graft-related major bleeding at 30 days and for subsequent mortality at 1 year. His uncontrolled diabetes was not scored as a risk factor, but would certainly be an additional factor to consider.

That score accounts for patient factors and the use of particular antithrombotics when determining the risk level inherent in a particular patient presentation. Thus, combining bivalirudin and transradial access would seem to impart a definite advantage in STEMI patients without slowing D2B time. Unexpected situations once access is attained can certainly present a roadblock to the reduction of risks overall. This case report presents just such a situation and can serve as a learning experience for anyone using the transradial approach in general.

This case report describes the unique presentation of a congenital anomaly (occurring in 1–2% of the population) — arteria lusoria, or aberrant right subclavian artery — in a STEMI patient. The anomaly occurs during embryonic formation and

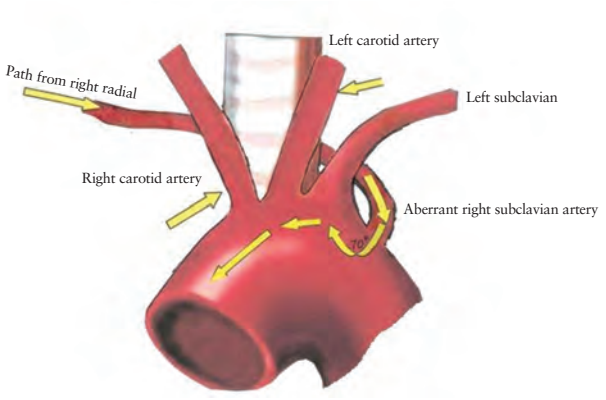

Figure 6. Arteria lusoria doesn't interfere with transfemoral access to the coronaries, but impedes access when right transradial access is attempted.

may be associated with other genetic abnormalities; in many patients it is asymptomatic and discovered only during the course of imaging. The right subclavian artery originates directly from the descending thoracic aorta distal to the left subclavian (see **Figure 5**), creating approximately a 70° angle into the ascending aorta. In 80% of cases, it runs behind the esophagus.

Arteria lusoria doesn't interfere with transfemoral access to the coronaries, but presents a challenge to right transradial access. It can be discovered by the interventional cardiologist only during the course of treatment, when access via the right radial is impeded (see **Figure 6**). It's possible to dissect the right subclavian artery and aorta from repeated attempts to negotiate the 70° angle into the ascending aorta. In planned procedures, switching to the left radial or to transfemoral access is easily accomplished. However, the patient's emergent STEMI in this case made it vital to identify and treat the culprit vessel.

Conclusions

It was fortunate that a method to negotiate this rare presentation was improvised before right radial access was abandoned. The intervention did require additional wire and catheter exchange — but it did not affect the outcome, and D2B time was 59 minutes. Although this anomaly is fairly rare, interventionalists are sure to encounter it as transradial access becomes more prevalent.

This challenge can be overcome by using an angulated pigtail catheter and soft floppy wire to successfully negotiate the angle into the ascending aorta. These tools can avoid complications, such as dissection of the subclavian and ascending aorta, that could occur in conjunction with transradial technique.

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