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A case of stroke during cardiac catheterisation: It's not common, but it is a double whammy!

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ABSTRACT

Ischaemic stroke during or just after cardiac catheterisation is rare but catastrophic to the patient when it happens. The incidence rate is low in the range of 0.08%–0.40%. Risk factors include diabetes mellitus, hypertension, increased age, prior stroke and renal impairment. The type of catheter used, catheter manipulation technique, emergency procedures and use of intra-aortic balloon pumps are some predictors of this complication. We report a case of a 57-year-old lady with acute myocardial infarction who developed stroke on the cardiac catheterisation table. The case illustrates the need for a protocol of care, vigilant cardiologist and staff who can recognise the symptoms and signs as well as good collaborative efforts between the cardiology, neurology and, at times, the interventional radiology teams.

1. Introduction

Coronary angiography and cardiac catheterisation have become invaluable in the management of coronary artery disease these days. As compared with other procedures, there are always associated risks ranging from the minor and inconsequential to the more major ones. Cerebrovascular complications represent a group of complications where the incidence rate is relatively low but it can be debilitating with high morbidity and mortality rates^[1–6].

These risks can be higher with coronary interventions which are done on an emergency basis where guiding catheters are commonly utilised. When multiple equipment exchanges take place at the aortic root level, aggressive anticoagulation is used and procedures are of longer duration^[1,2,4,5].

Patients have also been noted to be at higher risks for cerebrovascular events if they received more contrast agents, and they had the procedures for urgent reasons or had intra-aortic balloon counterpulsations, as these conditions were often associated with significant haemodynamic compromise^[1,4,5].

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The following case report is one such example where a patient developed stroke whilst undergoing cardiac catheterisation for a ST-elevation myocardial infarction (STEMI).

2. Case report

2.1. In the emergency department

A 57-year-old lady presented to the emergency department (ED) after she had a near fainting episode. She was on a train in a standing position when she felt unwell with cold sweats and giddiness. She claimed she was about to pass out, then she was offered a seat by a passenger and she gradually felt better. There was no episode of chest pain or shortness of breath. She was able to walk up two flights of stairs when she alighted from the train and then took a taxi to the ED for an assessment. She has no past medical history and is a non-smoker. There was no family history of any illnesses. On arrival, her vital signs were stable and her initial electrocardiograph was normal. Examination did not show her to be in heart failure and there was no postural drop in the blood pressure.

Her blood was sent to the laboratory. Whilst waiting for the result, she developed some vague central chest discomfort. A repeat 12-lead electrocardiograph showed mildly elevated ST-segments (1 mm) in the inferior leads. She was then sent to the resuscitation room, placed on cardiac monitors and given aspirin and ticagrelor, and the cardiac catheterisation laboratory

was activated for immediate percutaneous coronary intervention (PCI) after she consented to the procedure.

Her cardiac marker, troponin T result was 710 ng/L (normal being < 30 ng/L). Her full blood count, renal function and electrolytes were all in the normal range.

2.2. In the cardiac catheterisation laboratory

The PCI results showed total occlusion of the proximal right coronary artery (pRCA) and diffusion of the left anterior descending coronary artery disease. Primary PCI was done to the RCA lesion. Thrombosuction was carried out with Thrombuster II and predilated with 2.0 balloon. One drug eluting stent was inserted in the pRCA. It was then noted that the patient developed ventricular fibrillation on the cardiac monitor. A direct current shock was delivered immediately and she converted to sinus rhythm with return of spontaneous circulation. The final angiography showed TIMI 3 flow (thrombolysis in myocardial infarction).

It was then noted that the patient had developed expressive aphasia and dense right hemiparesis. Immediate neurology and interventional radiology consultations were made and it was decided that the patient should have an 'on the table' cerebral angiography. This confirmed a occlusion of the left middle cerebral artery. In view of her STEMI, intravenous (IV) thrombolysis was not decided upon. She underwent an immediate CT brain to exclude intracranial haemorrhage. Immediate intra-arterial (IA) thrombolysis with alteplase was then performed. This restored the blood flow and post procedure, her Glasgow coma score was 14 and she was able to move the affected limbs and maintain elevation for 10 s.

2.3. Post-event developments

She was managed in the coronary care unit. A 2-D echocardiography showed no thrombus.

On the next day, a brain magnetic resonance imaging (MRI) showed acute infarct of the left MCA. The magnetic resonance angiography confirmed a non occlusive thrombus. The ultrasound of her carotids showed a hard plaque causing 20% stenosis in the right carotid artery. At the mid-to-distal segment of the left common carotid artery there was hard plaque causing up to 25% stenosis.

Her lipids assessment came back high and she was started on statins. She continued to improved and underwent rehabilitation. Her functional recovery was optimised, then she was discharged 5 days after admission and given outpatient follow-up appointments at the cardiology and neurology clinics.

3. Discussion

Peri-procedural stroke with cardiac catheterisation is infrequent with reported rates ranging between 0.08% and 0.40%^[1-7]. More than half of these cases occur in the posterior cerebral circulation or the vertebro-basilar circulation, despite the fact that only a third of the blood flowing to the brain goes through the latter and two thirds passes through the carotid system^[3-6]. The anatomy of the branching from the aortic arch has been postulated to favour small emboli entering the vertebral arteries. It is important to understand this as the patient may develop visual field defects and gait abnormalities

in the peri-procedural period and may not be easily recognisable by the cardiologist, thus, making it possible to be missed or overlooked initially^[3,5,7].

Strokes were also more often noted when the interventional procedures were done on an emergency basis as compared to the elective ones^[1,7-9]. There has also been observations made that the occurrence of stroke was also more common when the patients had a history of diabetes mellitus, hypertension, prior stroke and renal failure. Those who required intra-aortic balloon counte-pulsations support were also found to be at higher risk of a stroke, likely due to the haemodynamic compromise they experience. In this group of patients, the procedures were also more likely to be carried out on an urgent basis^[3,5,6,8-10].

These strokes tend to be embolic in nature and could have several postulated origins. These include dislodged calcified plaques around the aortic valve area in retrograde catheterisation which can lead to brain embolization, catheter tips traversing the aortic arch area and dislodging atheromatous plaques which can embolize to the cerebral circulation and causes embolization from the thrombus formation *in situ* on catheter tips during procedures^[8-11]. Multi-purpose guiding catheters have been shown to more frequently dislodge atheromatous debris from the aorta as compared to other catheters. This is most likely due to its design^[12-15]. Gaseous emboli can also occur and is usually caused by the entry of micro-emboli during the injection of contrast or saline. Small gaseous micro-emboli are common and often undetected, but the solid embolis are the ones often associated with brain injury^[11,16]. The effect of the route of access chosen by the cardiologists on embolization has not been definitively established. Cerebral embolization often occur during catheter advancement, flushing and contrast injection. There also have been some correlation between the number of micro-emboli and the volume of contrast utilised^[17]. Patients who have atherosclerotic aortic debris and peripheral vascular disease (who generally tend to be older) are also at higher risk of the embolization process.

Peri-procedural stroke can occur during or within a few hours of the procedure^[1,10,12]. Once the signs and symptoms are detected, it is important to ascertain if there are other reversible causes or differential diagnoses. Hypoglycaemia, seizures, migraine attacks or encephalopathy may need to be ruled out. It is also important not to forget the drugs and sedatives which may have been used during the procedure, as these may have an effect on mental state or cause respiratory depression especially if administered in higher doses. Once the definitive diagnosis of stroke is made, the best treatment would have to be decided^[1,2,12,13]. The majority of patients with peri-cardiac catheterisation stroke have been reported to have unfavourable outcomes with at least moderate disability or coma. Patients with large vessel strokes tend to be worse^[9,12,14,15].

In terms of investigations for these patients, there are CT, MRI or even diffusion-weighted MRI (DMRI). MRI is more sensitive than CT especially in the early phases. Transcranial Doppler is also used and it is a non-invasive technique. If the femoral sheath is still in place, cerebral angiography can be done quickly. This can better define the thrombus morphology and extend and degree of occlusion as well as the presence of collaterals. This provides the opportunity for very rapid administration of IA thrombolysis, as was done in our patient. IV thrombolytics with recombinant tissue plasminogen activator within three hours of the onset of stroke is the usual treatment

for strokes with no contraindications. However, with per-procedural strokes, the concern is haemorrhage. IA thrombolytics in heparinised patients is also not recommended due to the higher risk of haemorrhagic transformation^[12–15,18–22].

The rates of canalization in the proximal middle cerebral artery is higher with IA thrombolysis than IV thrombolysis with quoted rates being 70% versus 30%^[20,22,23].

Mechanical microemboli disruption has also been tried as an adjunctive technique with IA thrombolysis^[21]. Others have attempted delivery of laser energy, ultrasound devices or the Neurojet (an angiojet device used in removal of clot in the coronary circulation)^[23,24]. Angioplasty and stenting has also been attempted at the Cleveland Clinic^[25].

Peri-procedural stroke is an iatrogenic complication. If it can be rapidly diagnosed and acted upon, a short event-to-treatment time can be achieved. A protocol or pathway for its management must be available in institutions offering cardiac catheterisation services and cardiologists must be made familiar with the diagnosis and management protocols. Neurologists and the stroke teams must also be activated to get involved early and assist in making the collaborative decision for each patient.

Conflict of interest statement

The author reports no conflict of interest.

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