

**CASE REPORT**

# Methaemoglobinaemia after cardiac catheterisation: a rare cause of cyanosis

L Kaendler, A Dorszewski, I Daehnert

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Two young women had unexpected cyanosis a few hours after cardiac catheterisation for electrophysiological investigation. The first patient had atrioventricular septal defect, had undergone repeated surgical interventions, and was referred because of atrial flutter. The second patient had ablation of an accessory pathway in Wolff-Parkinson-White syndrome. Local anaesthesia was performed with 40 ml prilocaine 2%. Cyanosis with oxygen saturation of 85% developed in both patients a few hours after the electrophysiological investigation. The patients were transferred to the intensive care unit and for the first patient a considerable diagnostic effort was made to rule out morphological complication. Finally methaemoglobinaemia of 16.7% and 33.4%, respectively, was found. Cyanosis resolved within 24 hours and did not reappear. Underlying glucose-6-phosphate dehydrogenase deficiency and erythrocyte-methaemoglobin reductase deficiency were ruled out. Physicians should be aware of this rare side effect of local anaesthetics in patients with unexpected cyanosis.

Cyanosis caused by methaemoglobinaemia is a rare condition beyond infancy. Methaemoglobin is the oxidised form of haemoglobin, and cannot bind and transport oxygen. Normal concentration accounts for less than 1% of circulating haemoglobin. The concentration is increased in heterozygous carriers of variants of the M chain of the haemoglobin molecule, who are cyanotic life long. Homozygous carriers have a dramatically reduced life expectancy.<sup>1,2</sup> Under normal conditions methaemoglobin is reduced in the erythrocytes to haemoglobin by methaemoglobin reductase.<sup>3</sup> The NAD phosphate enzyme system (NADPH3), which needs glucose-6-phosphate dehydrogenase (G6PD) as a cofactor, is an important alternative pathway.<sup>3</sup> So G6PD deficiency and methaemoglobin reductase deficiency have to be ruled out in cases of methaemoglobinaemia. Nevertheless, methaemoglobinaemia can rarely occur in patients with normal enzyme activity and normal haemoglobin under the influence of oxidants such as topical anaesthetics, sulfonamides, and nitrates.

## CASE REPORT

### Case 1

A 31 year old woman with atrioventricular septal defect had undergone repeated surgical interventions, among them mitral valve replacement after infective endocarditis. She was referred for electrophysiological investigation because of atrial flutter. Local anaesthesia of both groins was performed with 800 mg of prilocaine (13.5 mg/kg). Striking cyanosis with oxygen saturation of 85% emerged after the investigation. The patient felt otherwise well. Nevertheless she was

transferred to the intensive care unit and received 2 l/min of oxygen through a nasal tube. Treatment with heparin was started. Echocardiography and radiography were performed to exclude pulmonary embolism and disturbances of the mechanical valve. Finally, two and a half hours after local anaesthesia methaemoglobin was found to be 16.7%, decreasing to 1.7% next morning. Methaemoglobin reductase activity and G6PD activity were normal.

### Case 2

A 16 year old girl with Wolff-Parkinson-White syndrome had catheter ablation of the accessory bundle. Four punctures of both groins were performed to position the catheters. Local anaesthesia of both groins was performed with 40 ml prilocaine 2% (800 mg equivalent to 18 mg/kg). Notable cyanosis with oxygen saturation of 85% appeared three hours after the beginning of the investigation. Apart from vomiting she remained free of symptoms with 2 l/min of oxygen supply. Morphological complications were ruled out by echocardiography and radiography of the thorax. Methaemoglobin concentration was found to be 33.4% three hours after the beginning of the investigation and diminished slowly to 3.7% by the next morning. Methaemoglobin reductase and G6PD were normal.

## DISCUSSION

Methaemoglobinaemia is a rare complication in the use of local anaesthetics. It was seen in epidural infusion of lidocaine, after local anaesthesia with benzocaine for gastrointestinal endoscopy, after anaesthesia with prilocaine for removal of teeth, and after local anaesthesia for transoesophageal echocardiography.<sup>4-7</sup> Until now methaemoglobinaemia after cardiac catheterisation has not been reported. An early study on dose response by Nolte and colleagues<sup>8</sup> showed a great interindividual variation in methaemoglobin formation after subcutaneous and intramuscular injection of prilocaine. Prilocaine was much more rapidly absorbed by the synovium than by subcutaneous tissue for arthroscopy.<sup>9</sup> Scott and colleagues<sup>10</sup> observed methaemoglobinaemia in every patient given more than 900 mg of prilocaine for intercostal or epidural blockade. If necessary, methaemoglobinaemia can be treated with 1 mg/kg methylene blue intravenously, which was not necessary in our patients.

The recommended maximum dose of prilocaine is 8 mg/kg,<sup>2</sup> so both of our patients were accidentally overdosed (13.5 mg/kg and 18 mg/kg, respectively).

Keeping in mind the great interindividual differences in methaemoglobin response reported by Nolte and colleagues,<sup>8</sup> one should be aware of this side effect even among patients treated with no more than the recommended doses of local anaesthetics. This awareness may help to recognise methaemoglobinaemia promptly and avoid unnecessary diagnostic procedures.

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