CASE REPORT

A case of methaemoglobinaemia

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SUMMARY

Methaemoglobinaemia is rare but should be considered in cases of cyanosis unresponsive to oxygen therapy. An example of this is given involving the accidental ingestion of Amyl Nitrite.

CASE REPORT

A 20-year-old girl attended the accident and emergency department following a collapse. She was alert and orientated, but complained of headache. Her blood pressure was 80/40 mmHg. Her most striking feature was a blue-grey discolouration of her skin. Oxygen therapy made no difference to her appearance, although blood gas analysis revealed a P_{aO_2} of 46 kPa.

She had been attending a Halloween party, but was not wearing make-up, and admitted taking 'Poppers' (Amyl Nitrite). Instead of inhaling the vapour, she had swallowed the liquid. Amyl Nitrite may produce methaemoglobinaemia, and this was confirmed by analysis of her blood which revealed a value of 30% methaemoglobin. When dropped on to a white sheet, a sample of her blood produced the characteristic chocolate colouration, which is a qualitative test for methaemoglobin. Gastric lavage was performed and she was resuscitated with intravenous colloid and intravenous Methylene Blue. No further complications followed and she was discharged the following day.

DISCUSSION

Methaemoglobinaemia is characterized by increased amounts of haemoglobin where

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the iron of the haem molecule has been oxidized from the ferrous to the ferric state. Its physiological importance, is that this interferes with the ability of the haemoglobin to bind reversibly with oxygen, and causes a shift of the oxyhaemoglobin dissociation curve to the left. If present in large enough quantities, it leads to tissue hypoxia and, ultimately, death. Cyanosis occurs at levels of approximately 15%, but symptoms, such as headache and weakness, are not usually apparent until levels of over 30% are reached. Dyspnoea, acidosis, coma and convulsions occur at between 50 and 60%, and the lethal concentration is in the range of 70–80%. These effects will be made worse if the patient is suffering from anaemia or cardio-respiratory disease.

The condition may rarely be hereditary, but more often is caused by exposure to a wide variety of chemicals or drugs (Curry, 1982). Amongst some of the more common precipitants are nitrites, nitrates, aniline derivatives, sulphonamides and local anaesthetic agents.

Amyl Nitrite is a drug of abuse, inhaled to produce 'highs' and to intensify orgasm. Other properties include vasodilation, enhancement of penile erection, and relaxation of the anal sphincter and rectal smooth muscle. Thus it is most commonly used as an aphrodisiac, but it has also been popular as a 'room odouriser' and even been sprayed in discoteques to stimulate dancing. Its use is usually associated with the teenage or young adult population, especially in the gay community, but has been cited as being the cause of methaemoglobinaemia in a 2-year-old after accidental ingestion (Forsyth & Moulden, 1991).

It is presented as a yellow liquid in a glass ampoule – hence its other name of 'liquid gold', or 'poppers' after the sound made by cracking the ampoule. Therapeutically it has been used in angina, although found to be too short acting to be of value. It has, in the past, also been used to produce methaemoglobin as an antidote to cyanide poisoning, but it is no longer recommended for this purpose (Meredith *et al.*, 1987).

The diagnosis may be suspected from a history of exposure to a causative agent. The cyanosis, classically 'chocolate cyanosis', is not improved by oxygen therapy and in most cases the P_{aO_2} is normal. The saturation shown on a blood gas analysis will also tend to be normal, as this is a calculated value, based on the P_{aO_2} . An oximeter will record a fall in saturation, but will increasingly underestimate the degree of desaturation with increasing levels of methaemoglobin (Anderson *et al.*, 1988). It is important that laboratory estimation of methaemoglobin is undertaken promptly as the level drops quickly *in vitro*. If an assay is not readily available, a drop of blood turns to a characteristic chocolate brown colour when dried on filter paper. This is best recognized in comparison with a drop of normal blood, and when levels are greater than 15%. Similarly a venous sample fails to convert back to the usual red colour when oxygen is bubbled through it (Harley & Celermajer, 1970; Ellenhorn & Barceloux, 1988; Henretig *et al.*, 1988).

Treatment involves oxygen and supportive therapy. If practical the causative agent should be removed by emptying the stomach or removing contaminated clothing. Skin absorption has been reported to cause methaemoglobinaemia, and in one case proved fatal (Harris *et al.*, 1979).

Intravenous Methylene Blue ($1\text{--}2\text{ mg kg}^{-1}$), which facilitates the reduction back to the ferrous state, may be potentially life-saving in severe cases, and has a

relatively wide therapeutic index. It is not without complications and these include haemolysis, bladder irritation, and in high enough doses, it can itself cause methaemoglobinaemia. It is therefore best reserved where the methaemoglobin level is over 30% and/or there are signs of hypoxia.

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