

Lesson of the Week

Hazards of hydrogen peroxide

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Hydrogen peroxide solution is commonly used for irrigating and cleaning wounds. It has some germicidal properties and may remove contaminants mechanically. When it is applied to tissues catalase causes its rapid molecular decomposition with the release of oxygen bubbles (1 ml of hydrogen peroxide 3% (10 vol) will release 10 ml oxygen).¹ Irrigation under pressure or into enclosed body cavities, however, may have serious consequences. We present case reports illustrating two such hazards: oxygen embolus and surgical emphysema.

Case histories

CASE ONE

A 53 year old man presented with pain in his left thigh and groin, anorexia, and a fever of four days' duration. He had a 25 year history of rheumatoid arthritis, for which he was taking prednisolone 13 mg daily.

On examination he was feverish with a temperature of 37.5°C. His cardiovascular system was stable with a pulse rate of 105 beats/minute, sinus rhythm, and a supine blood pressure of 130/80 mm Hg. He had a swollen left thigh and groin with a fluctuant mass, thought to be an abscess tracking from the abdomen. Laparotomy and drainage were thought to be appropriate. Biochemical and haematological variables were normal. Immediate pre-operative treatment included dexamethasone 4 mg, cefotaxime 2 g, metronidazole 500 mg, and physiological saline one litre, all given intravenously.

He was anaesthetised and ventilated with oxygen 33% and nitrous oxide. A minute volume of 9.6 litres produced an end tidal carbon dioxide partial pressure of 38-42 mm Hg, as shown by continuous readout and waveform display (Datascop, Accucap, Cambridge). Additional monitoring consisted of automated recording of blood pressure at intervals of two minutes (Datascop 2100, Cambridge), electrocardiography, and measurement of fractional inspired oxygen concentration.

Laparotomy showed a perforated sigmoid diverticulum with an abscess extending behind the pubis and laterally into the left leg. The diseased bowel was excised and colostomy performed. Anaesthesia proceeded uneventfully, and his systolic blood pressure was stable at 110-120 mm Hg with a heart rate of 110 beats/minute. Estimated blood loss was 500 ml. He had received Hartmann's solution one litre, human plasma protein fraction 500 ml, and dextrose 4% and saline 0.18% 500 ml. At this stage an incision was made in his thigh over the greater trochanter and copious quantities of pus drained from beneath the fascia lata. Hydrogen peroxide 3% (200 ml), was syringed into the wound and up into the abscess cavity under the fascia lata. After pressing on the thigh to express the hydrogen peroxide and pus the surgeon packed the wound. At this point the end tidal carbon dioxide partial pressure dropped during three breaths to 15 mm Hg, and during the next minute the patient developed cyanosis, tachycardia (150 beats/minute), and hypotension (80/40 mm Hg). After a check to ensure that he was being adequately ventilated and that the anaesthetic equipment and gas supplies were functioning correctly an oxygen embolus was diagnosed.

Fractional inspired oxygen concentration was increased to 1.0, and dexamethasone 8 mg and whole blood 400 ml were given intravenously. His cyanosis improved during the next three minutes, and pulse and blood

Hydrogen peroxide solution is a commonly used germicidal cleansing agent. Irrigation of wounds with hydrogen peroxide under pressure or within closed body cavities may have serious consequences

pressure returned to previous values. End tidal carbon dioxide partial pressure rose to 55 mm Hg and the minute ventilation was therefore increased until it returned to a normal level. A postoperative standard 12 lead electrocardiogram was unchanged from the preoperative one. After a short period of postoperative ventilation and nursing in the intensive care unit he was discharged to the surgical ward, where he made an uneventful recovery.

CASE TWO

A 6 year old girl was referred to casualty, having sustained a dog bite to her right cheek, which had left a deep laceration 5 cm long.

Under general anaesthesia the wound was debrided, cleansed, and then irrigated with hydrogen peroxide solution 3% (60 ml) injected under pressure. Shortly after injection surgical emphysema was noted, extending over the entire cheek and right side of the neck. Fortunately, this did not cause respiratory embarrassment and resolved spontaneously over a few hours.

Discussion

Because hydrogen peroxide decomposes to water and oxygen it is often regarded as a particularly safe, useful cleansing agent. This view is justified when hydrogen peroxide is used in the correct circumstances, but when used in closed spaces or under pressure, where liberated oxygen cannot escape, it is particularly dangerous. In case 1 a sudden drop in end tidal carbon dioxide partial pressure indicated a sudden increase in alveolar dead space. This may have been due to an increase in ventilation-perfusion mismatch associated with a primary cause of hypotension. Three things, however, suggested an embolic episode as the cause in this case: the time course, the severity of the cyanosis, and the lack of cardiovascular instability before and after the episode. The rapid recovery makes a solid embolus unlikely. Thus it seems that the patient suffered a substantial oxygen embolus, which probably entered the circulation through the pelvic or gluteal vein. Previous reports of bubbles in mesenteric and portal veins and of systemic embolisation⁴ further emphasise the danger of hydrogen peroxide when used improperly.^{2,4}

References

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