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(Accepted 8 February 2006)

Lesson of the week

Secondary drowning in a patient with epilepsy

Stephanie Milne, Andrew Cohen

Drowning is defined as death by suffocation after submersion in a liquid; near drowning is survival, at least temporarily, after aspiration of fluid into the lungs.^{1,2} Secondary drowning is death or serious clinical deterioration following near drowning after a period of relative wellbeing; it is not due to neurological causes, respiratory sequelae of inhaled foreign material, or secondary infection. Secondary drowning is caused by inadequate alveolar gas exchange, probably due to primary alveolar membrane dysfunction and loss of surfactant. It can happen after immersion in fresh water or salt water.³⁻⁵ Secondary drowning occurs in 2-5% of all submersion incidents.^{6,7}

We report a patient who seemed to recover fully from near drowning. The diagnosis of secondary drowning was not made until several hours after admission with acute respiratory distress. We highlight the need to consider secondary drowning and describe its immediate care, diagnosis, and management.

Case report

A 44 year old woman with a history of hypertension and epilepsy had a tonic-clonic seizure while swimming unaccompanied in her local pool. She was submerged for about one minute then taken to the side of the pool, where the seizure continued for two minutes before stopping spontaneously. She seemed to recover fully and refused offers to be taken to the hospital, preferring to go home.

About an hour and a half after returning home she developed shortness of breath, chest pain, and a cough that produced pink frothy sputum. Her general practitioner was called. Her oxygen saturation was 80% and she was given 50 mg of furosemide. An ambulance was called and she had a second tonic-clonic seizure in the

ambulance. On arrival in the accident and emergency department she was deeply unconscious with a Glasgow Coma Scale of 3/15 and a rigid decorticate posture. She had a further tonic-clonic seizure, which was treated with lorazepam 4 mg intravenously. Vital signs were respiratory rate of 26 breaths/min, temperature of 38.5°C, blood pressure of 177/118 mm Hg, and pulse rate of 124 beats/min. On auscultation of the chest, bilateral coarse crepitations were audible throughout both lung fields.

Because of her depressed level of consciousness and the risk of obstruction to ventilation or aspiration of stomach contents, she was given intravenous thiopentone 200 mg and suxamethonium 100 mg and intubated using an 8.0 mm oral tracheal tube. After intubation, pink frothy sputum was aspirated from the endotracheal tube. A nasogastric tube was also placed. The patient was subsequently ventilated with 80% oxygen and 8 cm H₂O PEEP (positive end expiratory pressure). Her oxygen saturation rose to 92%. She was given a further 100 mg of furosemide, which increased oxygen saturation to 100%.

Initially the pulmonary oedema was thought to have a cardiogenic or neurogenic cause. A chest radiograph was consistent with pulmonary oedema, and an echocardiogram performed in the accident and emergency department showed concentric left ventricular hypertrophy with good left ventricular function and slight septal dysfunction. A computed tomogram of the brain was normal. Serum chemistry and haematology were within normal ranges except for mild hyponatraemia (sodium 133 mmol/l) and leucocytosis (13.98×10⁹/l). The patient was transferred to theatre recovery before being admitted to intensive care as no bed was immediately available. She was initially sedated

Even after apparent full recovery, near drowning victims are at risk of delayed major complications

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BMJ 2006;332:775-6

with propofol 160 mg/h and alfentanil 1 mg/h. She was started on a magnesium infusion (20 mmol/24 h) and her normal anticonvulsant drugs (carbamazepine 300 mg four times daily and gabapentin 1000 mg three times daily) restarted via her nasogastric tube to prevent further seizures.

When she arrived in intensive care about eight hours after presentation to the accident and emergency department, auscultation of her chest showed equal breath sounds bilaterally, with crepitations at the bases, which were worse on the left than the right. A repeat chest radiograph showed improved pulmonary oedema and patchy shadowing consistent with consolidation, which was worse on the left. She remained ventilated on 45% oxygen and 8 cm H₂O PEEP resulting in oxygen saturation of 99%.

Streptococcus viridans was detected in bronchoalveolar lavage fluid on the second day and intravenous cefuroxime was started. An attempt at extubation later the same day was unsuccessful owing to agitation, tachypnoea, and hypoxia. She also remained febrile (38°C) with a tachycardia of 95 beats/min. Over the next three days the same factors continued to complicate attempts at extubation. On day five she developed a left pleural effusion, which was treated with a chest drain.

She was successfully extubated on day six. Initially she was weaned on to facial continuous positive airway pressure, then on to high flow oxygen through a face mask. She was discharged to a respiratory ward on day eight and left hospital on day 11.

Discussion

The 90 minute delay between submersion and onset of symptoms is typical of secondary drowning. Aspiration of fresh water may cause dilution of surfactant in the alveoli, as well as osmotic and hypoxic damage to the pneumocytes, leading to decreased production of surfactant. Deficiency of surfactant causes alveolar instability, atelectasis, intrapulmonary shunting, and a mismatch of ventilation perfusion.⁷ In addition the particulate matter, diatoms, and chemical matter in fresh water cause alveolitis and exudation of plasma-rich fluid into the alveoli, which interferes with gaseous exchange across the alveolar capillary membrane.⁸

Aspiration of fresh water may also cause derangement of plasma electrolytes, particularly hypona-

traemia, which is usually self limiting and does not need correction.⁹

This case highlights several important points. The patient was known to have epilepsy and was swimming unaccompanied. Children with epilepsy have a 10-fold increased risk of injury from submersion. The support group Epilepsy Action recommends that patients with epilepsy should always swim with a companion who knows what to do in the event of a seizure and should inform the lifeguard before swimming. Patients with epilepsy should be told how to limit risk.

By the time our patient was admitted to hospital her level of consciousness was depressed as a result of post seizure confusion and having received lorazepam to stop tonic-clonic seizures. The diagnosis of secondary drowning was not made for several hours and she was treated for pulmonary oedema secondary to heart failure. If secondary drowning was more widely recognised the diagnosis might have been made by her general practitioner and her care in hospital would have been more focused.

Although our patient seemed to recover fully from aspirating water, she later developed acute pulmonary oedema complicated by infection, had difficulty being weaned from ventilatory support, and had a prolonged stay in hospital.

Contributors: SM studied the patient as part of a third year student selected component. AC was her tutor and guided her during the production of the original work. Under guidance SM redrafted the manuscript, which was further edited by both authors. AC is guarantor.

Funding: None declared.

Competing interests: None declared.

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(Accepted 24 December 2005)

What medicine's really about

I work as a senior house officer in clinical oncology. At times it is moving yet peaceful to share the distress of some terminally ill patients. On other occasions I feel helpless that I cannot help.

I cannot forget a talk I had with a woman with advanced breast cancer. She had had the fortitude to face two phases of intense chemotherapy and radiotherapy, but the disease had spread to the brain, liver, and lungs. I was supposed to tell her. It is not easy to break such bad news when someone is asking simply for a few extra months—to attend her daughter's wedding. And she had worked tirelessly raising funds for cancer patients in our hospital.

At one stage I was about to lose control. It must have been obvious. She turned to me and said softly, "Khurum, have you ever seen a man crying?" I was speechless. She continued, "I've

lived with my husband for 40 years and only saw him cry once. That was too much for me. I can't imagine him crying again." There were tears welling in her eyes—and mine. She said how thankful she was: "So now I know." I had stayed with her for an hour or so.

We rush about on busy rotas. We pay lip service to patient-doctor relationships, attend appraisals, and learn "rules" about how to break bad news. But this sort of conversation, this empathy is of pivotal importance. For me it will remain—a memory of what medicine is really all about.

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