Opiate toxicity in patients with renal failure

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investigations, which were planned by NF, NLTC, HJK, AH, PBC; HJK conducted hygiene investigations. NF computerised the data. Analysis and interpretation was conducted by NF and agreed on by all authors. NF wrote the initial draft; and NF and PBC revised it. All authors approved the final manuscript. NF is the guarantor.

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Lesson of the week

Opiate toxicity in patients with renal failure

B R Conway, D G Fogarty, W E Nelson, C C Doherty

Opiates and their metabolites are known to accumulate in renal failure, with increased potential for toxicity, the most serious aspect of which is respiratory failure.[1] Despite this knowledge, we continue to see life threatening cases of opiate toxicity in patients with renal failure, two recent examples of which we present below.

Unrecognised accumulation of opiates in patients with renal failure may be life threatening

Case reports

Case 1

A 68 year old woman with type 2 diabetes, angina, and obesity had an uncomplicated below knee amputation. Baseline creatinine was 133 µmol/l (estimated glomerular filtration rate 36 ml/min).[2] In the first 36 hours after surgery she received 50 mg of morphine and 76 mg of codeine. On the second day she developed oliguria despite intravenous fluid resuscitation, and her serum creatinine rose to 213 µmol/l. She became increasingly drowsy and her respiratory rate fell to 8 breaths/min. Opiate toxicity was suspected after consultation with the on-call nephrologist. She did not respond to 400 µg intravenous naloxone, however, and therefore she was transferred to the regional renal unit.

On admission she was drowsy and uncommunicative. Observations showed oxygen saturation 91% on 28% inspired oxygen; respiratory rate 6 breaths/min; pulse 50 beats/min, and blood pressure 132/68 mm Hg. Pupils were pinpoint. Initial investigations detected sodium 130 mmol/l, potassium 7.6 mmol/l, urea 28.4 mmol/l, creatinine 320 µmol/l, pH 7.39, Po_2 7.9 kPa, and Pco_2 5.9 kPa. Electrocardiogram showed no hyperkalaemic changes. We noticed that the cannula previously used to administer naloxone had tissued. We gave 400 µg of naloxone via a new cannula, and her Glasgow coma scale score improved to 14/15, and her respiratory rate rose to 14 breaths/min. We started a naloxone infusion, which was titrated to maintain her respiratory rate above 12 breaths/min. Her hyperkalaemia was managed conservatively. Within hours her urinary output increased, and in the following days her serum creatinine returned to baseline.

Case 2

A 63 year old woman with end stage renal failure, type 2 diabetes, and ischaemic heart disease was found semiconscious in bed. On the way to hospital she stopped breathing, and on arrival at the emergency department she was in cardiorespiratory arrest. We started cardiopulmonary resuscitation, and we intubated and ventilated her. After 90 seconds of pulseless electrical activity, we obtained cardiac output, and she became haemodynamically stable. Although she was obeying commands and resisting the endotracheal tube, she made no respiratory effort, therefore we sedated and paralysed her, and transferred her to the intensive care unit. Investigations found 17.4 mmol/l blood sugar, pH 7.02, Po_2 23.9 kPa, and Pco_2 9.5 kPa. An electrocardiogram showed a junctional rhythm, rate 50 beats/min, with no ischaemic changes. A chest radiograph was normal.

In the intensive care unit her pupils were noted to be small despite previous atropine and adrenaline administration. It was ascertained that she had been taking four tablets of Distalgesic (32.5 mg dextropropoxyphene hydrochloride and 325 mg paracetamol) a day for back pain for several days. We haemodialysed her for three hours, after which we extubated her. She

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subsequently made a full recovery, and we advised her against taking further opioid analgesics.

Discussion

The altered pharmacokinetics of opiates in renal failure may result in the accumulation of the parent compound or an active metabolite. Morphine, for example, is metabolised to morphine-3-glucuronide and morphine-6-glucuronide, both of which are renally excreted. Morphine-6-glucuronide, which is more potent than morphine itself, has a half life of about 50 hours in patients with end stage renal failure compared with 3-5 hours in the presence of normal renal function.[3] Pethidine, another commonly prescribed opiate, is converted to the neurotoxic renally excreted metabolite norpethidine. Patients with renal dysfunction are therefore susceptible to opiate toxicity unless doses are reduced or dosing intervals are lengthened appropriately.

The first case illustrates the difficulties in managing postoperative pain in patients with renal disease, including patients who appear to have relatively mild renal dysfunction when assessed by measurement of serum creatinine. We suspected opiate toxicity at an early stage but discounted it because of an inadequate response to naloxone, which had unwittingly been administered subcutaneously. Subsequently, we gave naloxone via an intravenous infusion. We continued this for 48 hours, as the half life of naloxone is much shorter than that of morphine-6-glucuronide in patients with renal failure. Respiratory depression has been reported up to 12 hours after stopping the naloxone infusion.[4] Indeed, we have previously observed life threatening opiate toxicity occurring more than 12 hours after withdrawal of patient controlled analgesia, when the protocol driven monitoring of respiratory function had already been discontinued. Finally, reversal of opiate toxicity coincided with the resolution of acute renal failure, a phenomenon previously described and probably reflecting morphine's haemodynamic effects.[5]

The second case emphasises that life threatening side effects may also result from conventional doses of less potent opioid drugs in patients with chronic kidney disease. Similar effects have been encountered with other weak opiates, including over the counter preparations.[6 7] Although we do not have definitive evidence of opiate toxicity, because naloxone was not given in this case, strong circumstantial evidence exists. Firstly, the patient's pupils were small despite giving her atropine and adrenaline. Secondly, the patient had recovered sufficiently from her cardiorespiratory arrest to obey commands and yet made no respiratory effort. Finally, there was a rapid improvement in respiratory function after removal of opiate metabolites during haemodialysis.

In conclusion, in patients with renal dysfunction, opiates and their active metabolites may accumulate, resulting in potentially life threatening toxicity. Use of non-opioid drugs should be considered and when opiates are necessary, those that tend not to accumulate in renal disease, such as buprenorphine or alfentanil, may be preferred for mild and more severe pain, respectively. Both medical staff and patients must be aware that patients with renal dysfunction have an increased risk of toxicity due to opiates, including over the counter preparations.

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A memorable patient

Students forever

An elderly woman was admitted under my care after an extensive myocardial infarction. After I had explained her prognosis to the waiting relatives, they asked me to speak to another family member, a retired professor of medicine. When I telephoned him, I was surprised to discover that he was my professor from 20 years ago when I was at medical college. He cautioned me about the risk of conduction block as well as heart failure.

On the third day after the patient's admission, he called me to suggest referring the patient to him for further management. This pricked my ego as a senior physician, and I declined—the patient was recovering well, and I said I was able to handle any emergencies. Barely two hours later, she collapsed as she sat up in bed. I found that she had intermittent heart block and had collapsed because of a Stokes-Adams attack. I advised transfer to a specialist cardiac centre for emergency pacemaker implantation. Once again the relatives contacted my old professor; oddly, he asked me not to transfer the patient, as the risk was unacceptable. I did not argue, the patient made a smooth recovery, and her family applauded me for my bold decision to treat her.

We tend to become more confident with age and experience. We may even feel more knowledgeable than our teachers and deride their unfamiliarity with state of the art tools and modern treatments. But incidents like this teach us that, in their eyes, we remain students forever.

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