OVERDOSE OF OPIOID FROM PATIENT-CONTROLLED ANALGESIA PUMPS

W. G. NOTCUTT, P. KNOWLES AND R. KALDAS

SUMMARY

Two incidents have occurred in our hospital when a patient-controlled analgesia pump has accidentally delivered the whole contents of the syringe of diamorphine (60 mg) over a period of approximately 1 h. Electrical corruption of the pumps' program has been identified as the probable cause. All pumps of this type have been modified to prevent such occurrences.

KEY WORDS

Patient controlled analgesia (PCA) has become established as an important technique for the administration of opioids for control of postoperative and other acute pain. PCA has a high safety record [1], and there is only one reported death resulting from equipment failure [2]. Two potentially lethal malfunctions of PCA pumps are presented.

CASE REPORTS

Patient No. 1

A 67-yr-old woman underwent laparotomy for intestinal obstruction. A malignant ovarian tumour was discovered, with deposits obstructing the terminal ileum, and an ovarian cystectomy and ileal resection were performed.

Anaesthesia and recovery were uncomplicated. PCA was used after operation with a Graseby PCAS pump which was connected to the i.v. infusion cannula by a one-way Y-connector (Abbott PCA Mini Bore with anti-syphon valve). According to the standard practice in this hospital [3], the pump was loaded with diamorphine 60 mg and set to give a 1-mg bolus dose with a 3-min lock-out time and no background infusion. No difficulties were encountered initially and monitoring was carried out satisfactorily. The patient achieved good pain relief, although she required diamorphine 59 mg in the first 24 h. Forty-three hours after operation, she had received diamorphine 115 mg, the pump was noted to be nearly empty, and a third syringe was prepared. Our standard practice to change the syringe was followed: the pump key was turned to "REPROG"; the gate was opened; the syringe was exchanged; the gate was closed; the key was turned to "ON". The pump was checked to confirm that the green light was illuminated, indicating that it was running. No alteration was made to the program.

After 1 h, the nurses were alerted by an alarm from the pump indicating that the syringe was empty. The patient was unrouseable and cyanosed, with a very slow ventilatory frequency. Immediate resuscitative measures were taken and the duty anaesthetist (P.K.) was summoned. Naloxone 400 µg was given, with rapid improvement in consciousness and ventilation. An infusion of doxapram 2 mg min⁻¹ and naloxone 6 µg min⁻¹ was commenced and supplementary oxygen was given via a face mask. A pulse oximeter was connected and close observation was maintained. After 6 h, the infusion was discontinued and further analgesia provided by papaveretum i.m. Further progress was uneventful and the patient experienced no residual effects.

The PCA pump was taken out of service immediately. Inspection of the pump was carried out by the hospital Electronic and Biomedical Engineering department, together with the technical director of Graseby Medical and a consultant anaesthetist (W.G.N.). It was confirmed from the PCAS totalizer and the ward monitoring chart that diamorphine 59 mg had been delivered over a period of about 1 h. No fault was found with the pump, the program settings or any other aspect of management. The incident was reported to the Department of Health and a Hazard Notice was issued.

Patient No. 2

Approximately 1 yr later, a 47-year-old man underwent laparotomy for an acute abdomen; he was healthy, but had a long history of chronic back pain. An appendicectomy was performed and the patient was returned to the ward. PCA was instituted after operation using a Graseby PCAS pump, again according to our standard practice. The pump was loaded with diamorphine 60 mg and set to give a 1-mg bolus dose with a 3-min lock-out time and no background infusion. No initial difficulties were encountered initially and monitoring was carried out satisfactorily. The patient achieved good pain relief, although she required diamorphine 59 mg in the first 24 h. Forty-three hours after operation, she had received diamorphine 115 mg, the pump was noted to be nearly empty, and a third syringe was prepared. Our standard practice to change the syringe was followed: the pump key was turned to "REPROG"; the gate was opened; the syringe was exchanged; the gate was closed; the key was turned to "ON". The pump was checked to confirm that the green light was illuminated, indicating that it was running. No alteration was made to the program.

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mechanical fault was found with the first pump. A

by engineers from Graseby Medical. No electrical or

opioid from the syringe [4] was eliminated, as anti-

interfere with the programming [3]. Syphoning of

had been undertaken as nurses are not allowed to

normally for more than 24 h. No reprogramming

programmed in the standard way and had functioned

monitored correctly according to our hospital stand-


to electrical disturbances, may need to be incor-

increase [5]. A mechanical safety device, impervious

versatility and complexity of design increase, the

modifications to enhance safety have been undertaken, and

sequence of events involving static electricity which

failing-safe because of program corruption have

three of problem that occurred. Further software modifi-

cations to enhance safety have been undertaken, and

manufacturer's instructions.

The second incident reported here was reproduced

by Graseby's engineers who demonstrated a rare

sequence of events involving static electricity which
could corrupt the programming and lead to the type

of problem that occurred. Further software modifi-
cations to enhance safety have been undertaken, and

all our pumps are now fitted with this second

modification.

PCA pump manufacturers will continue to im-

prove the safety of their products. Unfortunately, as

versatility and complexity of design increase, the

number of potential faults that can occur does

increase [5]. A mechanical safety device, impervious
to electrical disturbances, may need to be incor-

porated to prevent continuous overinfusion.

The survival of both our patients is attributable in

part to the high requirement for opioid of each, and

that they were relatively tolerant to the rapid
diamorphine overdose. No system of opioid adminis-

tration is 100% safe. Spinal opioid analgesia and

PCA probably have acceptable levels of safety [6].

However, this must be set against the unknown

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because of staff shortages. We have continued to observe the failure of nurses to carry out simple monitoring according to our schedules, in spite of time saved by the reduced number of i.m. injections [3]. Recently, we have been observing failure of nurses to recognize abnormalities in the variables they monitor (as with patient No. 2), reflecting failure in education of nurses in pain management.

The current nursing practice ("team nursing") of distributing patients throughout a ward also must be examined critically from the point of view of safety. Seriously ill postoperative patients requiring acute pain management sometimes are placed in the most remote corner of the ward.

PCA continues as our major technique for the relief of acute pain in this hospital. We are addressing the problems of improving our monitoring and our teaching, in addition to the broader issues of nursing care on the wards.

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REFERENCES