Case Report

Use of breath-activated Patient Controlled Analgesia for acute pain management in a patient with quadriplegia

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We report the use of breath-activated Patient Controlled Analgesia (PCA) for the provision of analgesia in a quadriplegic patient with traumatic neck injury. This provided good pain relief, decreased opioid complications, improved perceptions of self-control, smoothed recovery and enhanced patient, family as well as staff satisfaction. The setup and principles of its use in a patient with high anxiety and unable to use conventionally activated PCA are illustrated.

Keywords: acute pain; spinal injury; patient controlled analgesia; breath-activated

Case report

A 25-year-old pregnant woman at 24 weeks gestation was admitted to the Intensive Care Unit (ICU) having been sexually assaulted and shot in the left side of her neck just below the mastoid. She developed paraesthesiae and weakness in both arms and legs and clinical diagnosis was consistent with an incomplete Brown-Sequard syndrome. A CT scan showed a fracture of the posterior arch of C1, a comminuted fracture of C2 and multiple bullet fragments in the soft tissue. The cervical spinal cord and canal were radiologically normal. She was fully conscious and orientated and was managed conservatively with Virginia Tongs cervical and skull traction. The patient complained of severe acute pain in her neck, left shoulder and arms. Analgesia was titrated using intermittent intravenous boluses of morphine and then PCA was commenced. Attempts to activate the PCA device were unsuccessful because of weakness and poor coordination of her hands. Therefore an intravenous infusion of morphine at 1 mg/h, with additional bolus doses of morphine as required, was prescribed and commenced. After 3 days she was transferred from ICU to the spinal injury ward where the quality of her pain relief deteriorated despite an increase in the intravenous morphine infusion to 7 mg/h. The spinal unit ward protocol does not allow for nursing staff to administer intravenous bolus doses of morphine. The patient's verbal analogue pain score (VAPS) was persistently high, scoring 3–4 on a six point scale (where 0 equals no pain and 5 the worst

possible pain). Her pain was aggravated by physiotherapy and the 2 h changes in position. She experienced nausea and vomiting which was not relieved by metoclopramide, droperidol or prochlorperazine. She subsequently became sedated, developed laboured breathing and was unable to maintain verbal communication with her family and the staff.

The Acute Pain Service was contacted regarding provision of analgesia. It was clear that a PCA method would be most suitable, but as her hands were still weak the PCA machine would need to be activated by another means, such as air flow. A flexible tube with a soft vinyl mouthpiece and an eight foot connector to the PCA machine (Breathcall-Executone[®]) was supplied by Abbott Australasia (Figure 1). The tube was anchored to the headboard by means of a clamp. The PCA was activated by a light puff of air into the mouthpiece. As the patient was unable to move her head because of the head traction, the mouthpiece was placed near her mouth. At times some assistance was needed from the nursing staff or family members in positioning the mouthpiece. With this technique, using a background infusion of 2 mg/h and 2 mg on-demand bolus dose of morphine, the patient became more alert and her breathing and analgesia also improved. Her VAPS reduced to 2. The patient, her family and ward staff expressed great satisfaction with this form of pain relief. Over the following 3 days we ceased administration of the background infusion and analgesia was maintained with intravenous demand doses from the PCA.

The patient also experienced a post traumatic stress disorder manifested by recurrent nightmares, anxiety and panic attacks which exacerbated her pain. This was managed successfully by the liaison psychiatry

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Figure 1. A flexible tube (with a mouth piece) attached to the PCA infuser

team with counselling and a low dose of the tricyclic antidepressant, amitriptyline. Good analgesia and the patient's involvement in its administration greatly facilitated psychotherapy.

The patient used the PCA device for 2 weeks and then her analgesia was changed to Panadeine Forte administered on PRN basis. She continued to improve emotionally and physically. She was subsequently discharged four months later with a healthy baby and was able to attend to her own personal needs and walk with assistance.

Discussion

Opioids remain the mainstay of management for severe acute pain due to a variety of causes such as trauma, postoperative pain, burns and some painful chronic medical conditions.¹ In these conditions, opioids are delivered by the intravenous route. PCA is a technique in which patients are able to self-administer small bolus doses of opioid and titrate their pain relief. Trials have reported the superiority of PCA over conventional parenteral methods. These advantages include superior pain relief,^{2,3} decreased sedation and anxiety,³⁻⁵ earlier return to normal functional status,^{2,3,5} reduction in nursing time and reduction in hospital stay,^{2,5} and superior patient and nurse satisfaction.^{5,6}

For optimal use patients must be able to understand the concept and be physically capable of activating the device. Education in its use is important before instituting therapy.⁷ The mode of activation of the device should be simple. Patients who are physically unable to operate conventional PCA may benefit from modifications to the system. There is a report⁸ of modification made for patients with severe arthritis, allowing activation of the PCA by pushing the handset against the palm of their opposite hand or against their iliac crest. Another report⁹ of unconventional use of PCA describes family-controlled analgesia where a family member is designated as the patient's pain manager (to prevent overdosing only one person at a time can manage the patient's pain). In patients such as quadriplegics, who are unable to use their hands to activate the device, PCA could be breath-activated. The Breathcall-Executone[®] that was used in this case report can be interfaced with Abbott's Lifecare Model 4200 PCA infuser and PCA activated by a puff of air. Testing done by our Biomedical Engineering Department demonstrated that the force required to initiate delivery of a bolus dose is in the order of 3 mmHg. The device clamps to the bed and its flexible arm may be flipped out of the way when desired.

Both anxiety state and coping style are significant predictors of postoperative pain.⁴ Patients with high levels of anxiety experienced greatest reduction of pain with PCA.⁴ This suggests the importance of fulfilling the patient's desire for self control during recovery from an illness. As our patient was psychologically traumatised and exhibited significant anxiety, this mode of therapy gave her a perception of self control. It changed her role from a passive to an active one and permitted her to cope actively. This could explain our patient's dramatic improvement following institution of the PCA.

This report illustrates an alternative way of using PCA for patients who are unable to activate it by the conventional method. Participation, even minimal, enables the patient to derive the full benefit of PCA therapy and might advance the recovery process.

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