INTRANASAL DIAMORPHINE IN CHILDREN WITH TRAUMA

Hannah Skuse and Vanessa Lawlor consider methods and outcomes of analgesia among children experiencing pain after severe injuries.

Abstract

This article discusses the administration of intranasal diamorphine as an analgesia in paediatric trauma care. The authors outline evidence for its use and discuss a recent multicentre safety study of an intranasal diamorphine product. In addition, they advise emergency department nurses on administering the analgesia, and offer guidelines for determining patient suitability and post-administration assessment.

Keywords
Analgesia, intranasal diamorphine, paediatric trauma

BEST PRACTICE in treating children in severe acute pain, according to the College of Emergency Medicine Children’s Pain Assessment Tool (2010), is to administer intravenous (IV) morphine or intranasal diamorphine. This article discusses the intranasal delivery of analgesia, which according to Kidd et al (2009) is less traumatic than the potentially difficult and distressing IV route.

A survey of the use of intranasal medication for children in all emergency departments (EDs) in England and Wales (Hadley et al 2010) found that staff in most of them administer intranasal medications, usually diamorphine. The researchers conclude that administration of intranasal diamorphine is a safe and effective way to manage moderate-to-severe pain in children, and they hope that it will become more widespread.

Much of the evidence that supports the administration of intranasal diamorphine derives from Kendall et al’s (2001) randomised controlled multicentre trial of intranasal diamorphine as an analgesia for children and teenagers with clinical fractures. Results of the trial, in which the effectiveness of intranasal diamorphine was compared with that of intramuscular (IM) morphine, show that pain scores from children in the intranasal diamorphine and IM morphine groups improved over time, but that the onset of analgesia was faster in the intranasal diamorphine group. The adequacy of analgesia, which was assessed by calculating times until rescue analgesia was needed, was the same in both groups (Kendall et al 2001).

As part of the trial, nurses were asked to record children’s reactions to each of the administration methods under one of four categories: ‘no obvious discomfort’, ‘mild reaction’, ‘ winced or withdrew’, ‘cried or screamed’. The researchers conclude from this aspect of their trial that children or young people given IM analgesia become more distressed than those given intranasal analgesia.

To assess the acceptability of intranasal analgesia, the researchers asked nurses and parents to describe each of the two forms of administration in one of four ways: ‘acceptable’, ‘stressful’, ‘very stressful’ or ‘unacceptable.

Results show that nurses and parents think that intranasal analgesia is more acceptable than IM analgesia. Most importantly, the safety profile of intranasal diamorphine has been established as acceptable, with no serious adverse events noted (Kendall et al 2001). The study concludes that intranasal diamorphine is a safe and effective...
method of pain relief for young people presenting to EDs in acute pain with clinical fractures, and is recommended instead of IM morphine in all circumstances (Kendall et al 2001).

In a more recent comparison of intranasal and IV diamorphine, Kidd et al (2009) studied relevant pharmacokinetic data, including the concentration-time profile of plasma morphine, the active metabolite of diamorphine, in children. The researchers did this by using an IV catheter to take blood samples at regular intervals from children with traumatic fracture who had received IV or intranasal diamorphine.

The researchers found that, in children given diamorphine by the nasal route, maximum plasma morphine concentration occurs on average ten minutes after administration, or eight minutes later than in children given the same dose of diamorphine intravenously. However, plasma levels achieved through the intranasal route were found to be adequate (Kidd et al 2009). The study concludes by supporting the wider use of diamorphine administered by intranasal drops in children.

Intranasal diamorphine solution is typically made by reconstituting diamorphine from 10mg ampoules with saline or water solution, whereby the concentration of diamorphine depends on the weight of the child receiving analgesia. Administration of 0.2ml of the solution is through a needleless syringe, sometimes with an atomiser to produce a fine spray, into the child’s nasal cavity.

To avoid errors during reconstitution and administration, practitioners should follow local protocols. According to Gilby et al (2012), however, these methods of formulation and administration can lead practitioners to make errors.

Between 2010 and 2011, the authors undertook a study at one of eight sites of the effects of an intranasal diamorphine spray product. Results of this research, called the Diasafe study, are yet to be published, but will that the spray can be used as a safe alternative to nasal drops. The authors’ formulation method involves diluting freeze-dried diamorphine hydrochloride in quantities of 144mg and 320mg, before reconstituting it with 10ml of 0.5 per cent saline.

Their alternative administration method involves using an intranasal spray device with attachable nozzles designed for use with individual patients. They tested the safety of these methods by using the spray device to administer the solution to 226 children, aged between two and 16 years, with acute traumatic pain. Each child received between two and four sprays of the solution, with the dosages calculated according to the child’s weight.

The children were then monitored intensively for signs or symptoms of adverse reactions, including:
- Respiratory depression, which was evaluated by monitoring pulse, and oxygen saturation and respiratory rates.
- Deteriorating consciousness, which was evaluated using the Glasgow Coma Scale (GCS).
- Nasal irritation, which was evaluated by monitoring for nasal discharge, itching, persistent sneezing, redness, swelling or tenderness.

Results show that all vital signs were within the ranges expected in a population of children experiencing pain and stress, and changes in GCS scores were within the range expected in children who had received diamorphine. There was a low incidence of nasal irritation but no serious adverse events or significant safety issues were reported.

The College of Emergency Medicine (2010) has devised an algorithm to help practitioners determine when intranasal diamorphine should be used and to recommend different types of analgesia for children, depending on the severity of their pain. A pain-assessment scoring tool is used to determine whether a child’s pain is mild, moderate or severe. The college’s algorithm has been adapted for Figure 1.

Recent Royal College of Paediatrics and Child Health (2012) standards for children and young people in emergency care settings recommend that analgesia requirements should be determined at triage by use of appropriate pain tools, and pain should be treated within 20 minutes of each child’s arrival at the ED.

Pain scoring tools
The College of Emergency Medicine’s clinical audit of pain in children (2012) found that only 17 per cent of UK EDs record children’s pain scores and that, in 39 per cent of all EDs, pain scores are recorded for less than one in two children. However, since 2003, when the College of Emergency Medicine began an audit programme, the number of practitioners recording children’s pain scores has increased consistently.

Various pain-assessment tools are available to practitioners. Some are suitable and validated for children in EDs, while others are not, but no single tool can be recommended for all children in all contexts (Royal College of Nursing (RCN) 2009).

According to Simons and Macdonald (2004), the Wong-Baker Faces Pain Rating Scale (Wong and Baker 1988) is one of the most popular children’s pain-scoring tools in the UK and an adapted version of the scale is used in the authors’ ED.
The Wong-Baker Faces Pain Rating Scale comprises a row of stylised faces in different degrees of pain, with each face correlating to a number on a scale between 0 and 10, and to a short description of the pain experienced. Children are asked to choose the face that most closely matches the pain they feel.

Other pictorial and numerical pain scales include the Oucher scale (Beyer and Aradine 1986) and the Manchester Pain Scale (Mackway-Jones 1997).

One of the most commonly used pain-rating tools in the United States, the Oucher scale (Beyer et al 1992) includes photographs rather than illustrations of children’s faces in different degrees of pain. Versions of the Oucher include pictures of children of both sexes and different ethnicity.

To address criticism that the Oucher scale requires children to have an advanced level of cognition, Mackway-Jones (1997) introduced the Manchester Pain Scale. This comprises a picture of a ladder and a series of illustrated human or panda faces expressing different levels of pain.

All of these numerical tools have been criticised, however, because they depend on children being able to report the pain they experience (Nash 2012).

The Wong-Baker self-report tool, for example,
has been found to be reliable only in children who are older than three years, who are conscious, and who can communicate and understand the tool (Moor 2001, Shavit et al 2008, Kaplan et al 2008).

To assess pain in pre-verbal children, nurses should use behavioural scoring systems that allow them to score the levels of pain experienced by children after observing behaviours such as crying, grimacing or holding an injured limb (Maurice et al 2002).

In a guideline for the management of pain in children in EDs, due for review next year, the College of Emergency Medicine (2010) recommends that emergency nurses use a pain-scoring tool that combines a faces scale, a ladder scale and a structure for observations of children’s behaviour, and includes examples of common injuries in children. This guideline has been adapted for Figure 2.

Such pain-assessment tools should be used during initial assessments to determine whether or not analgesia is required. In making these assessments, nurses should acknowledge that parents are experts in understanding their children’s behaviour (Nash 2012) and usually have a great deal of experience in estimating the severity of the pain their children feel (College of Emergency Medicine 2010).

Procedure

Consent Nurses should explain the procedures associated with intranasal diamorphine to the children concerned, where appropriate, and to their parents or guardians, whose consent for the procedure should then be obtained. An area of the ED should be set aside for the procedure so that each child can be safely monitored for side effects associated with opiates.

Dosage Nurses should consult prescriptions to ascertain their validity and relevant dosages (Dougherty and Lister 2011), ensure the diamorphine has been prepared in accordance with controlled drug regulations, and check whether it is administered as nasal drops or as a spray by using an atomiser. Administration of the drug should be recorded on the prescription.

Administration A pre-administration set of observations can be undertaken so that comparisons can be made with those made after administration. Delivery of intranasal medications does not require a sterile technique. Nasal secretions can inhibit absorption of the diamorphine solution so, where appropriate, each child should be asked to blow his or her nose before administration to clear the nasal passages (Wolfe and Bernstone 2004).
Gilby et al (2012) recommend that children sit in an upright position for administration of the nasal spray, which should be directed at the lateral side of the nasal wall. However, if drops are administered to a child in this position, they may run back out of the nose and so many staff administer nasal drops with the child in a recumbent position (Gilby et al 2012). Such run-off is minimal when atomisers are used (Hadley et al 2010).

If children cannot sit up due to pain or distress, administration should continue while they are in their preferred positions.

To optimise drug absorption, intranasal delivery should produce a thin layer of the solution over the largest surface area possible. Nurses can double the absorptive surface area by delivering half the dose into each nostril (Wolfe and Bernstone 2004). To ensure that the diamorphine is absorbed by the nasal mucosa rather than inhaled, practitioners should refrain from asking children to sniff the absorptive surface area by delivering half the dose into each nostril (Wolfe and Bernstone 2004).

Side effects Following administration, standard observations of the children should be undertaken for 20 minutes (College of Emergency Medicine 2010). Unwanted side effects of opiates, such as respiratory depression and reduced consciousness, should be closely monitored, and each child's respiratory rate and GCS score post administration should be recorded. Pinpoint pupils might be caused by the opiate drug. The most common side effects of diamorphine in the initial stages of delivery are nausea and vomiting, which can be relieved by cyclizine, ondansetron or prochlorperazine (Paediatric Formulary Committee 2011).

When administering opiates, nurses must be aware of the severity of opiate overdose, which can cause varying degrees of coma and respiratory depression. The specific antidote naloxone is indicated in coma or bradypnoea (Paediatric Formulary Committee 2011), although Hadley et al (2010) note that there are no reports of naloxone being used to reverse respiratory depression secondary to intranasal diamorphine administration. It is important to note that opioid analgesics are contraindicated in patients with head injuries. They should be avoided or used with caution, depending on severity of illness, in children with impaired respiratory function (Paediatric Formulary Committee 2011).

Conclusion Intranasal diamorphine is a safe, effective and preferable method of analgesia for children with acute pain as a result of traumatic injury. In the authors' experience, it can be used effectively in children presenting with other types of pain, such as abdominal pain.