CHANGING INOTROPE INFUSIONS: WHICH TECHNIQUE IS BEST?

BACKGROUND

- Inotrope infusions are used for improving oxygen delivery and cardiovascular function in patients who are critically ill (Arino et al, 2004; Trim and Roe, 2004).
- All infusions must be changed regularly but inotrope infusions particularly frequently because the half-life of most inotropes used in the paediatric intensive care unit (PICU) is only 2–3 minutes (Arino et al, 2004).
- It is essential that a continuous supply of these drugs be achieved to prevent fluctuations in cardiac function that may lead to a child becoming haemodynamically compromised.

ABSTRACT


Inotrope infusions are commonly used in paediatric intensive care units (PICUs) to achieve cardiovascular stability in critically ill patients. These infusions are administered continuously and require frequent changeover. Various methods are used in practice when changing the infusions, none of which are evidence based. An audit was conducted to determine which method of changeover caused the least cardiovascular compromise to patients. This is a summary: the full paper and reference list can be accessed at nursingtimes.net.

Most inotrope infusions are delivered via an infusion pump in order to ensure a continuous supply. Although the type of pump used varies between hospitals, the principles surrounding safe use are the same. When a syringe pump is started, there is typically a delay before fluid delivery to the patient commences.

The start-up delay has two main implications for infusion device therapy: first, it delays the delivery of medication to the patient; second, because the half-life of inotropic drugs is very short, a delay in delivery to the patient may result in an adverse effect, such as a drop in mean arterial blood pressure (MABP).

The start-up delay can be reduced with most pumps by using the prime facility on the pump, if it has one, or purging/bolus the pump once the syringe has been fitted but before connecting it to the patient (Trim and Roe, 2004). It is also recommended that infusion devices are primed and then programmed at the same rate as the infusion to be changed.

There are two common methods of changing infusions: the double pumping technique and the switching technique. Double pumping involves running both infusions simultaneously, starting the new one at a lower rate and titrating both until the new infusion is at full rate and the old infusion has stopped. The switching technique involves running the new infusion at the same rate as the old and connecting it to the patient while turning the old infusion off.

Although both methods ensure that drug flow to the patient is not interrupted, their use can cause an increase or decrease in the patient’s MABP, and neither method is evidence based. An audit was undertaken to assess which method of changeover resulted in the least cardiovascular compromise to the patient.

METHOD

Before the audit was undertaken, all intensive and high-dependency care centres involved in delivering care to children in the UK were contacted by letter to ask which inotrope infusions. Unfortunately the response rate was poor, with only 10 centres replying out of 98 centres contacted across the country.

All 10 of these centres stated that they used a switching technique when changing inotropes but admitted that the evidence to support their preferred technique was limited. The responses were written by three practice development nurses, two ward managers and five ward sisters.

An audit was then carried out over a four-week period in which all staff involved in the changeover of inotrope infusions were asked to complete a simple questionnaire. The aim of the questionnaire was to find out which technique had been used to change over the infusion and what effect (if any) this had on the patient’s MABP.

RESULTS

A total of 30 questionnaires (recording 30 changeovers) were completed and analysis of the results showed that three techniques were used to change infusions. The double pumping technique was used for 43% of the changeovers, the switching technique for 33% and, in 4% of cases, the old infusion was stopped before the new one commenced.

The observational charts of inpatients revealed that 76 infusions were changed over that month, so the audit response rate was poor (39%).

None of the responses reported a fall in blood pressure, 29 reported a rise in MABP and one reported no change.

The results showed that the method of changing the infusion had different effects on the patient’s MABP. Sixteen
questionnaires documented the use of the switching technique when changing inotrope infusions: 11 stated there was a rise in patient MABP of 0–5mmHg, four observed a rise of 5–10mmHg, and one stated an increase of 15–20mmHg.

No drop in MABP was documented in the questionnaires. Rises in MABP were observed with the use of both techniques and the double pumping method was associated with the greatest rises, with considerably more patients experiencing rises of up to 20mmHg than with the switching technique.

LIMITATIONS OF THE AUDIT
Changes to the patient’s MABP were recorded by the person changing the inotropes rather than by another individual. Therefore, it is possible that transient changes in blood pressure might have been missed because the respondent was concentrating on undertaking the inotrope changeover.

The audit was very specific to the PICU and did not consider other risk factors associated with the use of inotrope infusions. For example, when starting an inotrope infusion, there may be a delay before the medication reaches the patient (Medical Devices Agency, 1998). This delay can be overcome by purging the infusion pump before attaching the infusion to the patient, though this was not covered in the audit.

Occlusion of the central venous line may occur during infusion. If this happens, the venous line may need to be flushed and the inotrope infusion stopped while this takes place.

However, flushing the line can result in a bolus of drug being administered to the patient which will, consequently, cause a rise in MABP. The audit did not ascertain whether the venous line had to be flushed in any of the patients included.

In addition, the audit did not assess the duration of increases in MABP and whether the rise had a detrimental effect on patients’ cardiovascular status. No assessment was made of whether there was any rebound drop in MABP after the initial increase.

User knowledge is essential when changing inotrope infusions as the nurse has to be confident not only in making up the drug correctly but also with the equipment needed to administer it (Crisp, 2002). However, the audit did not analyse the experience of the nurse administering the inotrope and whether this had any effect at changeover.

It may also have been beneficial to identify which inotropes were used to see whether there was any correlation between the type of inotrope and the differences in increase in MABP. As the half-lives of inotropes vary, it is possible that certain types might have caused a larger rise in MABP than others during changeover.

The delivery devices used in the PICU were standard and there were no documented variations in the syringe drivers employed.

CONCLUSION
Although the audit was limited, it was felt by the team that the switching method should be adopted when changing inotrope infusions in the PICU because increases in MABP associated with this technique were lower than increases associated with the double pumping technique.

The findings of the audit supported the replies received from the 10 PICUs in the UK, which highlighted switching as the favoured technique. There is no guidance on which changeover method should be adopted for inotrope infusions, so the method adopted by staff is usually based on how they were taught and their previous experiences of various methods. Senior staff are responsible for the training and development of junior staff regarding this skill, and it is likely that they demonstrate the double pumping method because that was the method that they were used to.

The switching technique is now used more frequently than it was in the past. Old infusion devices were not as reliable as modern ones, so it was considered safer to titrate a new infusion alongside one ready for change in case the infusion device failed. This is no longer necessary, as infusion devices are able to deliver at their set rate immediately.

A guideline is currently being produced to ensure that all staff members in the PICU have access to straightforward instructions about which method to adopt when changing over inotrope infusions and how this switching process should be undertaken.

Once this guideline has been in place for three months, another audit will be undertaken. This will aim to establish what impact the use of the guideline has had on patients’ cardiovascular status during changeover of inotrope infusions.

It is evident that there has been insufficient research on the changing of inotrope infusions. This area requires further investigation in order to allow the guideline to be developed and to promote evidence-based practice.

REFERENCES


IMPLICATIONS FOR PRACTICE

| The switching technique had less impact on arterial blood pressure in this audit. |
| Changeover method for inotrope infusions is related to how staff were taught or their previous experience and was not found to be evidence based. |
| The switching technique is being used more frequently with increasing confidence in improved devices that are able to deliver at their set rate immediately. |
| This audit has its limitations and more research is required to add to the evidence base. |