Letters to Editor

Elastomeric pumps: How cautious should we be?

Sir,

Elastomeric pumps are frequently used in providing postoperative analgesia. They are simple to use, provide continuous infusions with less technical difficulties, and allow patient ambulation. However, the accuracy of delivery of the set flow rates may vary under certain conditions. We report a case in which the delivered flow rate was in excess of the set rate.

A 10-month-old male child weighing 7.5 kg with Hirschprung's disease underwent Duhamel's procedure under general anaesthesia with epidural analgesia using a 22-G epidural catheter. The procedure was uneventful and child was extubated and shifted to the intensive care unit. An elastomeric pump (nominal flow rate: 2, 3, 5 mL/h, maximum fill volume of 300 mL) containing 0.1% bupivacaine with 1 μg/mL of fentanyl was loaded to 100 mL (33% of maximum fill volume) with the intention of providing about 30 h of analgesia postoperatively at a flow rate of 3 mL/h. Child was comfortable and maintaining vital parameters. At around 15 h postoperatively, the pump was noticed to be completely empty. Epidural infusion was subsequently withheld and child was continuously monitored. No complications were seen and child's recovery was uneventful.

A flow rate of 2.22 times the set flow rate would have been needed to empty the infusor in this time with the flow inaccuracy exceeding 200%. Though reports exist of premature emptying of the reservoir, this value is much higher than the manufacturer error of ±15%.[1,2] Several factors could have contributed to this discrepancy, including pump being under-filled, use of the diluent 0.9% sodium chloride instead of the manufacturer recommended 5% dextrose, and other factors such as the pump height and the temperature of the infusor.

It is worthwhile to review some of these factors in detail.[3] Infusor rate is most accurate at 33°C, increasing approximately 2.3% per 1°C rise in temperature. A diluent solution of 5% dextrose suggested to be more accurate than an infusor filled with 0.9% sodium chloride, which flows about 10% faster (possibly due to the lower viscosity of 0.9% sodium chloride). Pumps filled to <81% of the optimal fill volume have reduced accuracy and flow at faster rates. A 22-gauge or larger access system is recommended with smaller catheters having decreased flow rates. Flow rate is most accurate when the balloon reservoir and the luer lock connector are at the same height. Flow rate increases about 0.5% for every 2.5 cm that the balloon reservoir is above the luer lock connector.

We believe that the inaccurate delivery in our case was predominantly due to underfilling. The company could not detect gross device malfunction on detailed testing of the pump.

Infusor pumps have been shown to have varying flow rates. Different infusors operating in similar environmental conditions differ in flow rate, accuracy, and may have varying consistency in performance.[1,4,5] The inability to estimate the actual amount of drug being delivered combined with the lower margin for error entails extremely cautious use of elastomeric pumps in children. Because the margin of safety in the paediatric age group is narrow, one should consider the possibility of 15–20% inaccuracy while setting the infusor flow rate. We recommend strict adherence to manufacturer instructions when using elastomeric pumps, regular visual inspection of the reservoir, and careful monitoring for any complications of over and under dosing. Use of elastomeric pumps with clear gradations for the volume delivered may enhance patient safety.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the parent(s) has/have given his/her/their consent for his/her/their child's images and other clinical information to be reported in the journal. The parents understand that their child's names and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

None.

Conflicts of interest

There are no conflicts of interest.

Swarup Ray, Barkha Agrawal, Raylene Dias, Nandini Dave

Department of Pediatric Anesthesiology, Seth G.S. Medical College and KEM Hospital, Mumbai, Maharashtra, India

Address for correspondence:
Dr. Nandini Dave,
Department of Pediatric Anesthesiology, Seth G.S. Medical College and KEM Hospital, Mumbai, Maharashtra, India.
E-mail: nandinidave@gmail.com

REFERENCES

1. Weisman RS, Missair A, Pham P, Gutierrez JF, Gebhard RE. Accuracy and consistency of modern elastomeric pumps. Reg Anesth Pain Med 2014;39:423-8.
2. Grissinger M. Improved safety needed in handling elastomeric reservoir balls used for pain relief. Pharmacy Ther 2013;38:243-5.
3. Baxter. International Baxter Elastomeric Pumps Clinician Guide. 2010. Available from: http://www.capca.ca/wp-content/uploads/Baxter-Elastomeric-Pumps-Clinician-Guide11.pdf. [Last accessed on 2014 Jan 07].
4. LeRiger M, Bhalla T, Martin D, Bettesworth J, Tobias JD. Comparison of flow rate accuracy and consistency between the on-Q, Baxter, and ambu pain infusion devices. World J Anesthesiol 2014;3:119-23.
5. Ackermann M, Maier S, Ing H, Bonnabry P. Evaluation of the design and reliability of three elastomeric and one mechanical infusers. J Oncol Pharm Pract 2007;13:77-84.

Access this article online	
Quick response code	Website: www.ijaweb.org
	DOI: 10.4103/ija.IJA_347_18

How to cite this article: Ray S, Agrawal B, Dias R, Dave N. Elastomeric pumps: How cautious should we be?. Indian J Anaesth 2018;62:558-9.