Fluid Management Device

Tech ID: 22537 / UC Case 2011-621-0

BRIEF DESCRIPTION

A computer-aided fluid delivery device that administers metered volumes of medication intravenously from pre-filled cartridges. This device can be operated by health providers with ease by their pressing clearly marked electronic buttons and other options on a touchpad.

FULL DESCRIPTION

In 2006 the Institute of Medicine conducted an investigation into drug-related errors in our medical system. Its report found that 1.5 million adverse drug events occur every year, sometimes resulting in serious or even fatal harm. It also found the primary cause of this patient injury epidemic was human error.

That is not because doctors and nurses are careless, though. Our medication delivery system is simply too prone to mistakes [1-3]. Injected drugs are currently delivered by drawing medications into syringes from vials and pushing them through intravenous lines connected to patients. This method accounts for higher rates of errors than any other route of medication administration [4, 5]. About half of all errors occurs during administration, and two-thirds of these errors involve injection drugs [3, 6]. Further, some medications require dilution before use [7]. These imprecise methods allow for accidentally selecting the wrong medication, mislabeling, and concentrations that are either more or less potent than what is needed [8, 9].

Considering medical providers are often overworked, overtired, and stressed while having to juggle multiple tasks simultaneously [10], it is not surprising that when the system they operate under has built-in allowances for mishaps, serious mistakes happen. Preparing for a case takes a significant proportion of provider's daily tasks [11]. Additionally, many medications must be prepared for emergencies. Most of the time unused medications are thrown away but cannot be used for another case since they have been taken out of their original packaging [12].

What we propose is reducing such avoidable errors with a computer-aided fluid delivery device that administers metered volumes of medication intravenously from pre-filled cartridges. This device can be operated by providers with ease by their pressing clearly marked electronic buttons and other options on a touchpad.

We believe this is the logical next step in the evolution of medical technology. For example, in the operating room specialized machines now allow anesthetists to deliver gases to patients easily and precisely by turning dials to change the gases' flow and concentration.

Similarly, the drug delivery assistant would safely and reliably prepare, deliver, and chart intravenous medications to patients. And it would do so with the consistency and precision of an untiring and unflappable computer.

Saving time of medical providers

Because syringes would not be needed to transfer medication from one container to another, medical providers would no longer have to spend the time and effort required for such transfers. In addition, they would be spared from having to label concentrations, and to initial and mark the date of syringes per the policy of many hospitals [7]. A close look at drug preparation reveals that there are forty-one steps required to administer a single drug to a patient, and experienced providers took on average thirty-five seconds to do so [1].

CONTACT

Richard Y. Tun
tunr@uci.edu
tel: 949-824-3586.

OTHER INFORMATION

CATEGORIZED AS

- » **Medical**
  - » Delivery Systems
  - » Devices
  - » Other
- » **Sensors & Instrumentation**
  - » Medical
- » **Engineering**
  - » Other

RELATED CASES

2011-621-0

The alternative would be to make a few touchpad screen selections to deliver the medication. And the device would automatically make a record of the medication, concentration, and date and time in the electronic medical record.

The device can also provide reminders for redosing medications. For example, the neuromuscular blockading agent rocuronium has a half life of one hour. This device can alert providers every hour on the dot when a new dose of this medication is needed, providing an extra safety net for patient health.

The automating of both drug delivery and record-keeping chores would free up medical providers to focus their attention and skills on the aspects of their job that genuinely require their expertise.

Another advantage to this approach is speed. The prompt supplying of medication can sometime spell the difference between life and death for a patient who is bradycardic, hypotensive, or arresting.

Under current methods, medications packaged in vials not immediately available for patient use must first be transferred into syringes. If a medical provider fumbles with these vials during the stress of an emergency, the administration of the medications could be delayed and result in seriously adverse patient outcomes.

In contrast, the apparatus allows the medical provider to deliver lifesaving medications in seconds, and with absolute precision, via pre-packaged cartridges and the pressing of a few on-screen buttons.

Further, it can link to other devices and display notifications when an adjustment in medication or different medication may be called for-for example, in response to an abrupt change in breathing over a ventilator, or an out of range change in blood pressure. A medical provider can then choose to act on the suggestion instantly via the easy-to-use screen selections. This ability to respond to an abrupt new patient condition by delivering medications in moments is certain to save lives.

Catching contraindications

The invention can access the electronic record of each patient's medical history. This will allow it to detect when it is being asked to deliver medication that is contraindicated by the patient's preexisting medical conditions.

For example, if a provider tries to give succinylcholine to a patient with hyperkalemia, or administer penicillin to a patient with a history of being allergic to that medication, the device will display a warning on its screen to alert the provider of the potential problem.

The provider can then still choose to deliver the medication via screen options after acknowledging awareness of the potential issue.

Ensuring Correct Dosages

The drug delivery assistant makes it easy to adjust a medication's dosage. All a provider has to do is choose a different dosage and approve it, and the new amount of the drug will be delivered with computer precision.

Further, because it can be integrated into electronic medical record systems, the drug delivery assistant can access pertinent factors such as a patient's weight. A common source of dosage errors is incorrect calculations based on weight. The device makes these calculations instantly and without errors. At the same time, a provider can always override a suggestion and specify a different dosage. Whenever a dosage change is made, the device will record it into the patient's medical records automatically, ensuring providers always have access to this treatment history.

Providing multiple fail-safes to ensure accuracy and safety

The drug delivery assistant will reduce the contamination of medicines, because the pre-filled drug cartridges can be installed directly from the manufacturer into the delivery system.

Further, it will include redundant fail-safe mechanisms to ensure it is delivering the correct medication. For example, the drug cartridges will be labeled with bar codes, and the delivery system will have an electronic chip that reads the codes to verify the contents of each cartridge [13]. A drug will not be delivered if it does not pass this safety check.

As another safety measure, cartridges with Drug Enforcement Administration scheduled drugs will contain locks that can not be removed without an appropriate security code or security key.

Further, physical parts of the packaging will periodically be scanned electronically to verify seals have remained intact and the medications remain sterile. This scanning will also determine which cartridges have not been used and can be given to another patient, enhancing the efficiency of supply chain management, inventory control, and billing.

References

1. Fraind, D.B., et al., Reengineering intravenous drug and fluid administration processes in the operating room: step one: task analysis of existing processes. Anesthesiology, 2002. 97(1): p. 139-47.

2. Brennan, T.A., et al., Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. N Engl J Med, 1991. 324(6): p. 370-6.

3. Bates, D.W., et al., Incidence of adverse drug events and potential adverse drug events. Implications for prevention. ADE Prevention Study Group. Jama, 1995. 274(1): p. 29-34.

4. Taxis, K. and N. Barber, Ethnographic study of incidence and severity of intravenous drug errors. Bmj, 2003. 326(7391): p. 684.

5. Cousins, D.H., et al., Medication errors in intravenous drug preparation and administration: a multicentre audit in the UK, Germany and France. Qual Saf Health Care, 2005. 14(3): p. 190-5.

6. Bates, D.W., et al., The costs of adverse drug events in hospitalized patients. Adverse Drug Events Prevention Study Group. Jama, 1997. 277(4): p. 307-11.

7. Grissinger, M., Reducing errors with injectable medications: unlabeled syringes are surprisingly common. P T. 35(8): p. 428-51.

8. Cooper, J.B., R.S. Newbower, and R.J. Kitz, An analysis of major errors and equipment failures in anesthesia management: considerations for prevention and detection. Anesthesiology, 1984. 60(1): p. 34-42.

9. Leape, L.L., et al., Systems analysis of adverse drug events. ADE Prevention Study Group. Jama, 1995. 274(1): p. 35-43.

10. Howard, S.K., et al., Fatigue in anesthesia: implications and strategies for patient and provider safety. Anesthesiology, 2002. 97(5): p. 1281-94.

11. Weinger, M.B., et al., An objective methodology for task analysis and workload assessment in anesthesia providers. Anesthesiology, 1994. 80(1): p. 77-92.

12. Weinger, M.B., Drug wastage contributes significantly to the cost of routine anesthesia care. J Clin Anesth, 2001. 13(7): p. 491-7.

13. Poon, E.G., et al., Effect of bar-code technology on the safety of medication administration. N Engl J Med. 362(18): p. 1698-707.

ADVANTAGES

Saving time of medical providers: Because syringes would not be needed to transfer medication from one container to another, medical providers would no longer have to spend the time and effort required for such transfers.

Catching contraindications: The invention can access the electronic record of each patient's medical history. This will allow it to detect when it is being asked to deliver medication that is contraindicated by the patient's preexisting medical conditions.

Ensuring Correct Dosages: The drug delivery assistant makes it easy to adjust a medication's dosage. All a provider has to do is choose a different dosage and approve it, and the new amount of the drug will be delivered with computer precision.

Providing multiple fail-safes to ensure accuracy and safety: The drug delivery assistant will reduce the contamination of medicines, because the pre-filled drug cartridges can be installed directly from the manufacturer into the delivery system.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,132,228	09/15/2015	2011-621
Patent Cooperation Treaty	Published Application	WO 2012/109678	08/16/2012	2011-621

92697-7700 / Tel: 949.824.2683