TITLE

MULTIPLE DRUG INFUSION SYSTEM AND METHOD

BACKGROUND

[0001] The present disclosure relates generally to medical fluid delivery and in particular to multi-channel infusion pump delivery.

[0002] Doctor's routinely order infusion treatments as a specific combination of multiple intravenous ("IV") medications that are to be infused into a patient simultaneously. Common infusion drug combinations include patient preparation for surgery ("pre-op") and patient after surgery ("post-op") combination of antibiotics, anesthetics and/or vasopressors.

[0003] The drug combinations are often handled using multi-channel pumps that can deliver different drugs from different sources simultaneously. Multiple channel infusion pumps are known, such as Baxter's multi-channel COLLEAGUE™ Volumetric Infusion Pump made by the assignee of the present disclosure. Previously, each drug of a combination has been entered individually into the pump. Each drug delivery entry presents an opportunity for error in terms of any one of: (i) entering the wrong drug; (ii) entering the dose; and (iii) entering the wrong time in the combination sequence for delivery.

[0004] An improved infusion drug combination delivery system and method is needed accordingly.

SUMMARY

[0005] The present disclosure has several aspects.

[0005a] According to one aspect, there is provided a drug infusion system comprising: a first infusion pump; a second infusion pump; an input device; and a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient by the first and second infusion pumps, the first infusion pump determining which one or more drug of the combination is to be pumped by the second infusion pump, the preprogrammed combination including a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification,

(ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

[0005b] According to another aspect, there is provided a drug infusion system comprising: a first infusion pump; a second infusion pump; an input device; and a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient by the first and second infusion pumps, the first infusion pump determining which one or more drug of the combination is to be pumped by the second infusion pump, the preprogrammed combination including a preprogrammed sequence in which at least two of the plurality of drugs are delivered at different times, and wherein the input device and the processor are further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

[0005c] According to a further aspect, there is provided a drug infusion system comprising: a first infusion pump; a second infusion pump; an input device; and a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient, the processor further configured to assign each of a plurality of channels of the first infusion pump to a plurality of the drugs of the combination and employ the second infusion pump if one or more drug of the combination cannot be pumped by the first infusion pump, and wherein the preprogrammed combination includes a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

[0005d] According to an additional aspect, there is provided a drug infusion system comprising: a first infusion pump; a second infusion pump; an input device; and a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient, the processor further configured to designate a different drug or drugs of the combination to the first infusion pump or the second infusion pump according to at least one of (i) a sequence of delivery of the plurality of drugs or (ii) a type of

each of the plurality of drugs, and wherein the preprogrammed combination includes a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

[0005e] According to yet another aspect, there is provided a drug infusion system comprising: a master infusion pump including at least one drug infusion channel; a delegate infusion pump in communication with the master infusion pump; an input device; and a processor associated with the master infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient, the processor further configured to divide the delivery of the plurality of drugs between the master infusion pump and the delegate infusion pump if the number of the plurality of drugs is greater than the number of the drug infusion channels of the master infusion pump, and wherein the preprogrammed combination includes a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

[0005f] The present disclosure sets forth a system and method for delivering a protocol or combination of drugs, each drug of the combination or protocol being delivered at a desired time in a sequence to achieve a desired dose. The system and method enables the nurse or technician to select an icon or identifier that represents the desired combination of drugs. The entered drug combination can have preset features and features that are tailored for the patient. The actual drugs of the combination can be preset. The timing and sequence of when the different drugs are delivered can also be preset. The actual amount of the drug or drug dosage, however, can be tailored for the patient. For example, the drugs can be delivered in an amount that is proportional to the patient's weight, e.g., on a per kilogram basis.

[0006] In one embodiment, the nurse or technician selects a particular drug combination and enters the patient's weight and/or body surface area ("bsa"). The

The invention is claimed as follows:

1. A drug infusion system comprising:

a first infusion pump;

a second infusion pump;

an input device; and

a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient by the first and second infusion pumps, the first infusion pump determining which one or more drug of the combination is to be pumped by the second infusion pump, the preprogrammed combination including a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

2. The drug infusion system of claim 1, wherein each of the drugs is delivered based on the entered weight and/or bsa of the patient.

3. The drug infusion system of claim 1, wherein the timed delivery starts for the drugs result in a sequence in which the plurality of drugs is delivered.

4. The drug infusion system of claim 1, wherein at least one of a rate, a dose and a concentration is specified for at least one of the drugs.

5. The drug infusion system of claim 4, wherein the dose is based on the entered weight and/or bsa of the patient.

6. The drug infusion system of claim 4, wherein the rate is specified to achieve the specified dose.

7. The drug infusion system of claim 4, wherein the concentration is predetermined.

8. The drug infusion system of claim 1, wherein the first and second infusion pumps are capable of pumping drugs of a type selected from the group consisting of: (i) an antibiotic, (ii) an anesthetic, (iii) an anticoagulant, and (iv) a drug to manage hypertension.

9. The drug infusion system of claim 1, wherein at least one of the infusion pumps is a multi-channel pump, and wherein a plurality of the drugs are delivered via multiple channels of the multi-channel pump.

10. The drug infusion system of claim 1, wherein at least one of the input device and the processor is integrated with the first infusion pump.

11. The drug infusion system of claim 1, wherein at least one of the input device and the processor are located on a remote computer in communication with the first infusion pump.

12. The drug infusion system of claim 1, wherein the selection is made from a library of selections, each selection associated with a different combination of drugs.

13. The drug infusion system of claim 12, which includes a display device that displays the library of selections to the operator.

14. The drug infusion system of claim 1, which includes (i) a display device that displays the combination of drugs to the operator and (ii) a confirm function requiring the operator to confirm that the displayed combination of drugs is correct before delivery to the patient.

15. The drug infusion system of claim 1, which includes a mechanism that verifies a drug of a supply for operation with the first or second infusion pump is one of the selected combination of drugs.

16. A drug infusion system comprising:

a first infusion pump;

a second infusion pump;

an input device; and

a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed

combination of a plurality of drugs to be delivered to a patient by the first and second infusion pumps, the first infusion pump determining which one or more drug of the combination is to be pumped by the second infusion pump, the preprogrammed combination including a preprogrammed sequence in which at least two of the plurality of drugs are delivered at different times, and wherein the input device and the processor are further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

17. The drug infusion system of claim 16, wherein the preprogrammed combination includes a specified delivery start time for each of the plurality of drugs, the specified delivery start times resulting in the preprogrammed sequence.

18. The drug infusion system of claim 17, wherein at least two of the specified delivery start times are different.

19. A drug infusion system comprising:

a first infusion pump;

a second infusion pump;

an input device; and

a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient, the processor further configured to assign each of a plurality of channels of the first infusion pump to a plurality of the drugs of the combination and employ the second infusion pump if one or more drug of the combination cannot be pumped by the first infusion pump, and wherein the preprogrammed combination includes a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

20. A drug infusion system comprising:

a first infusion pump;

a second infusion pump;

an input device; and

a processor associated with the first infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient, the processor further configured to designate a different drug or drugs of the combination to the first infusion pump or the second infusion pump according to at least one of (i) a sequence of delivery of the plurality of drugs or (ii) a type of each of the plurality of drugs, and wherein the preprogrammed combination includes a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.

21. A drug infusion system comprising:

a master infusion pump including at least one drug infusion channel;

a delegate infusion pump in communication with the master infusion pump;

an input device; and

a processor associated with the master infusion pump, the input device and processor configured to allow an operator to make a selection that specifies a preprogrammed combination of a plurality of drugs to be delivered to a patient, the processor further configured to divide the delivery of the plurality of drugs between the master infusion pump and the delegate infusion pump if the number of the plurality of drugs is greater than the number of the drug infusion channels of the master infusion pump, and wherein the preprogrammed combination includes a timed delivery start for each of the plurality of drugs such that the relationship between the delivery starts of the plurality of drugs is specified, and wherein at least two of the timed delivery starts are different, the input device and processor further configured to allow the operator to enter (i) the identification, (ii) weight and/or (iii) body surface area ("bsa") of the patient, at least one of the plurality of drugs delivered based on the entered weight and/or bsa of the patient.