Amended claims

We claim,

1. An apparatus for controlling an amount of carbon dioxide (CO_2) in a subject's lung to attain a series of targeted end tidal partial pressures of CO_2 ($PetCO_2^T$), the apparatus comprising:

(a) a gas delivery device;

(b) a control system for controlling the gas delivery device, wherein the control system is programmed to target a series of $PetCO_2^T$ values for a series of respective intervals, the series of $PetCO_2^T$ values comprising at least one of a set of $PetCO_2^T$ increments and a set of $PetCO_2^T$ decrements, the control system including means for:

a. Obtaining input of a series of logistically attainable $PetCO_2^T$ values for the series of respective intervals; and

b. Determining an amount of CO_2 required to be inspired by the subject in an inspired gas to target the $PetCO_2^T$ for a respective interval;

c. Controlling the amount of gas CO_2 in a volume of gas delivered to the subject in a respective interval to target the respective $PetCO_2^T$ for the interval;

wherein at least one of:

(a) the respective sizes of the at least one of the set of $PetCO_2^T$ increments and the set of $PetCO_2^T$ decrements and the size of the respective intervals; and

(b) the time over which the response is measured and the range of the vascular response;

is predetermined to reveal a dose response to at least one of the set of $PetCO_2^T$ increments and the set of $PetCO_2^T$ decrements.

2. An apparatus as claimed in claim 1, wherein each interval is a respective breath [i].

3. An apparatus as claimed in any one of claims 1 and 2, wherein the vascular response is a vasodilatory response to a set of $PetCO_2^T$ increments and wherein the set of logistically attainable $PetCO_2^T$ values produces a desired range of a vasodilatory stimulus and

wherein the series of intervals is selected to satisfy a condition, the condition defined by attainment of at least a minimum increment in the vasodilatory response to an increment in the subject's end tidal partial pressure CO_2 (optionally the series of $PetCO_2^T$ values for the series of respective intervals also revealing the time course of at least one of a partial range of a vasodilatory response and a full range of a vasodilatory response).

4. An apparatus as claimed in any of one claims 1, 2 and 3, wherein the set of increments in $PetCO_2^T$ for the series of respective intervals is predetermined to produce two time constants in the progress of the vascular response in a respective interval.

5. An apparatus as claimed in any of one claims 1, 2 and 3, wherein the at least one set of increments in $PetCO_2^T$ for the series of respective intervals is predetermined to produce three time constants in the progress of the vascular response in a respective interval.

6. A computer program product for use in conjunction with a control system for a gas delivery device for controlling an amount of carbon dioxide (CO_2) in a subject's lung to attain a series of targeted end tidal partial pressures of CO_2 ($PetCO_2^T$) for a series of respective intervals, the computer program product comprising program code for:

a. Obtaining input of a series of logistically attainable $PetCO_2^T$ values for the series of respective intervals; and

b. Determining an amount of CO_2 required to be inspired by the subject in an inspired gas to target the $PetCO_2^T$ for a respective interval; and

c. Controlling the amount of gas CO_2 in a volume of gas delivered to the subject in a respective interval to target the respective $PetCO_2^T$ for the interval;

wherein the series of $PetCO_2^T$ values for the series of respective intervals is at least one of a set of $PetCO_2^T$ increments and a set of $PetCO_2^T$ decrements and wherein at least one of:

(a) the respective sizes of the at least one of the set of $PetCO_2^T$ increments and the set of $PetCO_2^T$ decrements and the size of the respective intervals; and

(b) the time over which the response is measured and the range of the vascular response;

is predetermined to reveal a dose response to at least one of the set of $PetCO_2^T$ increments and the set of $PetCO_2^T$ decrements.

7. A computer program product as claimed in claim 6, wherein each interval is a respective breath [i].

8. A computer program product as claimed in any one of claims 6 and 7, wherein the vascular response is a vasodilatory response to a set of $PetCO_2^T$ increments and wherein the set of logistically attainable $PetCO_2^T$ values produces a desired range of a vasodilatory stimulus and wherein the series of intervals is selected to satisfy a condition, the condition defined by attainment of at least a minimum increment in the vasodilatory response to an increment in the subject's $PetCO_2$ (optionally the series of $PetCO_2^T$ values for the series of respective intervals also revealing the time course of at least one of a partial range of a vasodilatory response and a full range of a vasodilatory response).

9. A computer program product as claimed in any of one claims 6, 7 and 8, wherein the set of increments in $PetCO_2^T$ for the series of respective intervals is predetermined to produce two time constants in the progress of the vascular response in a respective interval.

10. A computer program product as claimed in any of one claims 6, 7 and 8, wherein the at least one set of increments in $PetCO_2^T$ for the series of respective intervals is predetermined to produce three time constants in the progress of the vascular response in a respective interval.

11. A method for assessing a vascular response in a subject using a gas delivery device, the gas delivery device configured for controlling an amount of carbon dioxide (CO_2) in a subject's lung to attain a series of targeted end tidal partial pressures of CO_2 ($PetCO_2^T$) for a series of respective intervals, the method comprising the steps of:

a. Obtaining input of a series of logistically attainable $PetCO_2^T$ values for the series of respective intervals; and

b. Determining an amount of CO_2 required to be inspired by the subject in an inspired gas to target the $PetCO_2^T$ for a respective interval; and

c. Controlling the amount of gas CO_2 in a volume of gas delivered to the subject in a respective interval to target the respective $PetCO_2^T$ for the interval;

wherein the series of $PetCO_2^T$ values for the series of respective intervals is at least one of a set of $PetCO_2^T$ increments and a set of $PetCO_2^T$ decrements

and wherein at least one of:

(a) the respective sizes of the at least one of the set of $PetCO_2^T$ increments and the set of $PetCO_2^T$ decrements and the size of the respective intervals; and

(b) the time over which the response is measured and the range of the vascular response;

is predetermined to reveal a dose response to at least one of the set of $PetCO_2^T$ increments and the set of $PetCO_2^T$ decrements.

12. A method as claimed in claim 11, wherein each interval is a respective breath [i].

13. A method in any one of claims 11 and 12, wherein the vascular response is a vasodilatory response to a set of $PetCO_2^T$ increments and wherein the set of logistically attainable $PetCO_2^T$ values produces a desired range of a vasodilatory stimulus and wherein the series of intervals is selected to satisfy a condition, the condition defined by attainment of at least a minimum increment in the vasodilatory response to an increment in the subject's $PetCO_2$ (optionally the series of $PetCO_2^T$ values for the series of respective intervals also revealing the time course of at least one of a partial range of a vasodilatory response and a full range of a vasodilatory response).

14. A method as claimed in any of one claims 11, 12 and 13, wherein the set of increments in $PetCO_2^T$ for the series of respective intervals is predetermined to produce two time constants in the progress of the vascular response in a respective interval.

15. A computer program product as claimed in any of one claims 11, 12 and 13, wherein the at least one set of increments in $PetCO_2^T$ for the series of respective intervals is predetermined to produce three time constants in the progress of the vascular response in a respective interval.

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