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I claim:

1. A ~~method of~~ system for acquiring in-vivo an image of interior parts of ~~the~~ a human body (20) or an image based quantification of blood flow conditions therein, ~~using~~ comprising:
   - an imaging system (21) and ~~comprising the steps of positioning the body (20) relatively to the imaging system (21), applying~~
   - a respiratory resistance device (10) to be applied to the respiratory system of the body (20),

     wherein
   - in the human body (20) a substance selected from a contrast fluid, dye or drug is flowing in the blood circulation,
   - the human body (20) is positioned relatively to the imaging system (21),
   - the respiratory resistance device (10) is applied to the respiratory system of the human body (20), and
   - ~~and performing~~ an image acquisition step is performed during an inhalation phase, during which the human body (20) provides suction against a resistance as provided by the respiratory resistance device (10), and/or ~~performing an image acquisition step~~ during an exhalation .phase, during which the human body (20) provides exhalation against a resistance as provided by the respiratory resistance device (10), whereby the distribution of the substance in the blood circulation is controlled through the selection of respiratory states by a controlled interaction between the respiratory system of the human body (20) and the respiratory resistance device (10) and thereby increasing the quality of the image obtained by the imaging system (21) in the image acquisition step.

2. The system as claimed in ~~method of~~ claim 1, wherein the image acquisition is performed while the inhalation/suction reduces the pressure in the respiratory resistance device (10).

Commented [D1]: Support: As-filed claim 15

Commented [D2]: Support: As-filed claim 27

Commented [D3]: Support: As-filed specification, Page 6, lines 29-30

3. The system as claimed in ~~method of~~ claim 1, wherein the image acquisition is performed while the inhalation/suction reduces the pressure in the respiratory resistance device (10) to a pressure in a range of -1 up to -80 mmHg ~~and preferably up to -60 mmHg and preferably up to -40 mmHg, and preferably -1 to -20 mmHg~~.

4. The system as claimed in ~~method of any of the preceding~~ claims 1 to 3, wherein the inhalation/suction is maintained during at least 1 second ~~and preferably over a period of between 1 and 60 seconds and preferably wherein the inhalation/suction is maintained during at least 5 seconds and preferably over a period of between 5 and 45 seconds and preferably over a period of between 5 and 30 seconds~~.

5. The system as claimed in ~~method of any of~~ the preceding claims, wherein a parameter related to a pressure generated through inhalation/suction 1s monitored during the –image acquisition.

6. The system as claimed in ~~method of any of~~ the preceding claims, wherein a parameter related to a pressure generated through inhalation/suction is used to generate a control signal indicative of deviation from a desired inhalation/suction state.

~~7. The method of any of the preceding claims, wherein a contrast fluid, dye, drug or similar is administered into a venous access in an upper extremity of the body (20) shortly before and/or during the inhalation/suction phase.~~

~~8.~~7. The system as claimed in ~~method of any of~~ the preceding claims, wherein the imaging system (21) is comprising a ~~used during~~ computer tomographic (CT) scanning~~,~~ or an ultrasound or magnetic resonance scanning (MRI) system~~or any other imaging method needing dyes within the body (20)~~.

~~9.~~8. The system as claimed in ~~method of any of~~ the preceding claims, wherein the image acquisition step is comprising ~~used during~~ angiography, perfusion, first

pass measurements ~~or similar~~ of the pulmonary arteries (PA) or other blood containing vessels distal to the vena cava and/or the heart.

~~10.~~9. The system as claimed in ~~method of any of~~ the preceding claims, wherein the image acquisition step is performed while the exhalation increases the pressure in the respiratory resistance device (10).

~~11.~~10. The system as claimed in ~~method of any of~~ the preceding claims, wherein the image acquisition step is performed while the exhalation increases the pressure in the respiratory resistance device to a pressure in range of + 1 mmHg to + 80 mmHg~~ and in particular to a pressure in the range +10 mmHg to +40 mmHg~~.

~~12.~~11. The system as claimed in the ~~method according to any~~ preceding claims, wherein the exhalation is maintained during at least 1 second~~ and preferably over a period of between 1 and 60 seconds and preferably wherein the exhalation is maintained during at least 5 seconds and preferably over a period of between 5 and 45 seconds and preferably over a period of between 5 and 30 seconds~~.

~~13.~~12. The system as claimed in ~~method of any of~~ the preceding claims, wherein a parameter related to a pressure generated through inhalation or through exhalation is monitored during the image acquisition.

~~14.~~13. The system as claimed in ~~method of any of~~ the preceding claims, wherein a parameter related to a pressure generated through exhalation is used to generate a control signal indicative of deviation from an optimal inhalation or exhalation state respectively.

~~15. The method of any of the preceding claims, wherein a contrast fluid, dye or drug is administered into a venous access in a lower extremity of the body (20) during or shortly prior to the image acquisition step during the exhalation phase.~~

~~17.~~14. The system as claimed in ~~method of any of~~ the preceding claims, wherein the image acquisition step is comprising ~~used during~~ angiography, computer tomographic (CT), Ultrasound (US) or magnetic resonance (MRI) scanning of the body or any other imaging method, including ~~(~~SPECT or SPECT/CT, PET~~,~~ and other optical imaging~~)~~.

~~18.~~15. The system as claimed in the ~~method of any~~ preceding claims, wherein the image acquisition step is comprising ~~used during~~ angiography of the pulmonary arteries or other blood containing vessels.

~~19.~~16. The system as claimed in the preceding claims, wherein the ~~A~~ respiratory resistance device (10)~~, for use in a method according to any of the preceding claims,~~ is comprising a main body (11) with one or more openings (121, 122) which are ~~to connect~~ connected in use with the respiratory system of the human body (20), and a closed inner volume or a inner volume with one or more constrictions (111) blocking partially the flow of air into or out of the respiratory system of the body (20) during an inhalation phase or exhalation phase, respectively.

~~20.~~17. The ~~respiratory resistance device according to~~ system as claimed in claim ~~18~~16, wherein the one or more constrictions (111) of the respiratory resistance device (10) are sufficiently small to enable the generation of an under/over pressure in the inner volume of the device (10) under normal inhaling/exhaling conditions of the human respiratory system.

~~21.~~18. The ~~respiratory resistance device according to~~ system as claimed in claims ~~18~~ 16 or ~~19~~17, wherein the respiratory resistance device (10) ~~having~~ has a replaceable subpart (12) comprising or consisting of a mouth piece (12) ~~and in particular a replaceable subpart~~ which provides the one or more openings (121, 122).

~~22. The respiratory resistance device according to claim 20, wherein the replaceable subpart comprises a mouth piece (12) or wherein the replaceable subpart consists of a mouth piece (12).~~

~~23.~~19. The ~~respiratory resistance device according to any of~~ system as claimed in claims ~~18~~ 16 to ~~21~~18, wherein the main body (11) of the respiratory resistance device (10) comprises a sensor (13) for measuring a parameter related to the pressure in the inner volume.

~~24.~~20. The ~~respiratory resistance device according to any of~~ system as claimed in claims ~~18~~ 16 to ~~22~~19, wherein the respiratory resistance device (10) is ~~further~~ comprising a control signal generator (14) for generating a control signal indicative of a deviation from a desired respiratory state or from a preset pressure value or range of pressure values.

Commented [D4]: Support: As-filed claim 24

~~25. The respiratory resistance device according to claim 23, wherein the control signal depends on deviations from a preset pressure value or range of pressure values.~~

~~27.~~21. The ~~respiratory resistance device according to~~ system as claimed in claim ~~23 or 24~~20, wherein the control signal generator (14) includes an indicator indicating whether inhalation/exhalation is too weak and/or too strong.

~~28.~~22. The ~~respiratory resistance device according to any of~~ system as claimed in claims ~~18~~ 16 to ~~25~~ 21, wherein the respiratory resistance device (10) is adapted to influence via defined respiratory states the distribution and/or standardization of blood supply either from the upper, superior vena cava or lower, inferior vena cava according to the respective requirement to increase blood supply from the respective vessel to the right atrium of the heart ~~or~~ and/or to enhance the concentration of a substance in the blood flow in the pulmonary arteries or in vessels beyond the pulmonary arteries.

~~29.~~23. The system as claimed in claims 16 to 22, wherein the ~~Use of a~~ respiratory resistance device (10) is comprising a main body (11) with one or more openings (121, 122) to connect in use with the respiratory system of the human body (20), and a closed inner volume or an inner volume with one or more constrictions (111) blocking partially the flow of air into or out of the respiratory system of the body (20) during an inhalation phase or exhalation phase, respectively, to influence via defined respiratory states the distribution and/or standardization of blood supply either from the upper, superior vena cava or lower, inferior vena cava according to the respective requirement to increase blood supply from the respective vessel to the right atrium of the heart, and/or to enhance the concentration of a substance in the S blood flow in the pulmonary arteries ~~or in vessels beyond the pulmonary arteries, and in particular enhance the concentration of a drug injected through the upper or lower peripheral veins~~.

~~30.~~24. The system as claimed in ~~Use according to~~ claim ~~27~~23, wherein the respiratory resistance device (10) includes a replaceable subpart (12) ~~and in particular a replaceable subpart~~ which provides the one or more openings (121, 122) and wherein the replaceable subpart comprises a mouth piece (12) or wherein the replaceable subpart consists of a mouth piece (12).

~~31.~~25. An image acquisition system for in-vivo acquisition of images ~~or quantitative data related to perfusion, blood flow or any controlled vascular parameter~~ of the interior of the human body (20) ~~and/or for the detection of thromboembolic material within the interior of the human body (20)~~, comprising:

- an image acquisition apparatus (21), in particular a CT scanner, MRI scanner, Ultrasound machine, Angiography, or a PET/CT or, PET/MRI apparatus,
- an injection system for administering a contrast fluid, dye or drug into a pre-established venous access of the body of a patient, and
- a respiratory resistance device (10).

Commented [D5]: Support: As-filed claim 30

Commented [D6]: Support: As-filed claim 7, 15 and 27

wherein the respiratory resistance device (10) is comprising a main body (11) with one or more openings (121, 122) which are connected in use with the respiratory system of the human body (20), and a closed inner volume or a inner volume with one or more constrictions (111) blocking partially the flow of air into or out of the respiratory system of the body (20) during an inhalation phase or exhalation phase, respectively,

and the respiratory resistance device (10) is comprising a control signal generator (14) for generating a control signal indicative of a deviation from a desired respiratory state or from a preset pressure value or range of pressure values of the pressure inside the main body (11)~~according to any of claims 18 to 26~~.

Commented [D7]: Support: As-filed claim 37

Commented [D8]: Support: As-filed claims 23 and 24

~~32. The image acquisition system of claim 29, comprising a CT scanner, MRI scanner, Ultrasound machine, Angiography, PET/CT, PET/MRI or similar imaging modalities (21) and a respiratory resistance device (10) as a set.~~

~~34.~~26. The image acquisition system ~~of claims~~ as claimed in claim ~~29 or 30~~25, comprising a synchronising element (15) linking the image acquisition ~~system~~ apparatus (21) with ~~parameter~~ parameters indicative of use conditions of the respiratory resistance device (10) during an image acquisition process.

~~35.~~27. The image acquisition system as claimed in claims 25 or 26, wherein ~~A method of~~ controlling and/or standardizing the distribution of a substance which is administered by the injection system into the ~~in~~ the human body (20) is performed during an inhalation phase or exhalation phase while~~, comprising the steps of applying a~~ the respiratory resistance device (10) provides a ~~to the respiratory system of the body (20), and injecting the substance into the body (20) and controlling or standardizing the distribution of the substance in the body (20) through the selection of~~ respiratory resistance ~~states characterized by a controlled interaction between~~ to the respiratory system of the human body (20)~~ and the respiratory resistance device (10)~~.

~~36.~~28. The ~~method of~~ system as claimed in claim ~~32~~ 27, wherein the substance is a contrast enhancing medium or dye, ~~optionally administered intravenously, further comprising~~ and the ~~step of using an~~ image acquisition system ~~to acquire~~ acquires an in-vivo image of the interior of the human body (20) or ~~the step of~~ is analysing a tissue sample of the human body (20).

~~37. The method of claim 32 wherein the substance is a drug, optionally administered intravenously.~~

~~39.~~29. The ~~method according to any of~~ system as claimed in claim ~~32~~ 27 ~~to~~ or ~~34~~ 28, ~~further including the steps of performing~~ wherein a first pass ~~measurements~~ measurement or perfusion is performed and~~,~~ its characterization or~~,~~ its quantification ~~as~~ is used for patient diagnostics and/or the management of blood flow, such as analysis, characterization or quantification of blood supply, vascularization or vessel density of lesions, tumors, or other pathologies.

~~40. A method of controlling and/or standardizing the blood flow in the human body (20), comprising the steps of applying a respiratory resistance device (10) to the respiratory system of the body (20), and controlling or standardizing the blood flow in the body (20) through the selection of respiratory states characterized by a controlled interaction between the respiratory system of the body (20) and the respiratory resistance device (10).~~

~~42.~~30. The system as claimed in claims 1 to 15, the system ~~Image enhancement kit~~ comprising a subsance selected from a contrast agent, a dye or a drug, for injection into the human body (20) ~~and a~~ together with the respiratory resistance device (10) ~~in accordance with claims 18 to 26~~as an image enhancement kit.

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~~43.~~31. A system of acquiring in-vivo an image of interior parts of the human body or an image based quantification of blood flow conditions, using an imaging system, the system comprising:

- an imaging system,
- a respiratory resistance device to be applied to the respiratory system of the body, and
- an administering system for administering a contrast fluid or a dye into a venous access of the human body,

wherein a contrast fluid or a dye, which is administered into a venous access of the human body before and/or during the inhalation phase or before and/or during the exhalation phase by the administering system, is flowing in the blood circulation of the human body, while an image of interior parts of the human body or an image based quantification of blood flow conditions is acquired at least during

an inhalation phase, during which the body provides suction against a respiratory resistance provided by the respiratory resistance device, and/or during an exhalation phase, during which the body provides exhalation against a respiratory resistance provided by the respiratory resistance device,

whereby the distribution of the contrast fluid or a dye in the blood circulation is controlled through the selection of specific respiratory states by a controlled interaction between the respiratory system of the human body and the respiratory resistance device, thereby increasing the quality of the image obtained by the imaging system.

Commented [D9]: Support: As-filed claim 1

Commented [D10]: Support: As-filed claim 29

Commented [D11]: Support: As-filed claims 1, 8

Dated this 1st day of January 2016