DEVICE FOR PROTECTION AND NON-TRAUMATIC SUPPORT OF A SURGICAL CAVITY

Abstract: Device (100) for protection and non-traumatic support of a surgical cavity (101), characterized in that comprising: - a radial wall (150), composed of a set of elements (121), (122), (123), etc., aligned along the longitudinal axis and connected each other, or by a single element wrapping up the same longitudinal axis as a spiral or a double spiral, and having a previously defined shape so that it can be adapted to a surgical working space created inside the body of a patient; the same radial wall (150) including an inner air chamber, and means able to push air (125) from outside and keeping the same air inside, so that the stiffness of the same radial wall (150) can be increased, and a previously defined pressure can be achieved, pushing tissues and inner anatomical parts of the same patient, and so that a protected surgical space (101) can be achieved in order to insert surgical instruments.
DEVICE FOR PROTECTION AND NON-TRAUMATIC SUPPORT OF A SURGICAL CAVITY.

The present invention concerns a medical device, particularly suitable for protection and non-traumatic support of a surgical cavity, inside the body of a patient that is submitted to a surgical operation, in order to achieve an inner protected space where surgical instruments can be inserted.

As known, the current techniques of surgery include the use of specific instruments, so called retractors, in order to achieve and keep a space inside the body of a patient. These retractors are of different types and, usually, are composed of some real metallic pincers, that are attached at their distal end to an anatomical tissue of the same patient, in example to the edge of a skin layer, and at the other end to an outer structure or to a stiff frame. More of these retractors can be used in great operations, in order to keep an open and stable cavity and permit the insertion and the handling of surgical instruments inside the body of a patient.

All the above retractors imply the serious drawback of keeping the anatomical tissues of the same patient, at points of attachment, under hard stretching, all during the time of operation. This fact cannot avoid to generate traumas and/or local injuries that, although are quickly recovered during the stay in the hospital, can cause pain and/or possible after-surgery complications for the patient.

Therefore, the present invention arises from the need to find some alternative ways to achieve an inner surgical space inside the body of a patient, that is stable and permits the insertion and handling of surgical instruments and decreases, at the same time, the possibility of direct or indirect damages to the patient. In fact, besides the above said injuries at the attaching points of retractors, some incidental traumas are possible, in example due to a sudden and unexpected motion of instruments and/or anatomical parts of the patient, and other traumas due to an operation in emergency conditions with low visibility, where in example it happens to have inner hemorrhage and/or diffusion of inner biological liquids that are not drained promptly.

Therefore, the main objective of the present invention is to disclose a specific medical device, for protection and non-traumatic support of a surgical cavity, that can be easily inserted in the body of a patient, and that can be adapted smoothly so that it can express a gradual and homogeneous pressure towards the tissues of the same patient, all along the outline of the contact wall.

Another objective is that the same device can be adapted, and the stiffness
of the walls can be increased, on command, by inserting air in proper airtight chambers, contained inside the same contact walls.

Another further objective is that the same device includes some specific accessories, like in example: some spatulas (with respective housings) and some hooks suitable for a stable positioning of the same device inside the patient; some suction/drainage means so that the surgical space is kept free of possible operative and/or biological liquids, that can be lost; and means of lighting, so that the surgical space is kept enlightened and it is possible a direct vision of the area of intervention.

Therefore, it is specific subject of the present invention a device for protection and non-traumatic support of a surgical cavity, characterized in that comprising:
- a radial wall, composed of a set of elements aligned along the longitudinal axis and connected each other, or by a single element wrapping up the same longitudinal axis as a spiral or a double spiral, and having a previously defined shape so that it can be adapted to a surgical working space created inside the body of a patient; the same radial wall including an inner air chamber, and means able to push air from outside and keeping the same air inside, so that the stiffness of the same radial wall can be increased, and a previously defined pressure can be achieved, pushing tissues and inner anatomical parts of the same patient, and so that a protected surgical space can be achieved in order to insert surgical instruments.

The present invention will now be described for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to figures of the enclosed drawings, wherein:

figure 1 is a upper lateral perspective view of a head of a patient to be submitted to a surgical operation;

figure 2 is a upper lateral perspective view of the same head of a patient of figure 1, where it is shown the use of a device for protection and non-traumatic support of a surgical cavity, according to the present invention;

figure 3 is a front view of a human brain, where the right and left hemispheres are kept separated and at a specific distance by two pincers, according to the prior art;

figure 4 is a front view of the same human brain of figure 3, where the right and left hemispheres are kept separated and at a specific distance by a device for protection and non-traumatic support of a surgical cavity, according to the present invention;

figures 5, 6 and 7 are a sequence upper lateral perspective views, of a device
for protection and non-traumatic support of a surgical cavity, according to the present invention, following three respective increasing levels of inner air pressure, and therefore of stiffness of the entire structure;

figure 8 is a front perspective view of a patient submitted to a brain surgical operation, where it is represented the point of view of a surgeon who uses a surgical microscope;

figure 9 is a lateral perspective view of the same situation of figure 8, where it is better represented the point of view of a surgeon who uses a surgical microscope, with respective optical cone indicated.

It is here underlined that only few of the many conceivable embodiments of the present invention are described, which are just some specific non-limiting examples, having the possibility to describe many other embodiments based on the disclosed technical solutions of the present invention.

Figure 1 shows the head of a patient that should be submitted to a surgical operation, instead figure 2 shows the same patient with applied a device 100 for protection and non-traumatic support of a surgical cavity, according to the present invention. This device 100 includes a radial wall 150, composed of a set of elements 121, 122, 123, etc., aligned along the longitudinal axis and connected each other, or by a single element wrapping up the same longitudinal axis as a spiral or a double spiral, and having a previously defined shape, so that it can be adapted to a surgical working space created inside the body of a patient. The same radial wall 150 includes an inner air chamber, and means able to push air 125 from outside and keeping the same air inside. In such a way, the stiffness of the same radial wall 150 can be increased, and a previously defined pressure can be achieved, pushing tissues and inner anatomical parts of the same patient. That permits to achieve a protected surgical space 101 suitable to insert surgical instruments.

The above said inner air chamber can have a properly defined shape, in example having different volume profiles at respective control points, so that the progress of air insertion makes it possible to define, besides the stiffness of said wall 150, also the eccentricity of the entire structure, changing the shape of device 100 from a very elliptical shape to a nearly circular one, according to the operative needs of the moment.

The radial wall 150 can have a cylindrical shape, otherwise it can have a cone shape with an increasing diameter in the longitudinal direction, or it can have a cone shape with a decreasing diameter in the longitudinal direction.
The example represented in figure 3 shows a situation where the hemispheres of brain 200 should be separated and kept at a specific distance, in order to operate inside the same brain. The procedure, according to prior art, involve some particular instruments, like in example elements 201 and 202, or some retractors, having their respective hook-shaped ends, that joint the edge of the brain tissue and keep it open all during the surgical operation.

Figure 4 shows how this function can be embedded by device of the present invention. In particular, a radial wall 205 expresses a specific pressure towards tissues and inner anatomical parts of the same patient, so that a protected surgical space 101 can be achieved in order to insert surgical instruments.

Figures 5, 6 and 7 represent a sequence of device 100 of invention, following three respective increasing levels of inner air pressure, and therefore of stiffness of the entire structure. Said means able to push air 125 are composed of a bolt syringe that, through a connecting tube 126 is jointed to the air chamber contained inside said radial wall 150. As an alternative, said means able to push air 125 are composed of more complex mechanical or electrical systems, able to detect a pressure level, inside the same radial wall 150, and to start/stop automatically the process of inflation/deflation of structure.

According to a specific embodiment of the invention, the radial wall 150 can further include means supporting the insertion of device 100 in the final position in the patient. The above means being composed of respective longitudinal channels 127, 128, 129, fixed along the profile of the radial wall 150, wherein some spatulas are housed. These spatulas having function of driving and supporting the insertion of device 100, and having the possibility to be removed later, when the same device 100 is stable in its final position.

Said radial wall 150 can further include means of anchorage in order to keep device 100 in its final position. Said means being composed of respective retractable hooks, fixed along the profile of said radial wall 150, that can be pulled inside, on command, afterwards when the same device 100 should be moved and/or removed because it is no more necessary for the operation.

The device 100 for protection and non-traumatic support of a surgical cavity 101, according to the present invention, can further include means for suction/drainage of liquids. These means can include in turn at least a tube of aspiration that reaches with its far end the open bottom of said radial wall 150. The above means being enabled/disabled on command, so that the surgical space is kept
free of possible operative and/or biological liquids, that can be lost and can invade the area of intervention.

Furthermore, the device 100 can further include means of lighting, comprising in turn an optical fiber system that is wrapped as a spiral on said radial wall 150. This system is able to irradiate a widespread light, the above means being enabled/disabled on command, so that the surgical space is kept enlightened and it is possible a direct vision of the area of intervention.

Said radial wall 150 can be composed of an inert material, possibly transparent, not extendable or slightly extendable, so that a function of protection and non-traumatic support of a surgical cavity 101 can be embedded, and a direct vision of the area of intervention is possible along any direction.

Figures 8 and 9 show, with reference to a patient submitted to a brain surgical operation, the point of view of a neuro-surgeon who uses a surgical microscope and watches from different angles, through a so called key-hole, in order to provide a proper visual exploration of the inner parts of the same patient, just by tipping the microscope forward, backward or on side. The present invention achieves the ideal key-hole, because it is non-traumatic and, according to its geometrical conformation and technical features, it protects the patient's tissues at 360 degrees, and in addition, changing the orientation of axis of the same key-hole, it is possible to change the axis of the surgical space of intervention, adapting it to any possible situation.

Therefore, the above examples show that the present invention achieves all the proposed objectives. In particular, it permits to achieve a specific medical device, for protection and non-traumatic support of a surgical cavity, that can be easily inserted in the body of a patient, and that can be adapted smoothly so that it can express a gradual and homogeneous pressure towards the tissues of the same patient, all along the outline of the contact wall.

In particular, the same device of invention can be adapted, and the stiffness of the walls can be increased, on command, by inserting air in proper airtight chambers, contained inside the same contact walls.

Another further characteristic of the present invention is that the same device includes some specific accessories, like in example: some spatulas (with respective housings) and some hooks suitable for a stable positioning of the same device inside the patient; some suction/drainage means so that the surgical space is kept free of possible operative and/or biological liquids, that can be lost; and means of lighting, so
that the surgical space is kept enlightened and it is possible a direct vision of the area of intervention.

The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is clear that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope, as defined in the enclosed claims.

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CLAIMS

1. Device (100) for protection and non-traumatic support of a surgical cavity (101), characterized in that comprising:
   - a radial wall (150), composed of a set of elements (121), (122), (123), etc., aligned along the longitudinal axis and connected each other, or by a single element wrapping up the same longitudinal axis as a spiral or a double spiral, and having a previously defined shape so that it can be adapted to a surgical working space created inside the body of a patient; the same radial wall (150) including an inner air chamber, and means able to push air (125) from outside and keeping the same air inside, so that the stiffness of the same radial wall (150) can be increased, and a previously defined pressure can be achieved, pushing tissues and inner anatomical parts of the same patient, and so that a protected surgical space (101) can be achieved in order to insert surgical instruments.

2. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to previous claim, characterized in that:
   - said inner air chamber has a properly defined shape, in example having different volume profiles at respective control points, so that the progress of air insertion makes it possible to define, besides the stiffness of said wall (150), either the eccentricity of the entire structure, changing the shape of device (100) from a very elliptical shape to a nearly circular one, according to the operative needs of the moment.

3. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that:
   - said radial wall (150) has a cylindrical shape, otherwise it has a cone shape with an increasing diameter in the longitudinal direction, or it has a cone shape with a decreasing diameter in the longitudinal direction.

4. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that:
   - said means able to push air (125) are composed of a bolt syringe that, through a connecting tube (126) is jointed to the air chamber contained inside said
radial wall (150), otherwise said means able to push air (125) are composed of more complex mechanical or electrical systems, able to detect a pressure level, inside the same radial wall (150), and to start/stop automatically the process of inflation/deflation of structure.

5. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that:
   - said radial wall (150) further includes means supporting the insertion of device (100) in the final position in the patient, the above means being composed of respective longitudinal channels (127), (128), (129), fixed along the profile of the radial wall (150), wherein some spatulas are housed, having function of driving and supporting the insertion of device (100), and having the possibility to be removed later, when the same device (100) is stable in its final position.

6. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that:
   - said radial wall (150) further includes means of anchorage in order to keep device (100) in its final position; said means being composed of respective retractable hooks, fixed along the profile of said radial wall (150), that can be pulled inside, on command, later when the same device (100) should be moved and/or removed because it is no more necessary for the operation.

7. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that further comprising:
   - means for suction/drainage of liquids, including in turn at least a tube of aspiration that reaches with its far end the open bottom of said radial wall (150), the above means being enabled/disabled on command, so that the surgical space is kept free of possible operative and/or biological liquids, that can be lost and can invade the area of intervention.

8. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that further comprising:
   - means of lighting, comprising in turn an optical fiber system that is wrapped as a spiral on said radial wall (150), and that is able to irradiate a widespread light; the above means being enabled/disabled on command, so that the surgical
space is kept enlightened and it is possible a direct vision of the area of intervention.

9. Device (100) for protection and non-traumatic support of a surgical cavity (101), according to one or more of previous claims, characterized in that further comprising:

- said radial wall (150) is composed of an inert material, possibly transparent, not extendable or slightly extendable, so that a function of protection and non-traumatic support of a surgical cavity (101) can be embedded, and a direct vision of the area of intervention is possible along any direction.

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B. FIELDS SEARCHED

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A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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