NOVEL HEMOSTATIC DEVICE FOR GENERAL SURGERY

Field of the Invention

The invention relates to the technical field of medical auxiliary device, and in particular to a novel hemostatic device for general surgery.

Background to the Invention

General surgery is a clinical subject that mainly treats liver, biliary tract, pancreas, gastrointestinal, anorectal, vascular diseases, thyroid and breast tumors, trauma and other diseases by using surgery as a main method, and is the largest specialty of surgical system. After the existing general surgery, hemostatic treatment is required to be performed on the wound position of a patient, so a hemostatic device needs to be used.

The prior art has the following deficiencies: I. Current hemostatic methods cannot ensure proper ventilation at the patient's wound site, causing the wound area to remain sealed and prone to anaerobic bacterial growth, which significantly hinders rapid hemostasis and healing; II. The fixed structure of hemostatic devices prevents adaptation to different anatomical positions during surgical procedures, particularly on limbs and bilateral waist areas, resulting in operational inconvenience and excessive occupancy of limited operating table space.

To address deficiency I, the prior art (Chinese Patent Application No. 202210887149.0, filed July 26, 2022) discloses a novel general surgical hemostatic device. This device employs an activated carbon filter nozzle to purify airborne particulates, a drying plate to absorb atmospheric moisture, and a sterilization lamp to disinfect the air. The treated air is then directed through perforations in an airflow plate into the inner hemostatic gauze layer, thereby maintaining wound ventilation, preventing anaerobic bacterial proliferation in sealed environments, and enhancing hemostatic efficacy for general surgical wounds - effectively resolving the deficiency I.

To address deficiency II, the prior art (Chinese Patent Application No. 202210579830.9,

filed May 25, 2022) discloses an novel general surgical hemostatic device. This device is positioned along one edge of the operating table to minimize space occupation. After installation, it utilizes fixed and movable airbag clamping plates to compress limbs and bilateral waist areas for hemostasis. The design enables simple, rapid operation, with adjustable height and angle of both clamping plates to facilitate medical staff's manipulation - effectively resolving the deficiency II.

While Prior Art 1 and Prior Art 2 can address the aforementioned deficiencies, their hemostatic compression components employ either simple planar or arc-shaped surface structures. This design limitation prevents optimal conformal contact with skin surfaces at varying wound locations, consequently compromising hemostatic efficacy. Furthermore, these devices' fixed hemostatic compression assemblies cannot be disassembled for cleaning, resulting in inadequate sterilization that may cause infection risks.

To resolve these issues, an innovative redesign based on existing equipment is urgently required. Accordingly, a novel general surgical hemostatic device is proposed, so as to effectively address all the aforementioned problems.

Statement of Invention

The object of the present invention is to provide a novel general surgical hemostatic device that resolves the following limitations of existing market devices: (1) their hemostatic compression components employ either simple planar or arc-shaped surface structures, preventing optimal conformal contact with skin surfaces at varying wound locations and consequently compromising hemostatic efficacy; and (2) their fixed hemostatic compression assemblies cannot be disassembled for cleaning, resulting in inadequate sterilization that may cause infection risks.

In order to achieve the above purpose, the invention provides the following technical scheme: a novel hemostatic device for general surgery includes a support frame, wherein the inner side of the support frame is provided with an outer wrapping layer, and the inner bottom of the outer wrapping layer is provided with an air bag;

the inner part and the top of the outer wrapping layer are provided with a deformation

assembly, the deformation assembly comprises seven horizontally arranged linkage pressing plates disposed inside the outer wrapping layer and located at the top of the air bag; adjacent linkage pressing plates are rotatably connected to each other via connecting pins; fixed bases are fixedly connected to the tops of the three linkage pressing plates located at the center and both sides; connecting rotating blocks are rotatably connected to the inner sides of the fixed bases; magnetic rods are fixedly connected to the tops of the connecting rotating blocks; the magnetic rods extend upward and slidably penetrate to the outer side of the top of the support frame; first springs are fixedly connected between the magnetic rods and the top of the support frame; electromagnets are fitted and mounted on the support frame at a position surrounding the outer side of the three first springs.

During use, the support frame is first placed on the outer side of the patient's wound area with the air bag fitting against the wound. The upward thrust of the first springs provides downward compressive force to the magnetic rods, the magnetic rods continue to drive the three linkage pressing plates downward through the connections of the connecting rotating blocks and fixed bases. Since the multiple linkage pressing plates are rotationally connected to each other, the linkage pressing plates as a whole can perform corresponding rotational adjustments according to the surface curvature of different parts of the patient's body to form a conforming curvature. The air bag at the bottom of the linkage pressing plates simultaneously adjusts its curvature to ensure tight fitting and encapsulation of the bleeding wound surface. At this time, the three magnetic rods are manually pressed downward to provide additional hemostatic compression force. The control system energizes the three electromagnets, the three electromagnets generate magnetic force to attract and fix the positions of the magnetic rods, thereby maintaining constant compression force and preventing loosening, which effectively ensures hemostatic results.

The bottom of the air bag is detachably provided with a waterproof cloth through an installation assembly, and the bottom of the waterproof cloth is fixedly bonded with a sterile cotton cloth. The sterile cotton cloth achieves hemostasis through direct contact with the patient's bleeding wound, ensuring effective sterilization. The waterproof cloth prevents blood from permeating upward into the air bag, thereby avoiding difficult cleaning

scenarios. Furthermore, the mounting assembly enables convenient replacement of both the waterproof cloth and sterile cotton cloth after use, maintaining device hygiene.

Optionally, both sides of each linkage pressing plate are respectively formed with an interlocking protruding edge and an interlocking groove, so as to facilitate the rotary connection between pairs through the connecting pin.

Optionally, two electromagnets located at both sides are formed with straight slot structures, each having an activity chamber for the magnetic rods to move laterally, such that when the linkage pressing plates 3 at the bottom perform rotational adjustment, they adapt to the lateral movement changes of the magnetic rods.

Optionally, both sides of the bottom of the support frame are provided with preliminary fixing assemblies, the preliminary fixing assemblies each comprise a movable rod slidably connected to both sides of the bottom of the support frame; a second spring is fixedly connected between each movable rod and the outer sidewall of the support frame; a connecting base is fixedly connected to the sidewall of each movable rod located at the inner side of the support frame; a pressing arc plate is rotatably connected to the inner side of each connecting base; and a plurality of suction cups are fixedly mounted on the sidewall of each pressing arc plate.

By adopting the above technical solution, when the support frame is positioned adjacent to the patient's wound area, the second springs drive the movable rods to push inward, causing the two pressing arc plates to initially clamp both sides of the affected area. Through the rotational connection between the connecting bases and pressing arc plates, the pressing arc plates can adaptively adjust their tilt angles according to the surface curvature of the area, achieving better skin conformity. Furthermore, the multiple suction cups adhering to the skin surface enhance the clamping stability of the pressing arc plates, thereby ensuring reliable preliminary fixation of the device.

Optionally, each pressing arc plate is formed with rotating shafts at both ends thereof; the rotating shafts are rotatably connected to inner sides of both ends of the corresponding connecting base; a torsional spring is fixedly connected between each rotating shaft and an outer end wall of the corresponding connecting base. Through the arrangement of the

torsional springs and rotating shafts, when the device is removed after use, the two pressing arc plates can rotate back to their horizontal positions for subsequent use.

Optionally, the air bag is provided with inflation assemblies on both sides thereof; each inflation assembly comprises a fixed curved pipe fixedly connected to a corresponding side of the support frame; a negative pressure bulb is fixedly sleeved on top of each fixed curved pipe; a multi-branch pipe is fixedly installed inside each pressing arc plate, with branch ports of the multi-branch pipe communicating with an interior of each corresponding suction cup; each multi-branch pipe communicates with the corresponding fixed curved pipe through a first flexible hose fixedly inserted therebetween; and both sides of the air bag communicate with the fixed curved pipes through second flexible hoses.

When the pressing arc plates are clamped on both sides of the patient's injured area, the negative pressure bulbs are first compressed. After the suction cups adhere to the patient's skin surface, the negative pressure bulbs are released. Due to their elastic material properties, the negative pressure bulbs expand outward to their original positions, sequentially drawing residual air from inside the suction cups through the fixed curved pipes, first flexible hoses, and multi-branch pipes. This creates a vacuum state inside the suction cups, significantly enhancing their adhesive force. Subsequently, by sequentially pinching the first flexible hoses and compressing the negative pressure bulbs, the internal air of the negative pressure bulbs is forced through the fixed curved pipes and second flexible hoses into the air bag, causing the air bag to inflate and provide additional hemostatic compression force.

Optionally, a flow-blocking plate is disposed inside each fixed curved pipe; the flow-blocking plate is fixedly connected via a rod to a handwheel located outside the corresponding fixed curved pipe; after inflation of the air bag, rotation of the handwheel causes the flow-blocking plate to block the corresponding fixed curved pipe, thereby preventing backflow of air from the air bag into the negative pressure bulb.

Optionally, the mounting assembly comprises clamping hooks fixedly connected to outer walls of both ends of the linkage pressing plates on both sides; connection lugs are formed at four corner edges of the waterproof cloth; a clamping block is fixedly connected to an

end portion of each connection lug; the four clamping blocks are respectively clamped and hooked to inner sides of the corresponding connection lugs.

By employing the aforementioned technical solution, the waterproof cloth 24 can be rapidly installed at the bottom of the air bag 11 through the corresponding engagement between the four sets of clamping hooks 26 and clamping blocks 28. For disassembly, simply apply force to pry the clamping blocks 28 out from the top openings of the clamping hooks 26.

Optionally, clamping hook 26 is configured as an annular structure with a central angle exceeding 180°; each clamping block 28 comprises a cylindrical engagement portion and a wider limiting portion. The clamping hooks 26 securely retain the engagement portions of the clamping blocks 28 through positional confinement, ensuring stable connection while permitting easy disassembly by extracting the clamping blocks 28 through the top openings of the clamping hooks 26. Furthermore, the wider limiting portions of the clamping blocks 28 prevent lateral disengagement from the clamping hooks 26.

Compared with prior art techniques, the advantageous effects of the present invention are as follows: The novel hemostatic device for general surgery achieves improved clinical outcomes through its deformation assembly configuration. The combined action of the first spring's upward thrust and rotational connections between multiple linkage pressing plates enables the entire pressing plate assembly to adaptively adjust its curvature according to anatomical surface contours, while the coordinated interaction between electromagnets and magnetic rods maintains constant compression force, thereby ensuring optimal hemostasis. The mounting assembly's detachable installation of waterproof cloth and sterile cotton cloth beneath the air bag prevents blood permeation that could complicate cleaning procedures, with both assemblys designed for convenient replacement.

1. By incorporating the deformation assembly during use, the support frame is first positioned adjacent to the patient's wound area with the air bag conforming to the wound surface, where the first springs sequentially drive the three magnetic rods, connecting rotating blocks, fixed bases and linkage pressing plates downward through their upward thrust force. Due to the rotational connections between multiple linkage pressing plates, the entire assembly of linkage pressing plates can adaptively adjust its curvature according

to the surface contours of different body regions to form a conforming contact profile, while the air bag simultaneously undergoes corresponding curvature adjustment to achieve tight encapsulation of the hemorrhagic wound surface. Moreover, through coordinated interaction between the three electromagnets and magnetic rods, the positions of the magnetic rods become fixed to maintain constant compression force, preventing displacement and thereby effectively ensuring optimal hemostatic performance.

2. The mounting assembly detachably installs the waterproof cloth and sterile cotton cloth beneath the air bag. The sterile cotton cloth achieves hemostasis through direct contact with the patient's bleeding wound while maintaining sterilization efficacy. The waterproof cloth prevents upward blood permeation into the air bag that would complicate cleaning. Furthermore, the mounting assembly enables convenient post-procedural replacement of both the waterproof cloth and sterile cotton cloth, thereby ensuring optimal hygienic conditions during device operation.

3. The preliminary fixing assembly, when configured, enables the following operational sequence: Upon positioning the support frame exterior to the patient's wound area, the second springs actuate the movable rods to apply inward thrust, causing the dual pressing arc plates to establish primary clamping engagement on bilateral wound margins. Through the rotational coupling between connecting bases and pressing arc plates, the plates automatically conform to regional anatomical curvature via adaptive angular adjustment, achieving optimal cutaneous apposition. Concurrently, multiple suction cups actively adhere to the dermal surface, enhancing clamping stability of the pressing arc plates and thereby ensuring reliable preliminary fixation of the entire device.

4. By arranging the inflatable assembly, when the pressing arc plate is clamped on both sides of the injured part of the patient, the negative pressure ball is pinched, and when the suction cup is adsorbed on the skin surface of the patient, the negative pressure ball is released, and the negative pressure ball expands outward and resets due to its elastic material, and the residual air in the suction cup is sucked through the fixed curved pipe, the first hose and the multi-branch pipe in turn, so that the suction cup is in a vacuum state, thus greatly improving the adsorption strength of the suction cup, and then the first hose is pinched and the negative pressure is pinched in turn.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of the overall structure according to the present invention.

FIG. 2 is a schematic view of the cross-sectional structure of the support frame and the outer wrapping layer according to the present invention.

FIG. 3 is a partial structural schematic diagram of the deformation assembly according to the present invention.

FIG. 4 is a schematic diagram of the disassembly structure of the waterproof cloth and the sterile cotton cloth according to the present invention.

FIG. 5 is a schematic diagram of the connection structure between the primary fixing assembly and the inflation assembly according to the present invention.

FIG. 6 is a schematic view of the internal sectional structure of the fixed curved pipe according to the present invention.

FIG. 7 is a schematic diagram of the exploded structure of the connecting base and the pressing arc plate according to the present invention.

FIG. 8 is a schematic view of the sectional structure of the pressing arc plate and the multi-branch pipe according to the present invention.

In the figures: 1. support frame; 2. outer wrapping layer; 3. linkage pressing plate; 4. connecting pin; 5. fixed base; 6. connecting rotating block; 7. magnetic rod; 8. first spring; 9. movable cavity; 10. electromagnet; 11. air bag; 12. movable rod; 13. second spring; 14. connecting base; 15. pressing arc plate; 16. rotating shaft; 17. torsional spring; 18. suction cup; 19. multi-branch pipe; 20. fixed curved pipe; 21. negative pressure bulb; 22. first flexible hose; 23. second flexible hose; 24. waterproof cloth; 25. sterile cotton cloth; 26. clamping hook; 27. connection lug; 28. clamping block; 29. flow-blocking plate; and 30. handwheel.

Detailed Description

In the following, the technical scheme in the embodiment of the invention will be clearly and

completely described with reference to the attached drawings. Obviously, the described embodiment is only a part of the embodiment of the invention, but not the whole embodiment. Based on the embodiments in the present invention, all other embodiments obtained by ordinary technicians in the field without creative labor belong to the scope of protection of the present invention.

Embodiment 1: as shown in FIG. 1 - FIG. 3 and FIG. 5 - FIG. 8, the conventional devices employ a hemostatic compression portion with a simple planar or arc-shaped surface structure, which fails to achieve close conformal contact with skin surfaces at different wound locations, consequently resulting in inadequate hemostatic efficacy. To address this technical deficiency, the present embodiment discloses the following technical solutions:

the inner side of the support frame 1 is provided with an outer wrapping layer 2, and the inner bottom of the outer wrapping layer 2 is provided with an air bag 11;

the inner part and the top of the outer wrapping layer 2 are provided with a deformation assembly, the deformation assembly comprises seven horizontally arranged linkage pressing plates 3 disposed inside the outer wrapping layer 2 and located at the top of the air bag 11; adjacent linkage pressing plates 3 are rotatably connected to each other via connecting pins 4; fixed bases 5 are fixedly connected to the tops of the three linkage pressing plates 3 located at the center and both sides; connecting rotating blocks 6 are rotatably connected to the inner sides of the fixed bases 5; magnetic rods 7 are fixedly connected to the tops of the connecting rotating blocks 6; the magnetic rods 7 extend upward and slidably penetrate to the outer side of the top of the support frame 1; first springs 8 are fixedly connected between the magnetic rods 7 and the top of the support frame 1; electromagnets 10 are fitted and mounted on the support frame 1 at a position surrounding the outer side of the three first springs 8; the two electromagnets 10 located at both sides are formed with straight slot structures, each having an activity chamber 9 for the magnetic rods 7 to move laterally, such that when the linkage pressing plates 3 at the bottom perform rotational adjustment, they adapt to the lateral movement changes of the magnetic rods 7;

during use, the support frame 1 is first placed on the outer side of the patient's wound area

with the air bag 11 fitting against the wound. The upward thrust of the first springs 8 provides downward compressive force to the magnetic rods 7, the magnetic rods 7 continue to drive the three linkage pressing plates 3 downward through the connections of the connecting rotating blocks 6 and fixed bases 5. Since the multiple linkage pressing plates 3 are rotationally connected to each other, the linkage pressing plates 3 as a whole can perform corresponding rotational adjustments according to the surface curvature of different parts of the patient's body to form a conforming curvature. The air bag 11 at the bottom of the linkage pressing plates 3 simultaneously adjusts its curvature to ensure tight fitting and encapsulation of the bleeding wound surface. At this time, the three magnetic rods 7 are manually pressed downward to provide additional hemostatic compression force. The control system energizes the three electromagnets 10, the three electromagnets 10 generate magnetic force to attract and fix the positions of the magnetic rods 7, thereby maintaining constant compression force and preventing loosening, which effectively ensures hemostatic results.

Further, both sides of the bottom of the support frame 1 are provided with preliminary fixing assemblies, the preliminary fixing assemblies each comprise a movable rod 12 slidably connected to both sides of the bottom of the support frame 1; a second spring 13 is fixedly connected between each movable rod 12 and the outer sidewall of the support frame 1; a connecting base 14 is fixedly connected to the sidewall of each movable rod 12 located at the inner side of the support frame 1; a pressing arc plate 15 is rotatably connected to the inner side of each connecting base 14. Specifically, each pressing arc plate 15 is formed with rotating shafts 16 at both ends thereof; the rotating shafts 16 are rotatably connected to inner sides of both ends of the corresponding connecting base 14; a torsional spring 17 is fixedly connected between each rotating shaft 16 and an outer end wall of the corresponding connecting base 14. Through the arrangement of the torsional springs 17 and rotating shafts 16, when the device is removed after use, the two pressing arc plates 15 can rotate back to their horizontal positions for subsequent use. A plurality of suction cups 18 are fixedly mounted on the sidewall of each pressing arc plate 15. By adopting the above technical solution, when the support frame 1 is positioned adjacent to the patient's wound area, the second springs 13 drive the movable rods 12 to push inward, causing the

two pressing arc plates 15 to initially clamp both sides of the affected area. Through the rotational connection between the connecting bases 14 and pressing arc plates 15, the pressing arc plates 15 can adaptively adjust their tilt angles according to the surface curvature of the area, achieving better skin conformity. Furthermore, the multiple suction cups 18 adhering to the skin surface enhance the clamping stability of the pressing arc plates 15, thereby ensuring reliable preliminary fixation of the device.

In addition, the air bag 11 is provided with inflation assemblies on both sides thereof; each inflation assembly comprises a fixed curved pipe 20 fixedly connected to a corresponding side of the support frame 1; a negative pressure bulb 21 is fixedly sleeved on top of each fixed curved pipe 20; a multi-branch pipe 19 is fixedly installed inside each pressing arc plate 15, with branch ports of the multi-branch pipe 19 communicating with an interior of each corresponding suction cup 18; each multi-branch pipe 19 communicates with the corresponding fixed curved pipe 20 through a first flexible hose 22 fixedly inserted therebetween; and both sides of the air bag 11 communicate with the fixed curved pipes 20 through second flexible hoses 23. By employing the aforementioned technical solution, when the pressing arc plates 15 are clamped on both sides of the patient's injured area, the negative pressure bulbs 21 are first compressed. After the suction cups 18 adhere to the patient's skin surface, the negative pressure bulbs 21 are released. Due to their elastic material properties, the negative pressure bulbs 21 expand outward to their original positions, sequentially drawing residual air from inside the suction cups 18 through the fixed curved pipes 20, first flexible hoses 22, and multi-branch pipes 19. This creates a vacuum state inside the suction cups 18, significantly enhancing their adhesive force. Subsequently, by sequentially pinching the first flexible hoses 22 and compressing the negative pressure bulbs 21, the internal air of the negative pressure bulbs 21 is forced through the fixed curved pipes 20 and second flexible hoses 23 into the air bag 11, causing the air bag 11 to inflate and provide additional hemostatic compression force. Further, a flow-blocking plate 29 is disposed inside each fixed curved pipe 20; the flow-blocking plate 29 is fixedly connected via a rod to a handwheel 30 located outside the corresponding fixed curved pipe 20; after inflation of the air bag 11, rotation of the handwheel 30 causes the flow-blocking plate 29 to block the corresponding fixed curved pipe 20, thereby

preventing backflow of air from the air bag 11 into the negative pressure bulb 21.

Embodiment 2: the technical content disclosed in this embodiment is a further improvement on the basis of the above-mentioned Embodiment 1. As shown in FIG. 4, conventional devices feature fixed hemostatic compression assemblys that cannot be disassembled for cleaning, resulting in inadequate sterilization of the hemostatic device and potential infection risks. To address this technical limitation, the present embodiment discloses the following technical solutions:

the bottom of the air bag 11 is detachably provided with a waterproof cloth 24 through an installation assembly, and the bottom of the waterproof cloth 24 is fixedly bonded with a sterile cotton cloth 25. The sterile cotton cloth 25 achieves hemostasis through direct contact with the patient's bleeding wound, ensuring effective sterilization. The waterproof cloth 24 prevents blood from permeating upward into the air bag 11, thereby avoiding difficult cleaning scenarios. Furthermore, the mounting assembly enables convenient replacement of both the waterproof cloth 24 and sterile cotton cloth 25 after use, maintaining device hygiene and preventing potential infections.

Specifically, the mounting assembly comprises clamping hooks 26 fixedly connected to outer walls of both ends of the linkage pressing plates 3 on both sides; connection lugs 27 are formed at four corner edges of the waterproof cloth 24; a clamping block 28 is fixedly connected to an end portion of each connection lug 27; the four clamping blocks 28 are respectively clamped and hooked to inner sides of the corresponding connection lugs 27. By employing the aforementioned technical solution, the waterproof cloth 24 can be rapidly installed at the bottom of the air bag 11 through the corresponding engagement between the four sets of clamping hooks 26 and clamping blocks 28. For disassembly, simply apply force to pry the clamping blocks 28 out from the top openings of the clamping hooks 26. Each clamping hook 26 is configured as an annular structure with a central angle exceeding 180°; each clamping block 28 comprises a cylindrical engagement portion and a wider limiting portion. The clamping hooks 26 securely retain the engagement portions of the clamping blocks 28 through positional confinement, ensuring stable connection while permitting easy disassembly by extracting the clamping blocks 28 through the top openings of the clamping hooks 26. Furthermore, the wider limiting portions of the

clamping blocks 28 prevent lateral disengagement from the clamping hooks 26.

What is not described in detail in this specification belongs to the prior art known to those skilled in the art.

Although the present invention has been described in detail with reference to the foregoing embodiments, it is still possible for a person skilled in the art to modify the technical scheme described in the foregoing embodiments or to replace some technical features by equivalents. Any modification, equivalent replacement, improvement, etc. made within the spirit and principle of the present invention should be included in the protection scope of the present invention.