LESS
Laparosc Endosc Surg Sci 2025;32(1):64-65
DOI: 10.14744/less.2025.91249

Letter to the Editor

Adjustable organ manipulation device for laparoscopic surgery

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Dear editor,

Manipulation of solid organs and achieving adjustable positioning during laparoscopic surgery remain significant challenges. Particularly during laparoscopic liver surgeries, instruments such as graspers, claw-like tools, and similar devices used for manipulation and these devices can traumatize liver and lead injuries and bleeding. Trauma to the liver during surgery also triggers systemic inflammation, adversely affecting the prognosis.[1]

Some surgeons address this issue in laparoscopic liver surgery by suturing the liver to the abdominal wall through its ligaments to maintain position. However, this method results in organ trauma and does not allow adjustable positioning. Others attempt to provide positioning by filling a surgical glove with water.[2] However, this approach is challenging to prepare, lacks durability, and does not provide adjustability. The LiVac laparoscopic liver retractor system (LiVac retractor) is a novel laparoscopic liver retractor comprising a disposable, soft, collapsible silicone ring-shaped device connected to suction tubing. The LiVac retractor is placed between the liver and diaphragm, and suction is then applied to the tubing, which then apposes the liver and diaphragm with vacuum forces.[3] Although there is positive feedback regarding the use of LiVac, it still has certain drawbacks. Therefore, the search for an effective and innovative device with a different mechanism for laparoscopic surgery continues.

With this aim, we have developed an original device consisting of two main parts. The first part is a balloon made of silicone material, which is placed inside the abdomen in a deflated state through a trocar. The surface of the balloon is equipped with numerous projections to prevent slippage and ensure stability. Additionally, the surface includes grips suitable for holding with a grasper to facilitate placement in the desired location. One end of the balloon is connected to a silicone tube, the other end of which exits the abdominal wall through an opening, remaining external to the abdomen. The external end of the tube connects to the second part of the device. The second part comprises a piston mechanism that allows controlled delivery of saline solution into the balloon and a three-way valve to control the opening and closing of the piston tip. The balloon can be inflated via the piston until the desired position is achieved. Once the desired position is obtained, the balloon's inflation can be maintained by closing the three-way valve. For repositioning, the balloon can be partially deflated by withdrawing saline via the piston or further inflated by adding more saline, facilitated by the opening and closing of the three-way valve. This enables adjustable manipulation. Furthermore, the balloon can be grasped using the grips on its surface and placed in the desired location, providing another significant advantage in terms of manipulation and positional adjustment. Details of the device and its components are illustrated in Figures 1 and Figure 2.

Received: 30.12.2024 **Revision:** 30.12.2024 **Accepted:** 14.02.2025
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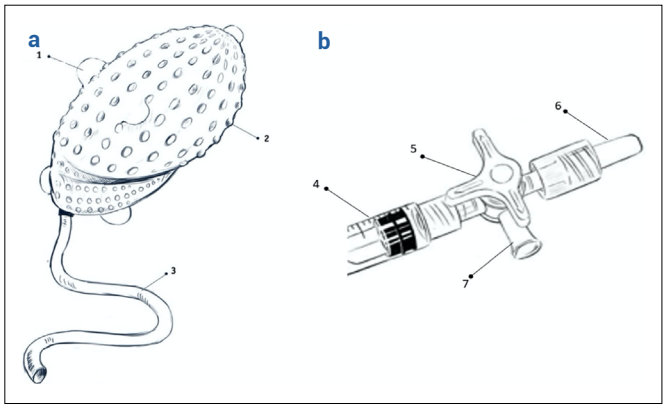

Figure 1. (a) Device Part 1: Grip handles (1) and numerous projections on the surface of the silicone balloon to prevent slippage. Silicone tube integrated into the balloon (3). The other end of the silicone tube passes through the abdominal wall and integrates with Part 2 of the device outside the abdomen. **(b)** Device Part 2: Piston (4), three-way valve (5), external integration point of the silicone tube, auxiliary channel of the valve for filling and emptying.

The device has been submitted to the Turkish Patent and Trademark Office with the application number 2024/006763. The prototype is currently under preparation. The device is expected to make significant contributions to laparoscopic and robotic surgical procedures, particularly in liver resections, in terms of achieving adjustable positioning.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

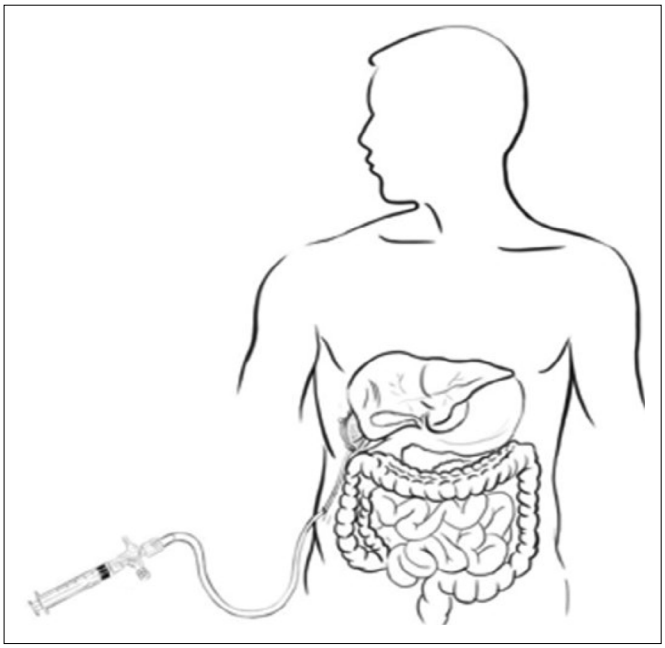

Figure 2. The balloon part 1 is placed in the posterior-superior inferior segment of the liver, integrated with part 2, and is ready for use.

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