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How to Build a Simple and Safe Laparoscopic Hydatid Evaluation System

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ABSTRACT

Background: One of the most common problems faced in laparoscopic treatment of hydatid cysts is the difficulty in evacuating the particulate contents (daughter cysts and laminated membrane). Although various instruments and laparoscopic techniques have been described to evacuate the contents of hydatid cysts, most are not available at many surgical centers.

Methods: By assembling disposable, cheap, and available anesthesia equipment with common laparoscopic instruments, a laparoscopic system was made to evacuate the contents of a hydatid cyst. Ten patients with hepatic hydatid disease underwent laparoscopic surgery using this new hydatid system between June 2011 and January 2013.

Results: The procedure was completely straightforward. Twelve hydatid cysts (2 patients had 2 separated cysts) were evacuated without any spillage. All patients were followed for at least 8 months, with no evidence of recurrence.

Conclusions: This simple apparatus, which can be assembled anywhere, was safely used to evacuate the contents of hydatid cysts without causing any spillage.

Key Words: Hydatid cyst of liver, Laparoscopic hydatid system, Catheter mount, Daughter cyst, Laminated membrane.

INTRODUCTION

One of the most important steps in surgery for hydatid cysts is the evacuation of the cavity without any spillage. Spillage of hydatid fluid is considered responsible for postoperative recurrence and intraoperative anaphylactic shock.[1–3] The most popular laparoscopic method to prevent spillage is intraoperative aspiration of the cyst fluid by inserting a long needle (eg, a Veress needle) into the hydatid cyst and replacing the fluid with a scolicidal agent.[4–6] Although this method seems to be easy and effective, there are several disadvantages, including the risk for leakage around the puncture site (because of the high pressure in the cyst)[7,8] and frequent blockage of the puncture needle by intracystic particles (necessitating withdrawal and causing further leakage).[9] Finally, even after complete aspiration of the fluid, this method cannot manage a common problem faced in laparoscopic treatment, which is the difficulty in evacuating the particulate contents (daughter cysts and laminated membrane).[10,11] Although various instruments and laparoscopic techniques have been described to evacuate the contents of hydatid cysts, most are not available at many surgical centers.[12–18] In this paper, it is shown how a surgeon can make a simple and safe laparoscopic hydatid system by assembling some disposable, cheap, and available anesthesia equipment with some typical laparoscopic instruments. Note, some components of this device may have been used by the anesthesiologist on the same patient at the same time. To prevent any confusion, "HHS" (Hemmati hydatid system) was added to the names of these components as used in a modified shape and task.

TECHNIQUE DESCRIPTION

The hydatid system was assembled by using some parts of a typical laparoscopic cholecystectomy surgical set, a disposable 12-mm laparoscopic trocar, a disposable flexible catheter mount with a suction cap, and a customized cuffed visually clear endotracheal tube (No. 7.5) with its connector (**Figure 1**). Most endotracheal tubes have an additional hole at the tip called a Murphy's eye. If there is a Murphy's eye, that part of the HHS endotracheal tube must be removed using an oblique incision. In this situa-

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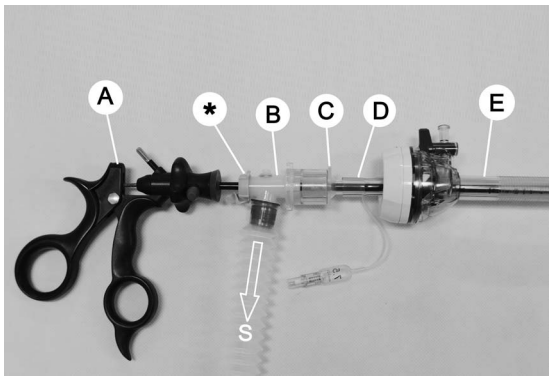

Figure 1. Hemmati hydatid system. A, Monopolar Maryland laparoscopic grasper/dissector. B, Catheter mount with suction cap (asterisk). C, Endotracheal tube connector. D, Customized endotracheal tube. E, Disposable laparoscopic trocar. S, suction applied via the catheter mount.

tion, the beveled tip can be opposed firmly to the surface of the cyst by suction applied through its lumen. The cuff of the HHS endotracheal tube can be saved to form a seal against the pericyst when it has been introduced and inflated in the cystostomy in the final step of hydatid material evacuation (in the hope of avoiding any leakage). The additional length of the HHS endotracheal tube should be removed (from its upper part) depending on the distance between the top of the hydatid cyst and the location of the adjacent 12-mm laparoscopic trocar (hopefully resulting in more suitable handling). After performing these modifications, the HHS endotracheal tube and its connector connect to a flexible catheter mount that has a suction cap. There are different types of catheter mounts, many of which have an additional suction cap, allowing the anesthetist to clear endotracheal secretion by inserting a suction catheter into the endotracheal tube while the patient is ventilated. The main reason for using this kind of catheter mount in this hydatid system is the presence of this sealed suction port, which can be useful in introducing different types of laparoscopic instruments into the HHS when it has a hypobaric atmosphere, which serves as an isolated working unit. The catheter mount has another dilated end that must be removed when used as a part of the HHS to join better to the suction tube.

OPERATIVE APPLICATION

Ten consecutive patients (6 female, 4 male) have undergone surgery using the HHS since June 2011. They had 12 cysts (2 patients had 2 cysts) that were not located in the blind area for laparoscopic procedures or in intraparenchymal locations, and none had any thick and calcified walls. Oral albendazole (400 mg twice daily) had been administrated to all patients for at least 2 weeks before surgery. All procedures were performed in the supine position. Prophylactic antibiotics were administered 30 minutes before the operation. Four ports were placed: a supraumbilical 10-mm port through which a 30° telescope was inserted, a 12-mm port introduced through the abdominal wall as close as possible to the upper pole of the cyst, and 2 additional 5-mm ports according to cyst location. Through the 12-mm port, gauze soaked with hypertonic saline as a scolicidal agent was introduced into the abdominal cavity around the cyst. The HHS was introduced into the abdominal cavity through the 12-mm port, and while being handled by the left hand, the tip of the tube was firmly attached to the top of the hydatid cyst by applying negative pressure from the suction machine. Then a monopolar Maryland grasper/dissector was introduced into the system to create a fine opening in the cyst wall by applying electrocautery and gentle manual dissection. Another sucker was introduced through one of the 5-mm ports near the working tube to avoid any accidental spillage of the cyst contents. The fluid of the hydatid cyst began to evacuate immediately after the cyst wall was perforated; the evacuation was assisted by applying the Maryland grasper/dissector, especially when the germinative layer or retained daughter cysts partially or completely blocked the stoma of the cyst (**Figure 2***)*. After a near total evacuation of the hydatid material, a linear cystotomy of about 10 mm was performed using hook electrocautery at the perforated site on the deflated cyst wall. Then the tip of the HHS endotracheal tube was advanced into the cystotomy until the cuff could be inflated safely in the cyst cavity; during this process, laparoscopic hook electrocautery was helpful to pull up the stoma like a simple surgical hook. While continuous suction was simultaneously maintained and the inflated portion of the cuff formed a seal against the pericyst by being inflated, a laparoscopic suction irrigation cannula was introduced into the cyst through the HHS to irrigate the cavity with hypertonic saline (**Figure 3**). Then a 5-mm laparoscopic telescope or a Hopkins telescope-guided foreign body grasper was introduced into the cavity to exclude any biliary communication or retained daughter cysts. Finally, a Foley catheter was placed in the remaining cyst cavity, and its cuff was inflated to be fixed in the stoma. Gauze was placed in an Endobag (Covidien, Dublin, Ireland) and removed. Oral intake was allowed the day after the operation, and the Foley catheter was removed 48 hours after the operation if bile did not appear in the drain. All patients were followed for at least 8 months, without any evidence of recurrence.

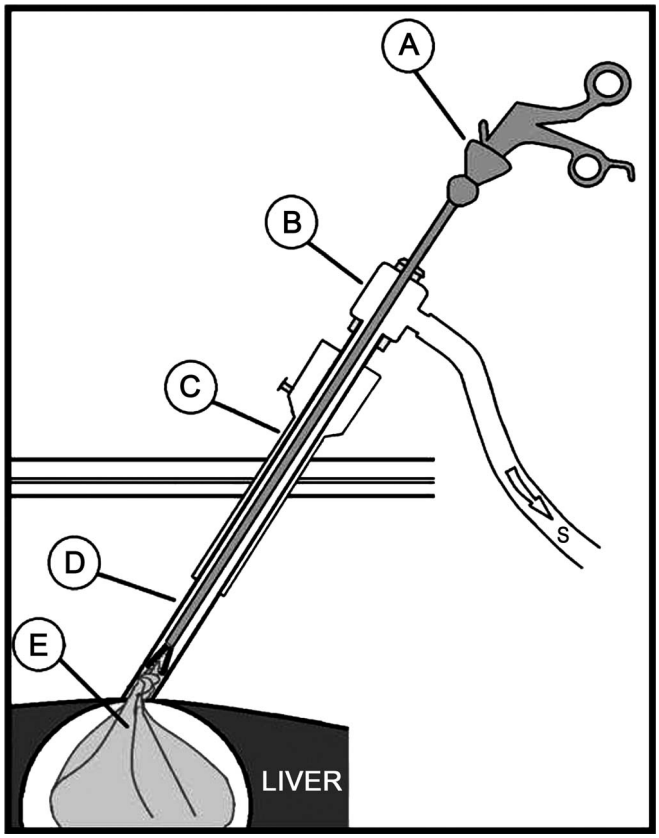

Figure 2. Diagrammatic representation of assisted evacuation of the germinative layer and retained daughter cysts by applying a laparoscopic grasper. A, Laparoscopic grasper. B, Catheter mount with suction cap. C, Laparoscopic trocar. D, Customized endotracheal tube. E, Ruptured layers of hydatid cyst. S, suction applied via the catheter mount.

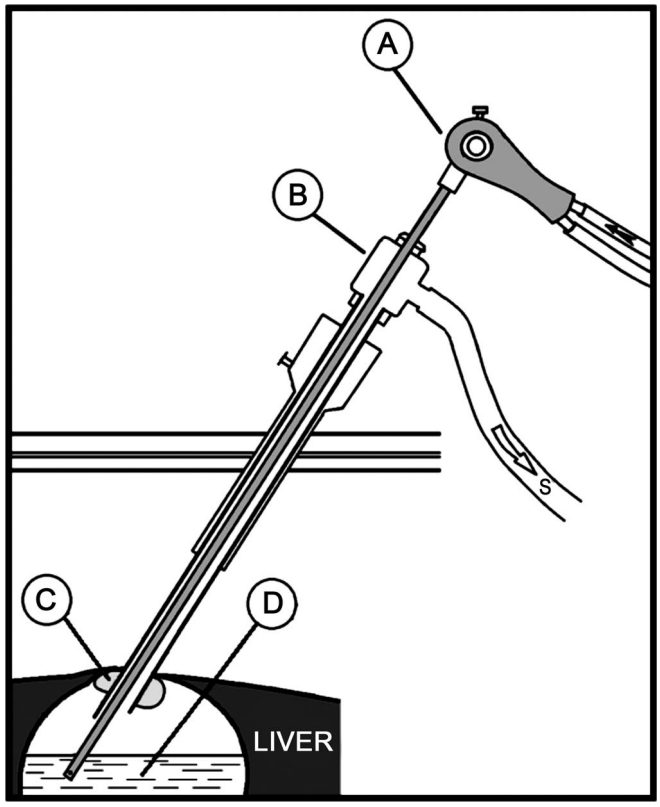

Figure 3. Diagrammatic representation of cavity irrigation with hypertonic saline. A, Laparoscopic suction irrigation cannula. B, Catheter mount with suction cap. C, Inflated cuff of the customized endotracheal tube. D, Hypertonic saline solution. S, suction applied via the catheter mount.

DISCUSSION

Hydatosis is a parasitic disease that is endemic in many cattle-raising regions of the world, such as the Mediterranean, the Middle East and Far East, Australia, and others. Currently, because of increased travel and immigration, hydatosis has a worldwide distribution, and every physician and surgeon in every part of the world may encounter the disease sporadically.[19,20] Therefore, they are expected to be familiar with this disease and its treatment. Although the management of hepatic hydatid disease varies from conservative management[21,22] to radical surgery,[23,24] for decades, the standard treatment, especially for large cysts, has been open surgery.[25,26] In recent years, laparoscopic surgical treatments for hepatic hydatid cysts have been gradually introduced, and with the advances in laparoscopic technology, they have gained wider acceptance.[27–30] Laparoscopic surgery as well as the open technique follows the principles of treating hydatid cysts: to eliminate scolices by evacuation of the cyst's contents without spillage, to sterilize the cavity with scolicidal agents, to check for any biliary communication, and to manage the residual cavity. The laparoscopic approach is a suitable surgical technique to achieve these aims, but there are certain technical problems to overcome. One of the most common problems faced in laparoscopic surgery for hydatid cysts is the difficulty in evacuating daughter cysts and laminated membranes. Failure to remove all viable protoscolices in the initial operation may result in local recurrence.[31] Although these components are completely fragile, classical surgical aspirators are usually blocked by them.[15] Even in open surgery of hydatid cysts, regardless of the use of an adequately sized suction cannula, this blockage sometimes happens at the tip of the sucker or at the junction of the tube and machine. To avoid this problem, various instruments

and laparoscopic techniques have been described to evacuate the contents of hydatid cysts; Bickel and Eitan[28] used the isolated hypobaric technique, Al-Shareef et al[15] used powerful liposuction, Alper et al[13] and Saglam et al[14] used an aspirator-grinder apparatus, and Palanivelu et al[17] introduced a complex hydatid system. Unfortunately, most of these specialized devices are not available at many surgical centers, and many laparoscopic surgeons prefer to remove and put the fragile laminated membranes into Endobag and then retrieve both the fragile laminated membranes and the Endobag through the biggest port. This kind of evacuation not only takes time but also has a high risk for spillage, and it cannot be considered a good option, especially when there is a contraindication to scolicidal agents or in the presence of daughter cysts. Although among these various devices, the isolated hypobaric technique through a transparent beveled cannula seems more practical and accessible, there are some concerns, especially if used by an untrained surgeon. To illustrate, Bickel and Eitan published an intraoperative photograph in their first paper regarding the isolated hypobaric technique that clearly shows the considerable amount of spilled hydatid fluids within the large cannula while the aspirating needle was inside the cyst. The photograph definitely demonstrates that intraperitoneal spillage was mostly prevented by the large cannula connected to the suction tube through its small-caliber 2-way stopcock. Indeed, the laparoscopic trocar that was used in this system was classically designed as a conduit for gas and an instrument through the body wall. This kind of trocar has at least one valve that is closed in the passive state to prevent gas leakage. Although this valve is completely air sealed when there is positive pressure in the trocar, because of the shape of the valve, it cannot play the same role when used as a hypobaric chamber under negative pressure. In addition to the valve incompetency, the small-diameter stopcock of the trocar is an additional problem, as it is potentially predisposed to be occluded by small particles, which are not infrequent in this procedure. Theoretically, the absence of negative pressure on the cyst wall when there is an obstruction in the cannula in the presence of a noncompetent valve could damage the sealing effect in the isolated hypobaric technique and would increase the risk for spillage. On the other hand, the valve of the trocar will resist pulling out any large material such as the germinal layer or daughter cysts, even if grabbed by a grasper. In this situation, the valve will fragment the fragile objects into small particles, which could potentially block the tiny stopcock of the trocar, especially when the trocar has been connected to the suction machine. Even though the valve could be bypassed by introducing a wide-nozzle suction or another cannula into the trocar, occlusion of the suction system by a bulk of fragile layers inside the working trocar cannot be prevented. The reason for this problem is the practical fact that one of the most common sites of blockage in any suction system evacuating hydatid materials is the tip of suction, where a small part of the germinal membrane is pulled into the tube by negative pressure, but most germinal membrane that is larger, because of the spherical shape of the cyst, cannot enter. It seems that Bickel et al[12] had the same problem when they used a 12-mm trocar as a beveled cannula, which required that they gradually increase the size of the tube up to 30 mm in the presence of large cysts. Some other authors designed different devices with the capability of grinding[13,14] or powerful suctioning[7,15] to resolve this problem, but as mentioned previously, most are not available at many medical centers.

In this report, a new, simple, and safe device for the laparoscopic treatment of hepatic hydatid disease is described that can be made by assembling some disposable, cheap, and available anesthesia equipment. Indeed, the HHS can be considered a developed hypobaric transplant beveled cannula with additional capabilities; in particular, the laparoscopic instruments are part of the system, allowing the surgeon to better organize the evacuating process. Moreover, the risk for system blockage and subsequent leakage could be decreased by using this suction system, which has larger connections and is able to fragment the fragile layers.

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