

## Cost effectiveness of Glove Endobag in Laparoscopic Cholecystectomy: Review of the available literature

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### Abstract

Laparoscopic cholecystectomy is the most common procedure performed worldwide and remains the gold standard for symptomatic gallstones. The most common complication observed during this procedure is gallbladder perforation resulting in spillage of stones and bile into peritoneal cavity. In order to avoid such complications, gallbladder is commonly extracted in an endobag. The current literature review was conducted to assess the efficacy and cost-effectiveness of glove endobags. PubMed and Google Scholar databases were searched to find relevant studies from January 1990 to December 2017. Search terms used were 'glove endobag' and 'laparoscopic cholecystectomy'. Literature suggests glove endobag is an effective and comparatively inexpensive compared to commercially prepared endobags.

**Keywords:** Laparoscopic cholecystectomy, Surgical glove, Endobag.

### Introduction

Laparoscopic cholecystectomy is the most common general surgery performed worldwide and remains the gold standard for symptomatic gallstones.<sup>1</sup> It has the advantages of less postoperative pain, early recovery, short hospital stay and cosmetically small scars.<sup>2</sup> However, this procedure has its own set of complications ranging from gallbladder perforation and spilled stones to biliary injuries. The most common complication observed during this procedure is gallbladder perforation during its dissection from hepatic bed, resulting in spillage of stones and bile into peritoneal cavity. The reported incidence of gallbladder perforation ranges from 10% to 40% and spillage of stones from 6% to 30%.<sup>3</sup> Spilled stones can be removed with irrigation and suctioning with ease in open cholecystectomy, but this method of retrieval may be difficult to achieve in

laparoscopic cholecystectomy. Complications associated with spilled stones include abdominal wall, port site and intra-abdominal abscesses most commonly observed in sub-hepatic locations. Some rare complications, including fistula formation and presence of lost gallstones in hernia sacs, ovary and fallopian tubes have also been reported in literature.<sup>4</sup> The use of endobags is usually recommended for the retrieval of gallbladder during laparoscopic cholecystectomy to reduce the complications associated with spillage of gallstones and bile as well as the seedling of tumour cells in cases of incidental gallbladder carcinoma.

### Types of Endobags

A number of bags and their alternatives have been used by surgeons to retrieve the specimens during laparoscopic surgery.

#### 1. Commercially used Endobags

Commercially available endobag is a specially designed bag to extract specimens during laparoscopic procedures. It consists of an introducer connected to a leak-proof bag with a radiopaque thread at one end, and a hand piece for the delivery and extraction of the bag at the other end. It is introduced through one of the port sites and the bag is opened with the hand piece followed by insertion of the specimen in the bag and subsequent removal of bag through the port. These commercially available endobags are frequently used in the developed world to avoid spillage of bile and stones and contamination of peritoneal cavity. Some examples of such bags include the Endobag, EndoCatch bag and Endopouch (Ethicon); Pleatman Sac (Abbot Medicals); and Ponsky Endosac (US Endoscopy).<sup>5</sup> These commercially available endobags are easy to use, but the main disadvantage of these endobags is the huge cost, which limits their use in the developing countries. These bags are disposable and designed for single use only, which adds extra cost to the patient and the procedure. Sometimes it may also be difficult to handle

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the bags intra-corporeally due to limited space in the abdomen. The high cost of the commercially available bags adds to the financial burden on patients, especially in the developing world and in countries like Pakistan where patients generally have to pay the cost for surgery.

## 2. Inexpensive Alternatives

Several cost effective self-designed retrieval bags have been used in order to reduce the cost of commercially available bags. These include sterile male condoms, re-closeable zipper bags, Nadiad bags and surgical gloves. Several studies have shown the cost-effectiveness and safety of male condoms in reducing septic complications after gall bladder extraction in laparoscopic cholecystectomies.<sup>6,7</sup> Other inexpensive bag used for specimen extraction is the Nadiad bag used for urological procedures. It consists of a polyethylene bag, nylon thread and a 5F ureteral catheter. The neck of the bag is folded at the edge and sewn and the folded tunnel accommodates the ureteral catheter and nylon thread.

It is introduced with an atraumatic grasper and specimen is placed in the bag and subsequently extracted through 10mm port.<sup>5</sup> It is cheap, easy-to-make and easily deployable without the help of introducer sheath. The ureteral catheter is the key component to keep the bag open during entrapment. Another example of cheap extraction bag described in literature is sterile zipper bag which has been used for the extraction of various gynaecological and other laparoscopic specimens.<sup>8</sup>

## 3. Glove Endobag

Most commonly used inexpensive retrieval bag for specimen extraction in laparoscopic cholecystectomy is the glove bag. A sterile glove is double-tied at the level of wrist with vicryl suture and fingers cut to shape it like a bag (Figures 1-2). The bag is lubricated or placed in saline and introduced into abdomen with a non-toothed grasper via epigastric port and placed on the superior surface of liver. Gall bladder along with spilled stones, if any, are placed in the glove, and the ends of glove are grasped with a toothed grasper via axillary port and removed through either umbilical or epigastric port depending on primary surgeon's preference (Figure 3).

For large stones or distended gall bladders, stones can be crushed within the glove or gall bladders aspirated at the port sites with subsequent removal from port site.

At times, port site incisions can be extended to facilitate



Figure-1: Vicryl suture tied near the wrist to prepare the endobag.



Figure-2: Surgical glove endobag after cutting the finger end of the glove.

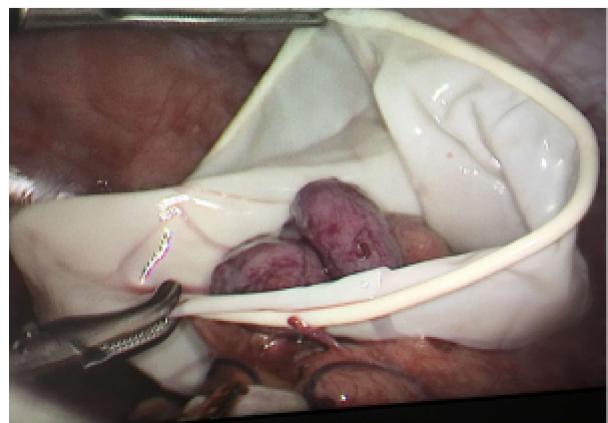


Figure-3: Specimen placed in the endobag ready for retrieval.

**Table-1:** Studies showing safety of glove endobag in reducing the rate of wound infection for gall bladder retrieval during laparoscopic cholecystectomy.

Author	Year	Type of study & patients	Wound infection with glove endobag	Wound infection without glove endobag
Yano H <sup>10</sup>	2003	Retrospective study: 830 patients	0.72%	Not mentioned
Holme JB <sup>11</sup>	2005	Retrospective study: 142 patients	0%	Not mentioned
Taj NM <sup>12</sup>	2012	Retrospective study: 492 patients	0.20%	5.28%
Khan ANA <sup>13</sup>	2016	Descriptive Study: 100 patients	2%	6%
Al-Dhahiry <sup>14</sup>	2016	Prospective (cross sectional study): 473 patients	0 (Non perforated gallbladders), 2.79% (Perforated gallbladders)	9.18%

**Table-2:** Studies showing cost-effectiveness when glove endobag is used for gall bladder retrieval during laparoscopic cholecystectomy.

Author	Year	Study type	Cost of Endobag
Raj PK <sup>9</sup>	1998	Letter to the editor	Pleatman Sac \$28 Ponsky Endosock \$60 Endo sac \$14 Endo bag \$15 Endopouch \$35 Endocatch \$75 Glove bag \$0.16
Yano H <sup>10</sup>	2003	Retrospective study: 830 patients	Endopouch Ethicon JPY 6000 Endopouch Pro Ethicon JPY 15000 Endocatch Tyco Healthcare JPY 16000 Endocatch II Tyco Healthcare JPY 16000 Endobag 3"X6" JPY 2400 Endobag 5"X8" JPY 2500 Sensi-touch Toray Medical co (Glove Endobag) JPY 280
Holme JB <sup>11</sup>	2005	Retrospective study: 142 patients	Cost not mentioned
Taj NM <sup>12</sup>	2012	Retrospective study: 492 patients	Commercial endobag PKR 5000 - 10000 Glove Endobag PKR 15
Al-Dhahiry <sup>14</sup>	2016	Prospective (cross sectional study): 473 patients	Commercial endobag \$ 14-15 Glove Endobag \$ one sixth of a dollar

easy delivery of the specimen, avoiding unnecessary spillage and contamination. An alternative way is to tie a purse-string suture at the opening of the glove to close the bag before extraction. Glove bag is inexpensive, easy to make and user-friendly, and this has been consistently proven in literature from low-income countries.<sup>12</sup>

## Methods

The current literature search was done using PubMed and Google Scholar databases to find relevant studies from January 1990 to December 2017. Search terms used were 'glove endobag' and 'laparoscopic cholecystectomy'. Only one relevant article was available on PubMed, while 166 publications were identified on Google Scholar. Further review of these abstracts identified only six studies which focussed on the outcomes relevant to our review, including reduction of complications and cost-effectiveness of glove as endobag to extract gallbladder in laparoscopic cholecystectomy.

As per institutional policy, no approval from the ethical

review committee is required for review articles, and informed consent prior to surgical procedures includes the consent for taking picture intra-operatively when required.

## a) Reduction of complications - Wound infection

Review of literature showed the superiority of glove endobag in reducing the rate of wound infection when glove was used to extract gallbladder compared with no glove. A study<sup>12</sup> concluded that the use of glove bag reduces the cost and risk of contamination of peritoneal cavity and port sites with bacteria, bile and stones and may reduce the chances of contamination by malignant cells in case of unexpected gallbladder carcinoma. Rate of wound infection was 0.20% compared to 5.28% in patients when glove endobag was used versus no bag. Another study<sup>14</sup> demonstrated the use of glove endobag to be simple, economic and safe. Glove endobag shortened the operative time and reduced wound infection rate to 0% in non-perforated gallbladders and

2.79% in perforated gallbladders compared to 9.18% when glove was not used. According to the authors, glove endobag reduced the chances of septic complications, including the port site infection from spillage of bile and stones during the delivery of gall bladder as well as the intra-abdominal abscesses and fistula formation from intra-abdominal spilled stones and bile. Another study<sup>13</sup> showed 2% wound infection rate with glove endobag compared to 6% without the use of endobag. Details of studies with focus on wound infection were noted separately (Table 1).

### b) Cost-effectiveness of glove Endobag

Review of the available literature from low-income countries like Pakistan and Iraq has shown the cost-effectiveness of the simple glove bag technique, which can be easy to replicate and learnt by fresh surgical assistants and residents in training. A study<sup>12</sup> showed a reduction in cost from PKR15000 to PKR15 when glove endobag was used for gallbladder extraction compared to commercially available endobags. According to a study<sup>14</sup>, the commercially available endobag costs US\$14-15 and a single pair of disposable surgical glove costs about one-sixth of the dollar. Studies<sup>9,10</sup> have also shown the cost-effectiveness of glove as an endobag in laparoscopic cholecystectomy. Details of studies showing cost-effectiveness of glove endobag were also noted (Table 2).

### Conclusions

Surgical glove endobag is an innovative, cheap and safe alternative to the traditional specimen retrieval endobag for gall bladder extraction during laparoscopic cholecystectomies. It reduces the frequency of septic complications as well as the procedure-related costs for the patients as well as the institutions and healthcare services in developing countries.

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