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REVIEW ARTICLE

Different Techniques of Tissue Retrieval from Abdominal Cavity during Minimal Access Surgery

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ABSTRACT

Minimally access laparoscopic surgery has undergone rapid development in last decade. It has many advantages but one of the challenges is the tissue retrieval from the surgical site. Large specimen can be retrieved after enlarging the port site but this is against the concept of minimal access surgery (MAS). In this article, we reviewed the literature to analyze the different methods of tissue retrieval during MAS. Tissue retrieval using the endobag for small to medium-sized specimens is straight forward through the umbilical trocar port. For larger specimens morcellation, delivery through colpotomy or hand-assisted laparoscopic surgery was used to retrieve the specimen. All these methods help to keep the incision size small hence improving the surgical outcome with minimal complications and early recovery.

Keywords: Laparoscopic tissue retrieval, Colpotomy, Endobag, Laparoscopic tissue retrieval sac, Morcellator.

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INTRODUCTION

Laparoscopic surgery has been known by surgeons since 1980. After the advent of laparoscopic surgery, it has undergone rapid development in last decade. Laparoscopic surgery has many advantages, like less tissue dissection, less need of analgesia postoperatively, better cosmetic aspect, less intraoperative and postoperative complications and early return to work.[1]

In laparoscopic surgery, one challenge is to retrieve the specimen from the abdominal cavity with minimal spillage as spillage of the content may cause dissemination of disease, infection or malignancy. Spillage rate depends upon the size of the mass, surgical expertise and route of removal of the tissue. Spillage rate of dermoid cyst by laparoscopy is 15 to 100% as compared to 4 to 13% in laparotomy.[2]

One method of retrieval of specimen from the abdomen is to enlarge one of the laparoscopic trocar incisions but it is against the concept of minimal access surgery (MAS).[3] Tissue retrieval through port site may cause contamination, implantation and port site hernia formation.[4]

Transumbilical port is most thinnest and most distensible portion of the anterior abdominal wall. As this technique may be satisfactory for simple cyst or tissue but challenging in cases of dermoid cyst of larger sizes. Endobags will be used but still the chance of spillage in case when perforation of the tissue inside the bag.[5]

Specimen retrieval bags used for removal of excised mass. It can avoid the spillage of the cyst and contamination of the wound (Fig. 1). The bags generally require 10 to 12 mm port.[2]

Many types of specimen retrieval bags have been described, including Nadiad bag, condom, modified zipper bag. Commercial bags can be costly and difficult to use and are available only in standard size. Some authors describe bags from surgical glove finger (powder free) but it can tear off during traction through abdominal wall. This can be minimized by making purse string suture around the opening (Fig. 2).[6]

Fig. 1: Endobag for tissue retrieval in MAS

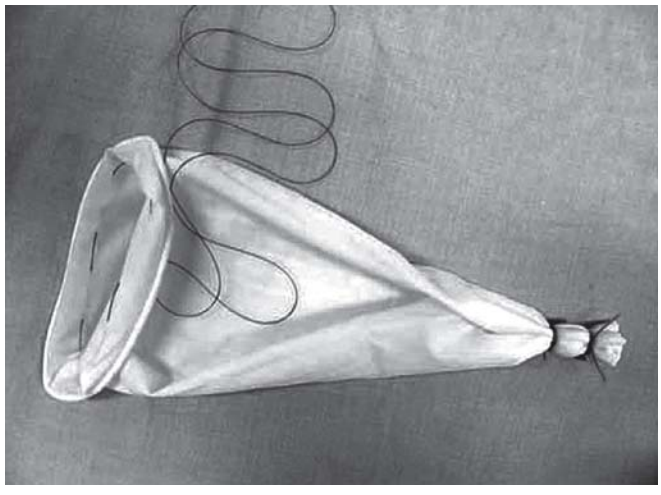


Fig. 2: Endobag made with surgical glove

Specimen can be retrieved through vaginal route by colpotomy. It was first documented over a 100 years ago but was not used much due to technical difficulties, poor exposure and increased risk of infection.[5]

Some surgeons prefer to use plastic bag for drainage package as endobag as it minimizes the tearing effect as in glove finger bag (Figs 3A and B).[7]

Transvaginal route has been popular again for last few years. Removal of the intact specimen through colpotomy is more important.

Colpotomy is generally safe and easily learnt technique. To minimize the risk of spillage, endoscopic bags can be used during removal of tissue under direct vision but, whenever incision is given in the posterior vagina, (colpotomy) pneumoperitoneum greatly affected.[8]

To maintain the pneumoperitoneum, counter pushing by other instrument inside the vagina is effective.[1]

This problem can be overcome by suturing the posterior vaginal wall laparoscopically.[8]

Colpotomy may result injury to nearby structures, bladder or bowel perforation, ureter injury, vaginal wall hematoma. Extra care has to be taken during specimen removal through vagina as it may tear or lacerate. Risks will be more, if patient is nulliparous or morbid obese.[5]

Obstetric forceps can be used to extract the specimen enclosed in an endobag. It can help to protect the integrity of the bag and specimen and minimize the diameter of the sac.[9]

Morcellator is another technique to retrieve the solid tissue from abdominal cavity. It is important instrument for tissue removal in myomectomy and splenectomy. Morcellator works through sharp cylindrical blade over the specimen and change tissue into small strips (Figs 4A and B). Morcellator do not affect the pneumoperitoneum during its work.[1]

Morcellator is not acceptable in cases where suspicion of infection or malignancy is there. Morcellated tissue may disturb the pathological findings on histopathology in cases of suspected malignancy.[3]

Large diameter morcellator remove tissue in less time but is associated with incisional hernia formation.[2] This complication can be avoided by port closure with sutures. Now morcellator with diathermy instead of blade are also available.[10] Since, morcellator decrease the operative time so the risk of port site herniation decreases due to decreased manipulation.[1]

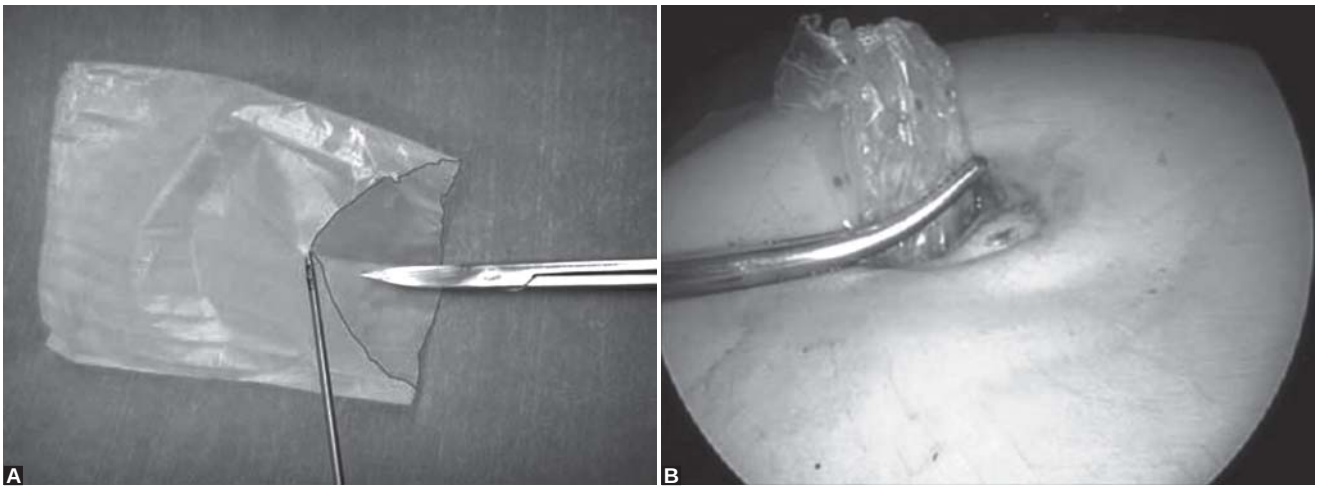
During morcellator use, caution must be taken as there is risk of inadvertent injury to the normal tissue. This can be avoided by bringing specimen toward the morcellator rather moving the morcellator toward specimen.[8]

Natural orifice, transluminal endoscopic surgery (NOTES) is another advancement of minimally invasive intra-abdominal surgery in which peritoneal cavity is approached by incising and traversing the lumen of natural orifices.[11]

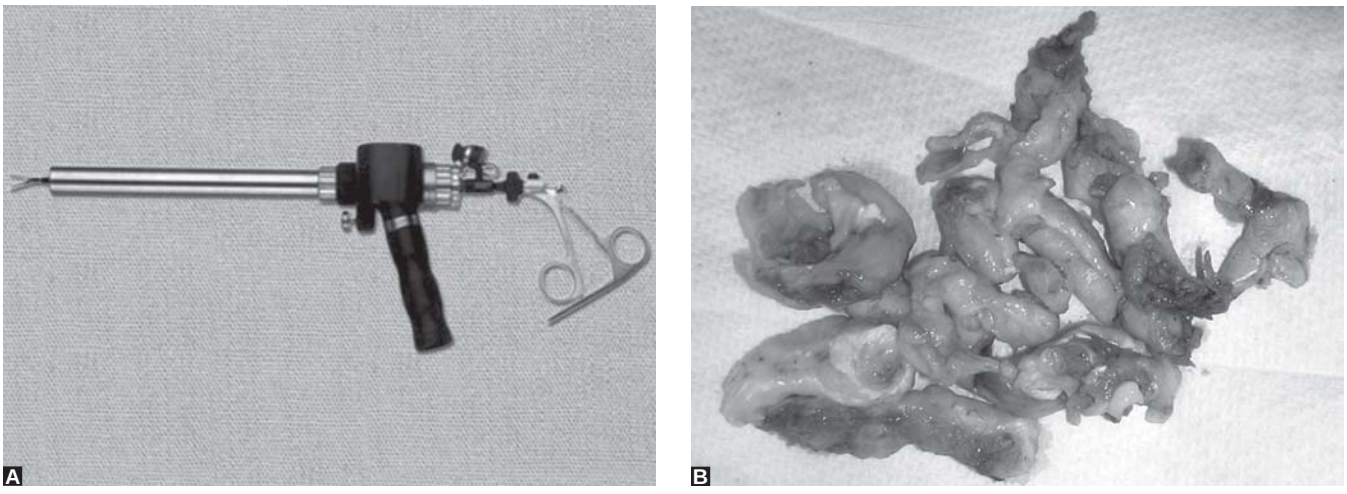
Natural orifices, like oral, anal, vaginal and urethral routes, have been described but optimal route is still to be determined. Vaginal access has been used for long time due to its ease of access and more capacity. Closure of vaginal wound can be done under direct vision and complication rate is also low.[12]

Vaginal approach is not possible in some situations, like fixed retroverted uterus, obliteration of Pouch of Douglas, due to endometriosis or previous pelvic inflammatory disease.[8]

In hand-assisted laparoscopic surgery (HALS), the surgeon can insert a hand through a small incision via pressurized sleeve. It is a new advancement in MAS. HALS initially was started for tissue retrieval and surgeons can use their hand for exploration, isolation and removal of tissue (Fig. 5).[1]



Figs 3A and B: Plastic bag used as endobag



Figs 4A and B: Morcellator and morcellated tissues

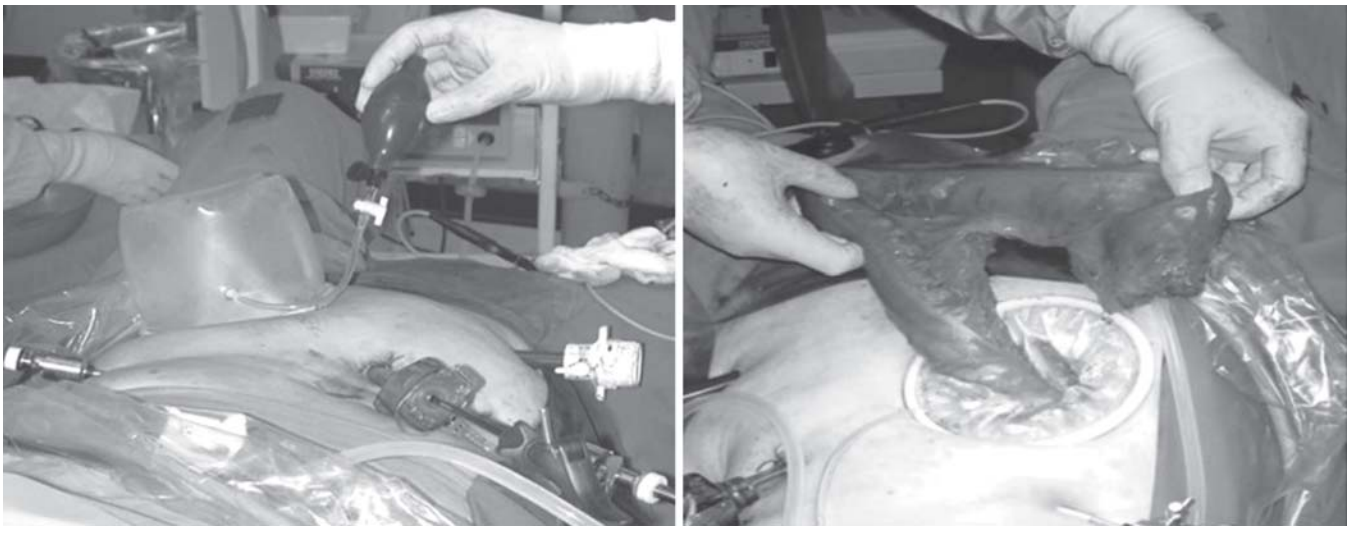


Fig. 5: HALS and tissue retrieval

It is indicated for complex and advance laparoscopy procedures. It restores tactile sensation and help to complete the laparoscopic surgery without conversion.[9]

MATERIALS AND METHODS

A literature search was performed using Google, Yahoo, PubMed, Springer library facility available at World Laparoscopy Hospital, Gurgaon, Haryana, India.

AIM

To evaluate the different techniques of tissue retrieval from abdominal cavity during MAS.

REVIEW OF EVIDENCE

Transumbilical Tissue Retrieval with Endobag

A prospective study was done by Schellpfeffer in which 42 patients underwent for laparoscopic tissue retrieval after surgery by transumbilical route. In 34 out of 42 patients, the tissue retrieval was successful, while in eight patients (19%), it was unsuccessful due to size of the mass. The subumbilical incision became large during specimen removal. There was no sac rupture and no intraoperative complications relating to tissue retrieval. There was no incisional hernia in 2 to 6 weeks postoperative period. Three patients (7%) had superficial subumbilical trocar site wound infection which was managed conservatively.[3]

In a study done by Turial and Schier, they used sterile plastic bag (innermost cover from Redon drain package) to laparoscopically remove tissue through umbilical port. According to them, this bag is cost effective, does not need port enlargement as compared to commercially available bags and there was no bag rupture as seen with glove bag technique.[7]

In a study done by Ghezzi et al (1,116 women) underwent operative laparoscopy and endobags were used for laparoscopic tissue retrieval through umbilical port. They described method to remove large specimen without

enlarging the umbilical port. In this method, they bring the mouth of sac out of the port with help of atraumatic grasper. The specimen then is morcellated with Kocher's clamps to avoid intra-abdominal spillage. No intraoperative or immediate postoperative complication related to technique of specimen extraction was noted. No trocar site hernia or metastasis was observed.[13]

A study was done by Kao et al who described homemade specimen retrieval bag (sterile glove) for laparoscopic tissue retrieval. A total of 135 patients underwent laparoscopic surgery and tissue specimen were retrieved using bag made with surgical gloves. No postoperative complications were noted such wound infection or wound metastasis. They found this bag easy to prepare, easy to use, cost effective and with short learning curve.[14]

Ganpule et al have described a novel cost effective specimen retrieval bag (Nadiad bag) to retrieve specimen in laparoscopic surgery. They used this bag in 40 patients. They found this bag to be inexpensive and easy to use. This bag needs less force for traction and is tumor seeding is less. Urethral catheter used in this techniques keeps the bag open during entrapment.[6]

Schellpfeffer described a novel laparoscopic tissue retrieval device in which a forceps was used in cases where endobag could not be removed with axial traction. Out of 42 patients in eight, the retrieval was not successful even with the forceps and it was due to the large size of the mass. In these cases, the port size had to be enlarged to remove the mass. In 34 patients, the procedure was successful without and significant complications. Three patients developed subumbilical trocar site superficial infection which was managed conservatively. No incisional hernia was noted in early postoperative period. No adverse outcome was noted on long term follow-up (until 5 years).[3]

Tissue Retrieval by Morcellation

Chen et al did laparoscopic myomectomy and morcellator was used to remove the tissue. They grouped the patients into three groups according to the weight of fibroid. They observed shorter surgical time in groups with lower fibroid weight. Patients were followed for until 3 months. They advised to do simultaneous enucleation and *in situ* morcellation as this minimize the operative time and missing of myoma. They did not report any late postoperative complications.[15]

Another study was done by Zhang et al in which 26 patients underwent laparoscopic myomectomy. Simultaneous morcellator *in situ* was used to remove fibroids which were more than 9 cm in size. There were no serious complications and hospital stay was not different for fibroids of different sizes.[16]

A study was done by Chang et al in which they compared the results of simultaneous laparoscopic uterine artery ligation and laparoscopic myomectomy for symptomatic myomas with a without *in situ* morcellation. No major complication was noted during morcellation in both groups. Improvement of symptoms was similar in both groups. Follow-up was done until 24 months postoperatively. They observed shorter surgical time in the group in which *in situ* morcellation of the myoma was done without enucleation.[17]

In a retrospective study done by Rosenblatt et al, 51 patients underwent laparoscopic supracervical hysterectomy with transcervical morcellation. They found this procedure efficient and safe.[18]

Tissue Retrieval in Hand-Assisted Laparoscopic Surgery

Hand-assisted laparoscopic living donor nephrectomy was done in 100 cases in which donor kidney was retrieved by surgeon's hand after laparoscopic nephrectomy through a specially designed hand assist device. Advantage of this technique was that there was shorter hospital stay, less ileus and postoperative pain.[9]

In a study done by Kakinoki et al, 28 patients underwent for HALS splenectomy. Out of these, one patient suffered from intraoperative hemorrhage and two patients had postoperative wound infection.[19]

Tissue Retrieval through Colpotomy (Transvaginal)

Transvaginal removal of large organs, like spleen, kidney and gallbladder with large stones, has been performed successfully.[20]

Mofid et al studied 1,281 patients who underwent notes procedure from 2007 to 2011. In 222 patients, cholecystectomy of appendectomy was done through transvaginal route. Twelve patients out of these need additional abdominal trocar for drainage system, 0.7% intraoperative complications while two patients had postoperative complications, (abscess in pouch of Douglas and biliary fistula). A total of 88% patients did not have any postoperative complications, like vaginal bleeding, incisional hernia, wound infection or sexual dysfunction.[21]

A 2 years prospective study done by Pillai and Yoong in which they studied the use of endobag to remove the benign ovarian mass through colpotomy. There was no spillage of the cyst and no intraoperative or postoperative complication observed.[5]

Panait et al performed transvaginal notes procedure on 17 morbid obese patients. There was no significant difference in operative time in morbid obese patients. These

patients had better cosmesis, decreased postoperative pain, faster recovery and early return to work.[22]

Wyman et al described robotic-assisted hysterectomy and bilateral salpingo-oophorectomy through transvaginal tissue retrieval by using anchor tissue retrieval system. These patients were having atypical endometrial hyperplasia. There was no split or tear in the sac and this system minimized the exposure of cancer bearing tissue to the pelvis.[4]

DISCUSSION

With advent of minimally access surgery by laparoscopy, the major challenge has been to find the easy and safe method of tissue retrieval from the surgical site. Enlargement of trocar incision site is against the MAS and various methods have been employed to overcome this problem. It is important to retrieve the tissue from the abdominal cavity in such a way so it will not cause infection, implantation of tumor cells or spillage of the contents into the abdominal cavity or tissue retrieval site. For this purpose, various types of endobags have been described. There are purpose built commercially available endobags but are expensive. Various do it yourself endobags have been described in literature which claim to be inexpensive and safe for tissue retrieval during MAS. These include endobags made of surgical glove or readily available polythene pouches available in operation theater. Although, these are inexpensive but there have been reports of rupture of these bags leading to spillage of contents. Endobags cannot be used to retrieve large specimen and in such conditions the specimen has to be fragmented or morcellated. An interesting technique is described by Ghezzi et al and Schellpfeffer in which a polythene bag is used to draw the large specimen into the mouth of the trocar port and then forceps are used to morcellate and retrieve the tissue without enlarging the port site as well as protecting the port site from contact of the specimen.[3,13]

Morcellator (mechanical or thermal) can be used in cases, where tissue is supposed to be benign in nature. Morcellator should be used with caution in any suspected malignancy and preferably specimen should be morcellated in a rip proof bag whenever possible.[1] In various studies, morcellator has been found safe and time saving device for tissue retrieval during laparoscopic surgery.[15-18]

HALS is another method used to retrieve large size tissue from the abdominal cavity. This method has been used to retrieve kidney after nephrectomy and large pieces of colon after hemicolectomy. Studies have shown this method to be less traumatic with less postoperative complications and early return to work.[9,19]

Tissue retrieval through colpotomy has been known since long and now with the advent of MAS this has become an important route for large-sized specimen retrieval.[20] Naturally, this method is only available in females. This procedure can be used in morbid obese patients with good results.[21,22] In robotic-assisted laparoscopic surgery, colpotomy wound can be closed laparoscopically.[22] Tissue retrieval through colpotomy has been found to be safe and easy to learn method. There are minimal intraoperative and postoperative complications, decreased hospital stay and early return to work.[4,5,22]

CONCLUSION

Tissue retrieval in MAS is an important issue. Various methods are being used and new technologies are being developed to make this procedure safe for the patient. For smaller specimens, transumbilical route using endobag technique and for larger specimens retrieval through colpotomy seems reasonable at this moment. Use of morcellator is time saving but can only be used in for tissues which are supposed to be benign in nature. For large tissue resections and organ removal, HALS shows good promise.

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