

Cholecatch: An Axial Compression Device to Improve Cholecystectomy Extraction

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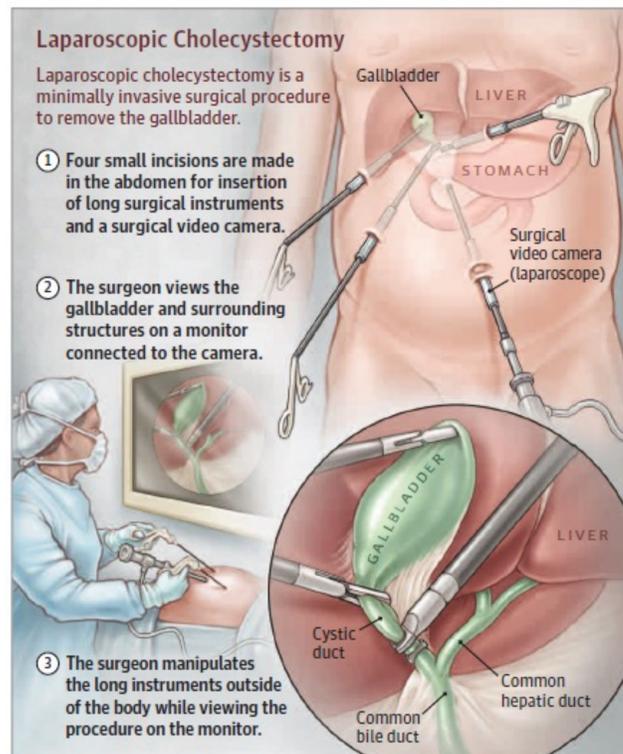


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Introduction

- In the US, it is estimated that approximately 400,000 laparoscopic cholecystectomies are performed annually.
- With this surgery being so common, it is important that it is done with maximum efficiency in order to save cost for the hospital as well as patients.

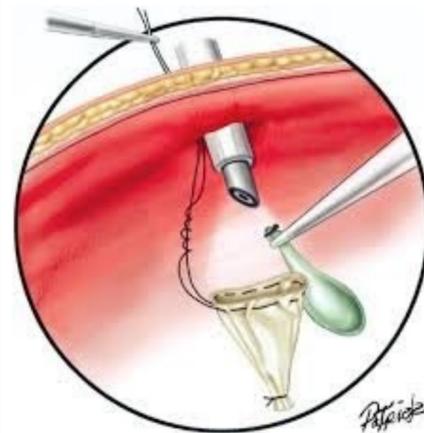
Laparoscopic Cholecystectomy: Steps



- After achieving the critical view, the surgeon then clips and ligates the cystic duct and cystic artery.
- They will then separate the gallbladder from the liver.
- The actual removal of the gallbladder is initiated by placing it into a bag which will then be pulled through the largest port or incision.
- Finally, the surgeon will remove all equipment and suture the patient closed.

Problem

- For cases where the stones are large or impacted, the current retrieval device/bag cannot manipulate the gallbladder into a geometrically favorable shape that allows for removal through the laparoscopic ports.
- This requires the surgeon to either create a larger incision or apply aggressive manual forces while pulling the bag out through the porthole
- The specific problem with extraction comes from the following:
 - Current bag's dimensions when filled with specimen
 - Sub-optimal gallstone arrangement in bag



-This is an illustration of what is occurring inside the abdomen after the gallbladder is excised.

-Note the size of the port/port incision and compare it to the size of the gallbladder plus the size of any excess material of the bag.

-The size of the gallbladder and excess material will bunch up when they are pulled through the relatively smaller hole and thus cause increased shear force.

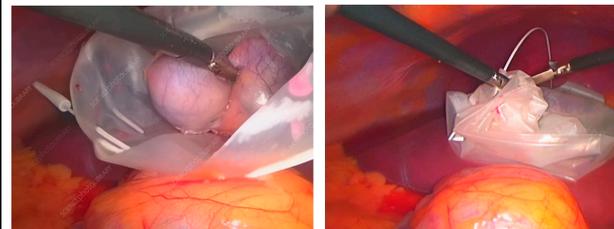
Consequences

- Increased time in OR
- Increased surgeon frustration
- Increased Complications leading to inpatient admission due to:
 - Bile leakage
 - Bile stone spillage
 - Infection and intra-abdominal abscess formation
 - Internal organ damage
 - Increased Incision size
 - Conversion from laparoscopic to open cholecystectomy

Current Design



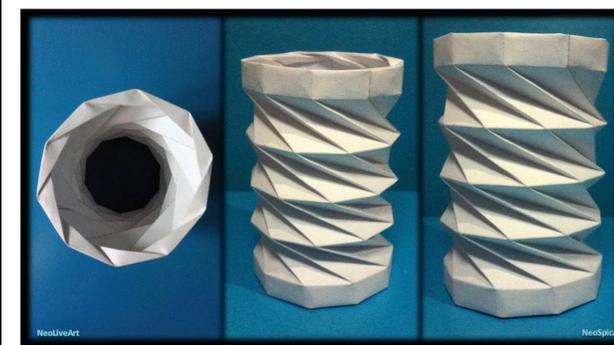
These are examples of current models of the bags that are used. The purpose of the different rims is to make the process of inserting the gallbladder easier. The purpose of the different shapes is to try to address the problem we are trying to address—inappropriate surface area causing increased shear force.



-The first two pictures show the process of inserting the excised gallbladder into the current model of bag as well as the synching of the bag. Note the excess material that could cause increased surface area.
-The third picture shows a surgeon pulling on the bag to remove it from the patient's abdomen.

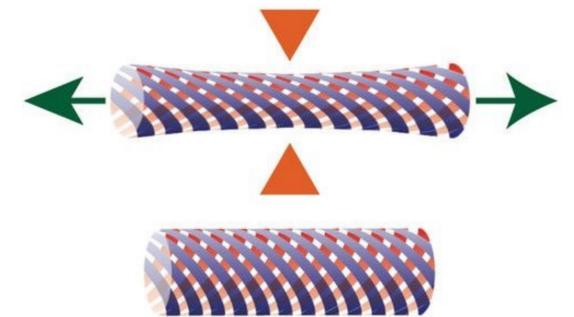
Solution

A new design: a shear-resistant, bio-inert polymer bag with integrated twistable metal to facilitate a geometric configuration that allows for seamless removal through the port or port incision.



Solution: Mechanism

This will allow for the contents of the bag to be slightly compressed and streamlined in order to decrease the contact area of the device during the process of extraction



Conclusion

The current design of the current bag for laparoscopic cholecystectomy works but is far from maximally efficient.

In cases complicated by large gallstones and/or an excessive number of gallstones, the geometry of the current bag design yields less than satisfactory results.

Because of this, a new design of a geometrically favorable retrieval device may prove to be more beneficial and seamless during the process of removing the excised gallbladder from the abdominal cavity.

This increase in efficiency will have positive impacts on patient outcomes, hospital budgets, and surgeon satisfaction.

Acknowledgments

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