

Dr. Ryan Strain is a General Surgery Specialist in Liberty, Missouri. Graduated with honors from the University of Missouri Kansas City School Of Medicine and completed his General Surgery Residency at the University of Kansas, followed by a Bariatric Surgery Fellowship at the University of Missouri. Having more than 7 years of diverse experience, Dr. Strain affiliates with many other doctors and specialists in his surgical practice at New Liberty Hospital Corporation.

# Laparoscopic Cholecystectomy with the FreeHold Duo™ Retractor

## Introduction

The first laparoscopic cholecystectomy was reported in 1987, introducing an era of minimally invasive surgery for this common procedure. Advantages of the laparoscopic approach include reduced postoperative pain and recovery time and improved cosmesis.<sup>1,2</sup> Since its introduction, the laparoscopic approach has been modified to reduce even further the number of incisions and trocars needed, while maintaining operative efficiency and good outcomes.<sup>3,4</sup> This report describes the use of a totally intracorporeal retractor (FreeHold Duo™) that eliminates the need for mechanical retractors, additional incisions, and an assistant during laparoscopic cholecystectomy, even in challenging cases.

## Minimizing Invasiveness

Cholecystectomy requires upward retraction of the liver lobe to visualize and access the gallbladder. The conventional approach to retraction during laparoscopic cholecystectomy involves the insertion of an atraumatic grasper that is held by an assistant and requires an additional incision and/or port, increasing risks for wound complications.

Conversely, suture-based methods of organ retraction are associated with fewer complications compared to mechanical retractors.<sup>5,6</sup> And studies of approaches using fewer incisions and ports describe similar operative time, incidence of complications, and length of stay; improved cosmetic outcomes and body image; and less postoperative pain, compared to procedures using more ports.<sup>7-9</sup>

An ideal method for retraction during laparoscopic cholecystectomy would lift the gallbladder and liver in a non-traumatic manner, providing adequate space for visualization and dissection for as long as required and without the need for additional ports or assistance.

## FreeHold Hands-Free Intracorporeal Retractors

FreeHold Duo™ is an intracorporeal retractor that can be used in minimally invasive procedures. This simple retractor is fully adjustable, hands-free, completely intracorporeal, and enables full surgeon autonomy.

FreeHold Duo™ consists of two hook assembly (one adjustable, one fixed), connected by a length of suture that can be adjusted to provide appropriate tension. The device can be inserted through an existing 5mm trocar, eliminating the need for an additional incision, trocar, or robotic instrument.

Using the adjustable hook, the surgeon controls the positioning and tension of the retractor. Sliding the release ring on the adjustable hook towards the hook with a grasper allows the suture to slide freely through the housing for easy adjustments. Once positioned, the surgeon has full use of both hands to perform the procedure, obviating the need for coordination with an assistant. The retractor can also be easily repositioned and the amount of tension adjusted as necessary, during the procedure.

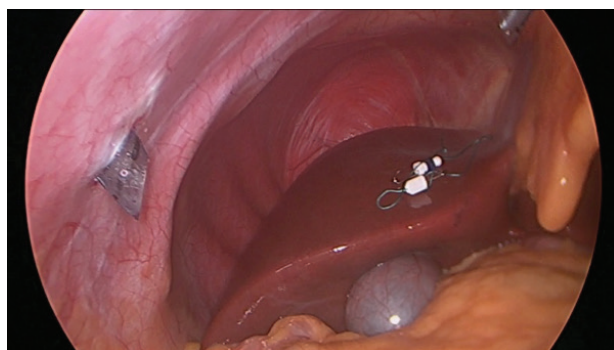
## Large or Elongated Gallbladders

Variations in the size, shape, and texture of the gallbladder can affect how easily it is grasped and retracted during cholecystectomy. One example is the large or elongated gallbladder, which may project beyond the liver margin and require additional maneuvers to maintain retraction during dissection. FreeHold Duo™ provides a simple approach to retraction in such cases, as illustrated in the following case study.

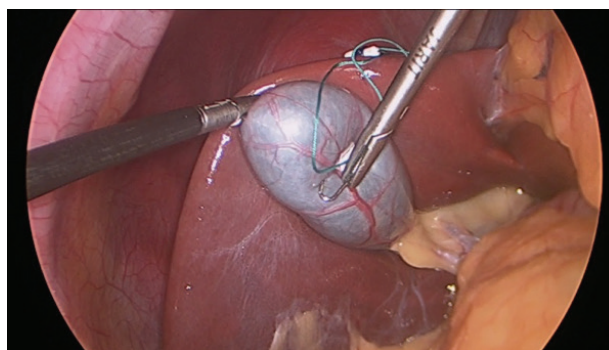
### Case #1

A 49-year-old woman with a history of biliary pain presented with recent onset of periodic, paroxysmal right upper quadrant pain and occasional nausea and vomiting. Ultrasound identified 4mm gallstones in the cystic duct, pericholecystic fluid, and positive Murphy's sign. The patient was admitted and scheduled for laparoscopic cholecystectomy.

Following insufflation and insertion of the laparoscope, a large gallbladder was visualized extending 3cm below the liver margin (Figure 1). The FreeHold Duo™ works simply and effectively for retraction of the gallbladder in this setting.



**Figure 1.** Visualization of a large gallbladder, extending 3cm below the liver margin. Note FreeHold Duo™, which has been dropped through the insertion tube onto the liver.



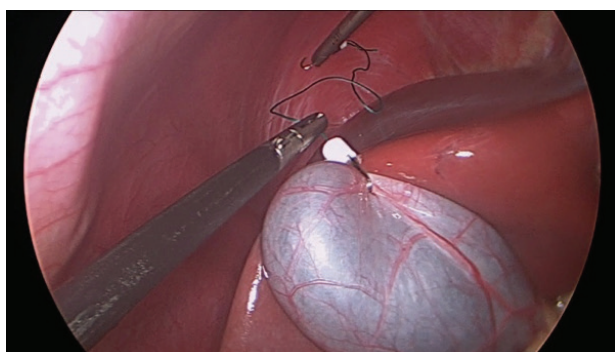
**Figure 2.** Using a grasper, lift the dome of the gallbladder and insert the fixed hook into roughly the center of the organ using the needle driver. Note the technique of holding the fixed hook near the plastic housing, with the hook perpendicular to the driver.

Use of the FreeHold Duo™ for retraction of a large or elongated gallbladder may be accomplished as follows:

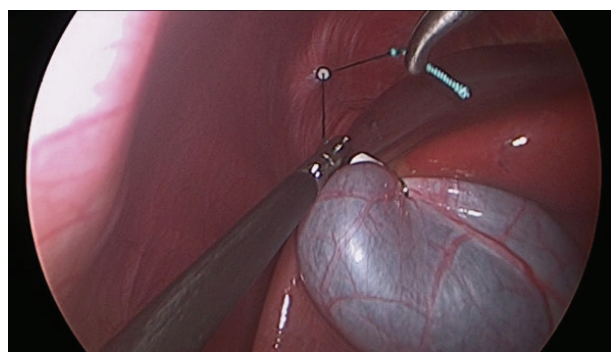
- Using a standard laparoscopic grasper with the left hand, lift the dome of the gallbladder to expose the side deep to the liver.
- With the right hand, use a needle driver to grasp the fixed hook of the FreeHold Duo™ retractor.
  - In my experience, it is most convenient to grasp the hook close to the plastic housing, maximizing the length of hook extending past the grasper. Hold the hook as one might hold a needle, with the hook perpendicular to the driver and facing upwards; this allows the surgeon to insert the hook with a twist of the wrist.
- Using the grasper in the left hand, lift the gallbladder and insert the fixed hook between the top one third and the center of the organ (Figure 2). Avoid inserting the hook laterally or below the center of the gallbladder.

## Case Studies

- Once the fixed hook is set, release the gallbladder from the grasper and grip the suture that extends from the fixed hook; pull on the suture to lift the gallbladder and liver (Figure 3).
- While holding the suture with the grasper, use the needle driver to grasp and insert the adjustable hook into the upper-right corner of the diaphragm, ie, toward the patient's right shoulder (see Figure 3).
  - Surgeons may find the adjustable hook is best handled with a dedicated laparoscopic needle driver, rather than a grasper.
- Once the adjustable hook is inserted in the diaphragm, continue to hold the suture near the fixed hook with the grasper and pull on the free end of the suture extending from the adjustable hook until the desired amount of retraction is achieved and the portal triad is exposed (Figure 4).



**Figure 3.** Holding the suture close to the housing of the fixed hook, pull the gallbladder upward. The adjustable hook is then inserted into the upper-right diaphragm.



**Figure 4.** While holding the suture near the fixed hook and lifting the gallbladder, pull on the free suture end to tighten the suture and achieve desired retraction.

- If the retraction is not adequate, loosen the suture at the adjustable hook (or tighten, as appropriate). Once loosened, the surgeon can then adjust the fixed hook as necessary to correct the position of the gallbladder and then tighten the suture again by pulling on the free end.
- Once the gallbladder is retracted, dissection of the ducts and vessels may be conducted as usual
  - Of additional benefit is the fact that the continual tension on the gallbladder allows for easy removal as tension is maintained back towards the adjustable hook while vessels and ducts are being dissected.

FreeHold Duo™ provides a simple and reliable method for retraction of the gallbladder for unassisted cholecystectomy. The key point with regard to a large or elongated gallbladder is to place the fixed hook between the top one third and the center of the gallbladder. This placement prevents torsion of the gallbladder and provides optimal exposure of the ducts and vessels.

## Necrotic Gallbladder

Gangrenous cholecystitis is one of the most severe forms of acute cholecystitis, occurring in approximately 10% to 40% of patients with acute cholecystitis.<sup>10-12</sup> Acute gangrenous cholecystitis has been associated with increased mortality and morbidity compared to non-gangrenous cholecystitis.<sup>12-14</sup> Even in these challenging patients, studies have demonstrated superior safety with laparoscopic compared to open procedures<sup>14</sup> and an advantage to early versus delayed intervention.<sup>15</sup>

FreeHold Duo™ demonstrates advantages over mechanical retractors in this setting. The necrotic gallbladder tends to be thicker, denser, and is often distended,<sup>16,17</sup> making it more difficult to hold with laparoscopic graspers. Unlike laparoscopic graspers, the fixed hook of the FreeHold Duo™ easily and securely anchors the necrotic gallbladder and, in my experience, very rarely causes any tearing of gallbladder tissues.

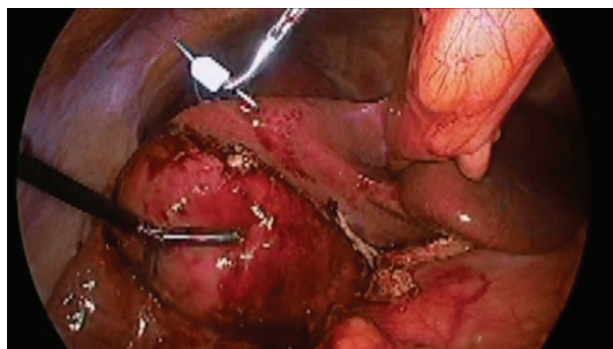
### Case #2

A 63-year-old man with a 20-year history of type 2 diabetes presents complaining of fever and acute right upper quadrant abdominal pain. CT was performed and identified dilated gallbladder with thickened walls, pericholecystic fluid, and large gallstones. No significant dilation of the common bile duct was found. Blood tests identified elevated white blood cells, but no elevations in serum bilirubin or transaminase levels. The patient was admitted, treated with IV antibiotics, and scheduled for cholecystectomy the following day.

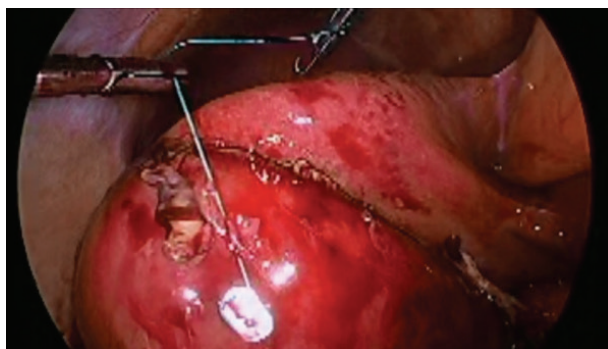
On insertion of the laparoscope, a necrotic gallbladder was identified, with gangrenous areas and extensive omental adhesions. Following adhesiolysis, FreeHold Duo™ was used in a method similar to the description above. The fixed hook was held with a needle driver, while the gallbladder was lifted with a grasper (Figure 5).

The fixed hook was inserted into the center of the gallbladder, and the gallbladder was lifted by pulling on the suture (Figure 6) to allow the adjustable hook to be placed into the upper right part of the diaphragm (Figure 7). The suture length was adjusted by grasping the fixed hook and pulling on the free suture end to achieve adequate retraction (Figure 8).

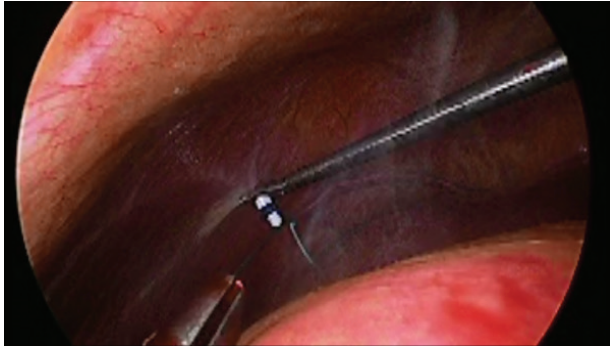
One difference with a necrotic gallbladder is that less tension may be required to achieve exposure, as the tissue may be weaker than non-necrotic tissue.



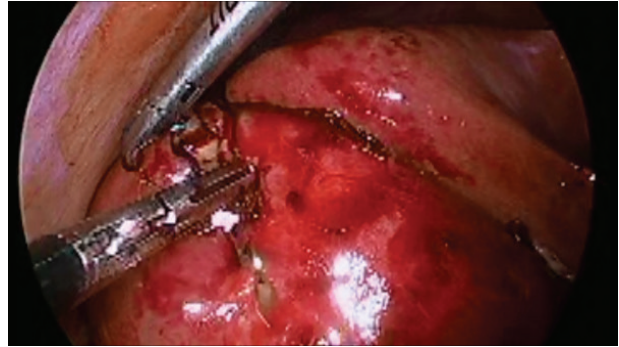
**Figure 5.** The necrotic gallbladder is held with a grasper for insertion of the fixed hook. Areas of gangrene can be seen along and around the gallbladder. Red areas are locations where omental adhesions were removed.



**Figure 6.** Pulling on the suture near the fixed hook to lift the gallbladder for insertion of the adjustable hook.



**Figure 7.** Placement of the adjustable hook in the upper right diaphragm.



**Figure 8.** Achieving optimal retraction of the necrotic gallbladder by pulling on the free suture end while holding the fixed hook.

## Clinical Pearls

FreeHold Duo™ is a hands-free retractor that is easy to use and provides excellent retraction during laparoscopic abdominal procedures. Advantages of the FreeHold Duo™ for laparoscopic cholecystectomy include:

- Ease of use, even in challenging cases
- One less incision and trocar
- Reduced need for an assistant
- Adjustable tension and exposure
- Secure retraction, even with very large or necrotic gallbladders

One of the barriers to minimally invasive procedures is the time it takes operators to learn the technique. For example, one study of single-incision laparoscopic cholecystectomy found that some surgeons required up to 15 procedures to achieve proficiency with this technique.<sup>18</sup> The learning curve with FreeHold Duo™ is brief; most surgeons should master its use within three or four procedures. In addition to being easy to learn to enhance a standard cholecystectomy, FreeHold Duo™ offers benefits in difficult cases by fostering consistency in technique through use in every case, regardless of circumstance.

## References

1. Johansson M, Thune A, Nelvin L, Stiernstam M, Westman B, Lundell L. Randomized clinical trial of open versus laparoscopic cholecystectomy in the treatment of acute cholecystitis. *Br J Surg*. Jan 2005;92(1):44-49.
2. Keus F, Gooszen HG, van Laarhoven CJ. Open, small-incision, or laparoscopic cholecystectomy for patients with symptomatic cholelithiasis. An overview of Cochrane Hepato-Biliary Group reviews. *Cochrane Database Syst Rev*. 2010(1):CD008318.
3. Erbella J, Jr., Bunch GM. Single-incision laparoscopic cholecystectomy: the first 100 outpatients. *Surg Endosc*. Aug 2010;24(8):1958-1961.
4. Hodgett SE, Hernandez JM, Morton CA, Ross SB, Albrink M, Rosemurgy AS. Laparoendoscopic single site (LESS) cholecystectomy. *J Gastrointest Surg*. Feb 2009;13(2):188-192.
5. Antoniou SA, Pointner R, Granderath FA. Single-incision laparoscopic cholecystectomy: a systematic review. *Surg Endosc*. Feb 2011;25(2):367-377.
6. Goel R, Shabbir A, Tai CM, et al. Randomized controlled trial comparing three methods of liver retraction in laparoscopic Roux-en-Y gastric bypass. *Surg Endosc*. Feb 2013;27(2):679-684.
7. Lee SC, Choi BJ, Kim SJ. Two-port cholecystectomy maintains safety and feasibility in benign gallbladder diseases: a comparative study. *Int J Surg*. 2014;12(9):1014-1019.
8. Hosogi H, Strassel V, Martin C, Sakai Y, Saad S. Single-port versus needlescopic versus conventional laparoscopic cholecystectomy: a comparative study. *Asian J Endosc Surg*. Aug 2011;4(3):120-126.
9. Lurje G, Raptis DA, Steinemann DC, et al. Cosmesis and Body Image in Patients Undergoing Single-port Versus Conventional Laparoscopic Cholecystectomy: A Multicenter Double-blinded Randomized Controlled Trial (SPOCC-trial). *Ann Surg*. Nov 2015;262(5):728-734; discussion 734-725.
10. Fagan SP, Awad SS, Rahwan K, et al. Prognostic factors for the development of gangrenous cholecystitis. *Am J Surg*. Nov 2003;186(5):481-485.
11. Aydin C, Altaca G, Berber I, Tekin K, Kara M, Titiz I. Prognostic parameters for the prediction of acute gangrenous cholecystitis. *J Hepatobiliary Pancreat Surg*. 2006;13(2):155-159.
12. Nikfarjam M, Niumsawatt V, Sethu A, et al. Outcomes of contemporary management of gangrenous and non-gangrenous acute cholecystitis. *HPB (Oxford)*. Aug 2011;13(8):551-558.
13. Bourikian S, Anand RJ, Aboutanos M, Wolfe LG, Ferrada P. Risk factors for acute gangrenous cholecystitis in emergency general surgery patients. *Am J Surg*. Oct 2015;210(4):730-733.
14. Ganapathi AM, Speicher PJ, Englum BR, Perez A, Tyler DS, Zani S. Gangrenous cholecystitis: a contemporary review. *J Surg Res*. Jul 2015;197(1):18-24.
15. Choi SB, Han HJ, Kim CY, et al. Early laparoscopic cholecystectomy is the appropriate management for acute gangrenous cholecystitis. *Am Surg*. Apr 2011;77(4):401-406.
16. Hunt DR, Chu FC. Gangrenous cholecystitis in the laparoscopic era. *Aust N Z J Surg*. Jun 2000;70(6):428-430.
17. Chaudhry S, Hussain R, Rajasundaram R, Corless D. Gangrenous cholecystitis in an asymptomatic patient found during an elective laparoscopic cholecystectomy: a case report. *J Med Case Rep*. 2011;5:199.
18. Deutsch GB, Sathyanarayana SA, Giangola M, et al. Competence acquisition for single-incision laparoscopic cholecystectomy. *JSLs*. Jan-Mar 2015;19(1):e2014 00116.

www.freeholdsurgical.com | info@freeholdsurgical.com  
Customer Service: 646.200.7005