



Advancements in liver retraction techniques for laparoscopic gastrectomy

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Abstract

Traditionally, liver retraction for laparoscopic gastrectomy is done *via* manual methods, such as the placement of retractors through the accessory ports and using a Nathanson retractor. However, these techniques often posed issues including extra abdominal incisions, risk of liver injury or ischaemia, and the potential for compromised visualization. Over the years, the development of innovative liver retraction techniques has significantly improved the safety and efficacy of laparoscopic gastrectomy and similar other hiatal procedures. This editorial will comment on the article by Lin *et al*, and compare this to the other liver retractor techniques available for surgeons and highlight the pros and cons of each technique of liver retraction.

Key Words: Liver retraction; Laparoscopic surgery; Bariatric surgery; Gastrectomy; Retractor-related liver injury

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Core Tip: The approach of the modified hepatic left lateral lobe inversion technique provides another tool for minimally invasive upper gastrointestinal surgeons to safely retract the liver.

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INTRODUCTION

Laparoscopic and robotic surgery has revolutionized the field of surgery, offering significant advantages over open surgery, including reduced postoperative pain, quicker recovery times, and better cosmetic outcomes[1]. Among the various complex laparoscopic procedures performed in the upper abdomen, for example gastrectomy for cancer, anti-reflux surgery, and bariatric surgery, a critical aspect of this surgery is effective liver retraction which allows surgeons to access the oesophageal hiatus, proximal stomach, diaphragm and surrounding structures safely.

Traditionally, liver retraction for laparoscopic gastrectomy is done *via* mechanical methods, such as the placement of metal retractors through the accessory ports, *i.e.*, a Nathanson liver retractor. However, these techniques do have some limitations including requiring an extra abdominal incision and the risk of liver injury or hepatic ischaemia[2]. Retractor-related liver injury (RRLI) represents a fairly frequent and potentially serious complication of laparoscopic surgery, which often manifests as deranged post-operative liver-function tests. Hepatic ischaemia increases the risk of focal or lobar necrosis, potentially resulting in acute liver failure or even death[3,4]. It is also associated with increased risk of patient readmission, requirement of HDU care and, rarely, need for reoperation[5].

Over the years, the development of different and innovative liver retraction techniques has significantly improved the efficiency of laparoscopic gastrectomy and other complex hiatal procedures. The pros and cons and techniques of each of these methods are summarised below.

MECHANICAL LIVER RETRACTORS

Metal mechanical retractors, such as the Nathanson liver retractor, have been widely used due to their simplicity and effectiveness. The Nathanson retractor, for instance, is introduced through an epigastric port and positioned to elevate the liver and connected to a mechanical device attached to the operating table. While extremely effective, this approach has its drawbacks, including the need for an additional incision and its difficulty to place in morbidly obese patients. There is also the potential for RRLI with evidence of retractor-related injury in up to 25% of patients undergoing laparoscopic upper gastrointestinal surgery[6]. More recently, the efficacy of an L-shaped metal retractor in laparoscopic bariatric surgery has been demonstrated with reduced post-operative liver function test (LFT) derangement compared to Nathanson retractors without the need for an additional trocar[7]. Despite this, in patients with obesity and a fatty liver care should be taken to avoid prolonged periods of mechanical liver retraction to avoid hepatic ischaemia[8].

ARTICULATING FAN OR PRETZEL TYPE LIVER RETRACTORS

To address some of the limitations of mechanical retractors, articulating fan or pretzel spaced retractors were developed, which can be adjusted by the assistant to provide more dynamic liver retraction[9]. Fan retractors, in particular, offer a broader area of contact, reducing the risk of RRLI. However, these tools still require additional incisions and can increase the complexity of the procedure. The port is usually placed in a right lower abdominal incision depending on the operation performed.

MAGNETIC LIVER RETRACTORS

The introduction of magnetic retractors represents a recent advancement in laparoscopic liver retraction[10,11]. These devices use an external magnet placed on the skin to control an internal magnetic retractor placed on the liver. Magnetic retraction offers some advantages, including the elimination of additional ports, leading to reduced pain scores and the potential for reduction in the risk of liver injury[12]. However, they do have some limitations in that in some livers, two magnetic retraction devices are required and the magnetic graspers can pinch and injure the liver.

SUTURE OR DRAIN SUSPENSION LIVER RETRACTION

Suture suspension is a less invasive alternative that involves placing a suture through the abdominal wall and the liver, lifting the liver out of the surgical field. Different techniques are described with either transabdominal sutures or intracorporeal sutures from the diaphragm to the abdominal wall[13]. However, it can be technically difficult, bleeding at the

hepatic suture site can be problematic, and may not provide sufficient retraction in patients with obesity and fatty livers [14]. Suture and clip-based techniques have also been used which offer a flexible surgical field by adapting suture traction and have been shown to reduce post-operative LFT derangement in gastrectomy compared to mechanical retraction[15]. Drain suspension represents a variation of suture suspension, instead utilising a drain or nasogastric tube which is sutured to or wrapped around an attachment point on the liver. This technique eliminates the need for additional incision and also reduces the risk of liver injury[16,17].

COMBINED LIVER MOBILISATION AND SUSPENSION LIVER RETRACTION TECHNIQUES

Combined liver mobilisation and suture suspension techniques mobilise the left lateral lobe and use sutures to improve liver retraction and are described in detail in this edition of *World Journal of Gastrointestinal Surgery* by Lin *et al*[18]. Nakamura *et al*[19] was the first to report on the technique hepatic left lateral lobe inversion, which completely isolates the hepatic left lateral lobe outside the surgical field and significantly reduced liver damage compared to Nathanson liver retraction[19]. The technique was modified by Harada *et al*[20] who simplified the method (and only required dissection of the falciform, coronary and left deltoid ligaments) and reduced the operative time to approximately 16 minutes[20].

Lin *et al*[18] should be commended for the quality of their operative photos and the associated video detailing their surgical methodology and those interested in performing this technique should refer to their manuscript for precise details. Lin *et al*[18] reported no evidence of significant liver dysfunction or hepatic ischaemia with their technique. Despite this, the study was single centre and did contain a relatively small patient cohort ($n = 13$). Table 1 summarises the previous published evidence for the hepatic inversion technique in liver retraction[18-21].

Table 1 Summary of published evidence describing the hepatic inversion technique for liver retraction during minimal invasive surgery

Ref.	Technique details	Operations	No of patients	Comments
Lin <i>et al</i> [18]	Modified hepatic left lateral lobe inversion as per Harada	Laparoscopic proximal gastrectomy	13 patients	No reports of hepatic injury, congestion, or ischaemia
Nakamura <i>et al</i> [19]	Suture of the round ligament to the peritoneum. The round, falciform, left triangular, and coronary ligaments were divided. The hepatogastric ligament was also divided to the depth of the ligamentum venosum	Laparoscopic proximal gastrectomy	81 patients (40 patients undergoing left lateral lobe inversion)	No reports of hepatic injury, congestion, or ischaemia
Harada <i>et al</i> [20]	2-0 straight needle to the peritoneum of the round ligament and pulling it to the outside of the abdominal cavity. The falciform, left triangular, and coronary ligaments were dissected	Laparoscopic total and proximal gastrectomy	24 patients	One intra-operative liver injury and Nathanson retractor insertion required in three patients
Yoshikawa <i>et al</i> [21]	Mobilisation through dissection of falciform, coronary, triangular, and pars flaccida of the hepatogastric ligament. A hooked organ retractor was then used to grasp the pars condense for inversion	Laparoscopic total gastrectomy	32 patients (12 patients with mobilisation)	No reports of hepatic injury, congestion, or ischaemia

The choice of retraction technique in laparoscopic upper gastrointestinal surgery strikes a balance between operative time, technical complexity, cost and patient morbidity in order to achieve an optimal surgical field, while minimising the risk of RRLI[22].

Mechanical devices deliver quick and technically straightforward retraction, offering consistent surgical views which can be easily adapted by adjusting retractor position. This is optimal for procedures requiring relatively short periods of liver retraction in patients with low risk of liver injury. In high-risk patients, such as those with fatty liver or cirrhosis, where prolonged retraction is likely to be required, strong consideration should be given to magnetic and suture-based methods. These techniques can also offer comprehensive and flexible surgical views while preventing the need for additional incision and reducing the incidence of liver injury and ischaemia. Despite this, they can be technically challenging and may be more time-consuming for less experienced surgeons. Where metallic retractors are used in high-risk patients for extended periods, surgeons should consider fan-shaped devices or concomitant use of an adjunct, such as a silicon disc, to reduce localised pressure and periodically adjust retractor position to reduce liver ischemia and prevent necrosis[23].

CONCLUSION

In conclusion, Lin *et al*[18] have further demonstrated the safety and efficacy of combined mobilisation and suture suspension techniques in proximal gastrectomy, providing a quick, and technically feasible method to achieve a comprehensive laparoscopic view. The wealth of retraction methods available, each with their own risks and benefits based on procedural and patient characteristics, offers surgeons multiple approaches. This facilitates clinical judgement to optimise visualisation of the surgical field in each case, while mitigating the risk of hepatic injury in high-risk patients. This

approach is only enhanced by the work of Lin *et al*[18] and provides another tool to safely retract the liver for complex laparoscopic or robotic upper operations.

FOOTNOTES

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