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*Review Article*

## *Major Vascular Injury in Laparoscopic Cholecystectomy*

**Supaporn Opasanon\***  
**Thawatchai Akaraviputh**

*Minimally Invasive Surgery Unit, Division of General Surgery, \*Division of Trauma Surgery, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

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### **Abstract**

**Background:** Major vascular injury (MVI) during laparoscopic cholecystectomy (LC) is a rare but very serious complication of the procedure.

**Materials and Methods:** The published literatures that have reported the MVI in LC were reviewed. The authors focused on MVI as an injury to any of the following vessels: aorta, vena cava, iliac vessels, and portal vein.

**Results:** The incidence of MVI in LC varies in literatures. There is no definite consensus classification of this complication. Inexperienced surgeons and factors related with patients and instruments constitute the risk. However, MVI in LC can be avoided.

**Conclusion:** The good surgical technique, adequate training and awareness can prevent the MVI in LC. Early recognition and proper management when dealing with this problem are keys to success and make this operation a safe procedure.

**Key words:** Bleeding, complications, laparoscopic cholecystectomy, minimal invasive surgery, vascular injury

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**Correspondence address:** Thawatchai Akaraviputh, MD, Dr. med., Minimally Invasive Surgery Unit, Division of General Surgery, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand; Telephone: +66 2419 8006; Fax: +66 2412 1370; Email: sitak@mahidol.ac.th

## INTRODUCTION

Minimally invasive surgery (MIS) using advanced laparoscopic technology is the preferred surgical approach for many illnesses. MIS is less invasive than open surgery performed for the same purpose. Laparoscopic surgery is referred to as MIS. In the late 1980s, the first successful laparoscopic cholecystectomy (LC) was reported in Europe.<sup>1</sup> It is now possible to remove the gallbladder through a small incision. Nowadays, LC is the gold standard treatment for gallstone disease. LC requires several small incisions in the abdomen to allow the insertion operating ports through which surgical instruments and a video camera are placed into the abdominal cavity. The surgeon can see internal organs with magnified image by video monitor and performs the operation by manipulating the surgical instruments through the operating ports.

The main advantage of LC for the patient is the short recovery period. When compared with standard abdominal surgery, there is less surgical pain and the patients heals quicker with shorter hospital stays and earlier return to work. There are fewer complications such as infection and adhesions, improved cosmetic results, and increased patient satisfaction. While the procedure seems very easy for the patient, it is still abdominal surgery and has the same risks as other general surgeries. Sometimes, an LC will be converted to an OC (open cholecystectomy) for technical reasons or safety.<sup>2,3</sup> Serious complications including bile duct injury, bile leaks, bleeding and bowel injury result in part from patient selection, surgical inexperience, and the surgical technique limited to the minimally invasive approach. However, all of these complications are rare. The overall incidence of laparoscopic complications is also related to the experience of the surgeon.

Moore and Bennett retrospectively reviewed 8,839 procedures performed by 55 surgeons, 90 percent of bile duct injuries occurred in the first 30 cases for each surgeon.<sup>4</sup> The incidence decreased from 1.7 percent in the first cases to 0.17 percent at the 50th case. Complication rates are tapered off after surgeons have more experience.<sup>5</sup> A large volume of data presents biliary complications of LC in available literature. However, little is reported on major vascular injury (MVI) of LC. Vascular injury during LC is a rare but potentially life-threatening complication if not recognized and treated quickly. This topic will discuss

major vascular complications related to LC.

### *Incidence*

The true incidence of vascular injuries in patients during LC is uncertain, although 3 is a large volume of data on LC in literature. It has been reported to occur with an incidence of up to 2% in various series, however, gynecologic and urologic laparoscopy are included in the majority of published series.

Retrospectively study was reviewed between 1992 and 1995 from PubMed database. Geers and Holden reported three MVIs in all 2201 laparoscopic procedures.<sup>6</sup> The incidence was 0.14%. Seidman et al reported the incidence of MVI was 0.26-1.1% for laparoscopic procedures.<sup>7</sup> Catarci et al showed in a multicenter study that the incidence of MVIs in laparoscopy (including aorta, iliac vessels, vena cava, inferior mesenteric arteries and lumbar arteries) was 0.07-0.4%.<sup>8</sup> Moreover, they mentioned the incidence of minor injuries (branches of the epigastric vessels, mesenteric and omental vessels) which was 0.1%-1.2%. In 2004, Guloglu et al showed that the major retroperitoneal vascular complication rate was 0.07%.<sup>9</sup>

### *Classification*

The major problem in discussing vascular injuries of LC is that there is no definite consensus classification. A small amount of published data may be the important reason. The authors defined MVI as injury to any of the following vessels: aorta, vena cava, iliac vessels, and portal vein.

Bacourt et al. retrospectively reported 9 cases of vascular injury. Six cases had occurred in 1991.<sup>10</sup> Injury was presented near the aortic bifurcation or at the origin of the common right iliac artery. Unstable hemodynamic was the presenting sign and occurred early in 6 cases and late in 2 cases. The vascular surgeon had been consulted by the operating surgeon. There was one death because of the delayed diagnosis.

Battaglia et al. showed a case report presented an aortic laceration of the anterior wall and a puncture wound penetrating the anterior wall of the inferior vena cava during LC.<sup>11</sup> The operation was converted to laparotomy. Injury was repaired using a 5-0 Prolene suture mounted on pledgets. The estimated blood loss was 1300 ml. The patient was discharged on the postoperative day 13.

Geers and Holden reviewed 2,201 laparoscopic procedures retrospectively over a three-year period.<sup>6</sup> There were three MVIs for an incidence of 0.14%. The primary operations were cholecystectomy in 1,012 patients. Right common iliac vein and left hypogastric artery were injured due to trocar insertion. Right common iliac artery was injured because of Veress needle insertion. The authors focused on the patient's position, sufficient pneumoperitoneum before trocar insertion, and the angle of trocar and Veress needle insertion.

In a review of 2,589 laparoscopic procedures performed at their institution from 1990 to 1996 by Usal et al.<sup>12</sup>, in the first four years there were three MVIs during the 1,372 operations. One aorta and one vena cava were injured because of trocar insertion. They were treated successfully by simple suture. The most serious was the portal vein injury due to dissection in the Calot's triangle. Laparotomy was performed immediately, however, the patient died following repair of the portal vein injury due to liver failure. Surprisingly, there was no MVIs reported during 1995-1996 and the overall rate of MVI was 0.11%.

Guloglu et al. reviewed 11,746 laparoscopic surgeries performed at eight hospitals in Istanbul, Turkey, between 1994 and 2002.<sup>9</sup> They reported seven MVIs during LC; of these five occurred during placement of the first umbilical trocar (71.4%), and one in the course of the insertion of a Veress needle (14.3%). One patient had the injured inferior vena cava occurred during second trocar placement (14.3%). Abdominal aortic injury occurred in two patients. Injuries involved the common iliac vessels in four patients. All were noticed in the operating theatre and laparotomy was performed immediately. One aortic injury was repaired by a tubular polytetra-fluoroethylene (PTFE) graft and another one was repaired by primary suture. Inferior vena cava injury and common iliac vein were repaired primarily. PTFE graft interposition was employed in two common iliac arteries and Dacron patchplasty in one common iliac artery injury. An average of blood transfusion was 3.5 units and length of hospital stay was 6.8 days without any mortality.

## DISCUSSION

MVI such as distal abdominal aorta, inferior vena cava and large pelvic vessels is one of the most important

complications of laparoscopic surgery which are rarely found in open surgery. This is susceptible prone to occur during the Veress needle or trocar insertion.<sup>6,9-12</sup> However, surgical factors and patient factors are also the risks of vascular injury.<sup>13</sup> Inadequate training, less experience, inadequate exposure, forceful retraction, and failure to recognize anatomical landmarks are surgical factors. Previous surgery, adhesions, coagulopathy and anatomical abnormalities are patient factors. In addition, the surgeon should keep in mind that the aorta may lie only a few centimeters below the skin in very thin patients. Entry-technique for laparoscopy is also important. Adequate insufflations to create pneumoperitoneum should be done prior trocar-entry, or various modifications of the open technique of port placement may reduce the complications.

Prompt diagnosis is crucial for proper management. The diagnosis of retroperitoneal vessel injuries may be delayed due to increased intra-abdominal pressure from CO<sub>2</sub> insufflation. The tamponade effect of pneumoperitoneum at the retroperitoneal region is occurred. In one study, delayed recognition of iliac artery injury during laparoscopic surgery was occurred,<sup>7</sup> probably due to the initial accumulation of blood in the retroperitoneum. Therefore the operating surgeon should be aware of this condition and perform the complete laparoscopic evaluation at the end of the procedure for early diagnosis of vascular complications.<sup>9</sup>

In addition, the complications of laparoscopy can be reduced with appropriate training. The majority of major vascular complications are occurred during the insertion of the Veress needle or the first trocar. The open Hasson technique, as the open introduction of the first trocar under direct vision, is recommended in order to prevent injuries.<sup>14</sup> In our hospital, we always used open technique for the first trocar placement. Early diagnosis is important to manage a major vascular injury. Vascular surgeons should be called to manage the definitive treatment of the injury in case the operating surgeons are unfamiliar with vascular surgery. Thiel et al. reported 6 major venous injuries due to laparoscopic urological procedures.<sup>15</sup> All the patients were treated successfully by laparoscopic suturing techniques. However, at present, there is no laparoscopic management in vascular injury related to LC. Mortality due to laparoscopy is reported to be

between 0.03% and 0.49% in a 7-year prospective study.<sup>16</sup>

### CONCLUSION

LC is a very safe procedure. Major vascular injury is an uncommon but potentially a serious complication, however, surgeons who perform laparoscopic surgery should be aware of the risk of major vascular injuries. These injuries can be avoided. Where faced with the possibility of injury to the aorta, vena cava or the iliac vessels, early conversion to open surgery must be quickly done to manage the definitive treatment of the injury.

### REFERENCES

1. Afdhal NH, Vollmer CM. Complications of laparoscopic cholecystectomy. UpToDate. (online) 2010 (cited 2010 Oct 21); Available from: URL: <http://www.uptodate.com/patients/content/topic.do?topicKey=~Ah/eWiY2.MQX>
2. Strasberg SM. Biliary injury in laparoscopic surgery: part 1. Processes used in determination of standard of care in misidentification injuries. *J Am Coll Surg* 2005;201:598-603.
3. Strasberg SM. Biliary injury in laparoscopic surgery: part 2. Changing the culture of cholecystectomy. *J Am Coll Surg* 2005;201:604-11.
4. Moore, MJ, Bennett, CL. The learning curve for laparoscopic cholecystectomy. The Southern Surgeons Club. *Am J Surg* 1995;170:55-9.
5. Hobbs, MS, Mai, Q, Knuiman, MW, et al. Surgeon experience and trends in intraoperative complications in laparoscopic cholecystectomy. *Br J Surg* 2006;93:844-53.
6. Geers J, Holden C. Major vascular injury as a complication of laparoscopic surgery: a report of three cases and review of the literature. *Am Surg.* 1996;62:377-9.
7. Seidman DS, Nasserbakht F, Nezhat F, et al. Delayed recognition of iliac artery injury during laparoscopic surgery. *Surg Endosc* 1996;10:1099-101.
8. Catarci M, Carlini M, Gentileschi P, et al. Major and minor injuries during the creation of pneumoperitoneum. A multicenter study on 12,919 cases. *Surg Endosc* 2001;15:566-9.
9. Guloglu R, Dilege S, Aksoy M, et al. Major Retroperitoneal Vascular Injuries During Laparoscopic Cholecystectomy and Appendectomy. *J Laparoendosc Adv Surg Tech* 2004; 14:73-6.
10. Bacourt F, Mercier F. Injuries to the abdominal aorta during laparoscopy. *Chirurgie* 1993-1994;119:457-61.
11. Battaglia L, Bartolucci R, Berni A, et al. Major vessel injuries during laparoscopic cholecystectomy. *Chir Ital* 2003;55:291-4.
12. Usal H, Sayad P, Hayek N, et al. Major vascular injuries during laparoscopic cholecystectomy. An institutional review of experience with 2589 procedures and literature review. *Surg Endosc* 1998;12: 960-2.
13. Kaushik R. Bleeding complications in laparoscopic cholecystectomy: Incidence, mechanisms, prevention and management. *J Minim Access Surg.* 2010;6:59-65.
14. Hasson HM. A modified instrument and method for laparoscopy. *Am J Obstet Gynecol* 1971;110:886-7.
15. Thiel R, Adams JB, Schulam PG, et al. Venous dissection injuries during laparoscopic urological surgery. *J Urol* 1996; 155:1874-6.
16. Kane MG, Krejs GJ. Complications of diagnostic laparoscopy in Dallas: a 7-year prospective study. *Gastrointest Endosc* 1984;30:237-40.