Laparoscopic cholecystectomy with aberrant bile duct detected by intraoperative fluorescent cholangiography concomitant with angiography: A case report

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Article history:
Received 16 March 2018
Received in revised form 27 May 2018
Accepted 7 August 2018
Available online 13 August 2018

Keywords:
Aberrant bile duct
Laparoscopic cholecystectomy
Indocyanine green
Intraoperative cholangiography

ABSTRACT

INTRODUCTION: Laparoscopic cholecystectomy is the standard surgical treatment for patients with benign gallbladder disease. However, bile duct injury continues to be reported as a surgical complication. Intraoperative cholangiography is recommended to reduce the risk of bile duct injury during laparoscopic cholecystectomy. Intraoperative cholangiography using indocyanine green, which is excreted into bile and shows fluorescence under infrared light, has recently been reported as useful in preventing bile duct injury during laparoscopic cholecystectomy. We report here a case of laparoscopic cholecystectomy with an aberrant bile duct detected by intraoperative fluorescent cholangiography concomitant with angiography.

PRESENTATION OF CASE: An 82-year-old woman was diagnosed with cholecystolithiasis and underwent laparoscopic cholecystectomy. An aberrant bile duct branching from the right side of the common hepatic duct was detected by intraoperative indocyanine green fluorescent cholangiography. Furthermore, we were able to confirm the cystic artery by reinjecting indocyanine green during the procedure. Laparoscopic cholecystectomy was performed safely without injuring the aberrant bile duct, despite no recognition of the abnormality on preoperative computed tomography or magnetic resonance imaging.

DISCUSSION AND CONCLUSIONS: Aberrant bile ducts are rare anatomical variation and clinically important because of the susceptibility to injury during cholecystectomy. Our case reported for the first time that fluorescence cholangiography concomitant with angiography was useful for identifying an aberrant bile duct and the cystic artery during laparoscopic cholecystectomy.

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bile duct (Fig. 2b). To confirm the anatomy, we reinjected 2 ml of ICG intravenously during LC and confirmed that the cystic artery showing fluorescence under near-infrared light was located anterior to the identified structure (Fig. 2c). We thus diagnosed the structure as an aberrant bile duct, and LC was completed without injuring this duct (Fig. 3a, b). The patient was discharged on postoperative day 5 without complications.

3. Discussion

LC is a common operation in the field of digestive surgery [3] and offers several advantages over open cholecystectomy, including reduced pain, a lower frequency of wound infection, improved cosmesis, and an earlier return to normal activity. LC is thus a standard surgical treatment for patients with benign gallbladder disease [1, 2]. On the other hand, bile duct injury is the most serious surgical complication; although the incidence is a relatively low 0.3–0.5% [3], such injury frequently causes serious conditions such as bile leakage and bile duct stenosis.

IOC is performed to reduce a risk of bile duct injury during LC [4]. However, radiographic IOC during LC is time-consuming, and insertion of a transcystic tube for injection of contrast material may injure the bile duct [11, 12]. Furthermore, radiographic IOC exposes the patient and medical staff to radiation and requires additional medical resources. Recently, a novel IOC technique utilizing the fluorescence of ICG excreted in bile after intravenous injection was developed for use in not only open surgery but also laparoscopic surgery [5–9]. ICG is a fluorescent contrast agent with a peak emission of 830 nm when assessed under near-infrared light. Following intravenous injection, ICG binds to plasma proteins and is excreted.

![Image 1](https://example.com/image1.png)

**Fig. 1.** Preoperative MRI image. The cystic duct is shown (arrow). MRI reveals no anomalous bile duct.

severe, and we were able to safely dissect Calot’s triangle. During dissection, we recognized a linear structure posterior to the cystic artery (Fig. 2a). This structure showed fluorescence under near-infrared light, and was considered likely to represent an aberrant bile duct. The structure thought to represent an aberrant bile duct (arrowhead) shows fluorescence under near-infrared light (Fig. 2b). The cystic artery (arrow) shows fluorescence under near-infrared light after intravenous injection of 2 ml of ICG during the operation. Posterior to the cystic artery, an aberrant bile duct is evident (arrowhead).

![Image 2](https://example.com/image2.png)

**Fig. 2.** Findings from Calot’s triangle during laparoscopic cholecystectomy. (a) A linear structure (arrowhead) is seen posterior to the cystic artery (arrow) under normal light. (b) The structure thought to represent an aberrant bile duct (arrowhead) shows fluorescence under near-infrared light. (c) The cystic artery (arrow) shows fluorescence under near-infrared light after intravenous injection of 2 ml of ICG during the operation. Posterior to the cystic artery, an aberrant bile duct is evident (arrowhead).

![Image 3](https://example.com/image3.png)

**Fig. 3.** Findings of the aberrant bile duct after laparoscopic cholecystectomy. (a) The aberrant bile duct (arrowhead) branching from the right side of the common hepatic duct appears well preserved under normal light. (b) The aberrant bile duct (arrowhead) shows fluorescence under near-infrared light.
4. Conclusion

Fluorescence cholangiography concomitant with angiography was useful for identifying an aberrant bile duct and the cystic artery during laparoscopic cholecystectomy.

Conflicts of Interest

The authors declare that they have no competing interests.

Funding

We declare that none of the authors received external funding for this study.

Ethical approval

The ethical approval has been exempted as it was not necessary in this case report by our institution.

Consent

The patient consented to publication of the features of the case, and the identity of the patient has been protected.

Author contribution

Y.T. and H.O. participated in the surgery, collected data and consent, and drafted the manuscript. T.S., K.H., K.M., K.A., M.W., and S.M. participated in the surgery. S.N. participated in the design, coordination, and drafting of the manuscript. All authors read and approved the final manuscript.

Registration of research studies

Not applicable.

Guarantor

Hirosi Okumura.

References

[1] N.J. Soper, P.T. Stockmann, D.L. Dunnegan, S.W. Ashley, Laparoscopic cholecystectomy. The new ‘gold standard’? Arch. Surg. 127 (1992) 917–921.
[2] National institutes of health consensus development conference statement on gallstones and laparoscopic cholecystectomy, Am. J. Surg. 165 (1993) 390–398.
[3] L. Stewart, iatrogenic biliary injuries: identification, classification, and management, Surg. Clin. North Am. 94 (2014) 297–310.
[4] D.R. Flum, E.P. Delinger, A. Cheadle, L. Chan, T. Koepsell, Intraoperative cholangiography and risk of common bile duct injury during cholecystectomy, JAMA 289 (2003) 1639–1644.
[5] T. Ishizawa, S. Tamura, K. Masuda, T. Aoki, K. Hasegawa, H. Imanura, et al., Intraoperative fluorescent cholangiography using indocyanine green: a bilary road map for safe surgery, J. Am. Coll. Surg. 208 (2009) e1–e4.
[6] T. Ishizawa, Y. Bandai, N. Kokudo, Fluorescent cholangiography using indocyanine green for laparoscopic cholecystectomy: an initial experience, Arch. Surg. 144 (2009) 381–382.
[7] T. Ishizawa, Y. Bandai, M. Ijichi, J. Kaneko, K. Hasegawa, N. Kokudo, Fluorescent cholangiography illuminating the biliary tree during laparoscopic cholecystectomy, Br. J. Surg. 97 (2010) 1369–1377.
[8] Y. Kono, T. Ishizawa, K. Tani, N. Harada, J. Kaneda, A. Saura, et al., Techniques of fluorescence cholangiography during laparoscopic cholecystectomy for better delineation of the bile duct anatomy, Medicine 94 (25) (2015) e1005, http://dx.doi.org/10.1097/MD.0000000000001005.
[9] S.L. Vlek, D.A. van Dam, S.M. Ruhnstein, E.S.M. de Lange-de Klerk, L.J. Schoonmade, J.B. Tuynman, et al., Biliary tract visualization using near-infrared imaging with indocyanine green during laparoscopic cholecystectomy: results of a systematic review, Surg. Endosc. 31 (2017) 2731–2742.
[10] R.A. Agha, A.J. Fowler, A. Saetta, I. Baral, S. Rajmohan, D.P. Orgill, for the SCARE Group, The SCARE statement: consensus-based surgical case report guidelines, Int. J. Surg. 34 (2016) 180–186.
[11] M.L. Landsman, G. Kwant, G.A. Mook, W.G. Zijlstra, Light-absorbing properties, stability, and spectral stabilization of indocyanine green, J. Appl. Physiol. 40 (1976) 575–583.
[12] T.T. White, M.J. Hart, Cholangiography and small duct injury, Am. J. Surg. 149 (1985) 640–643.
[13] K.M. Sheffield, Y. Han, Y.F. Kuo, C.M. Townsend Jr., J.R. Goodwin, T.S. Riall, Variation in the use of intraoperative cholangiography during cholecystectomy, J. Am. Coll. Surg. 214 (2012) 668–679.
[14] R.M. Schols, N.D. Bouvy, R.M. van Dam, A.A. Masclée, C.H. Dejong, L.P. Stassen, Combined vascular and biliary fluorescence imaging in laparoscopic cholecystectomy, Surg. Endosc. 27 (2013) 4511–4517, http://dx.doi.org/10.1007/s00464-013-3100-7.
[15] T. Schnellstorfer, M.G. Sarr, D.B. Adams, What is the of Luschka?–A systematic review, J. Gastrointest. Surg. 16 (2012) 656–662.
[16] T. Mariódi-Sapsako, M. Zarakosta, M. Zoulamoglou, T. Piperos, I. Papapanagiotou, M. Sgantzos, et al., Aberrant subvesical bile ducts identified during laparoscopic cholecystectomy: a rare case report and review of the literature, Int. J. Surg. Case Rep. 31 (2017) 99–102.
[17] A.A. Solf, O.H. Alaradi, M. Absoljoud, A.T. Nawras, Aberrant right hepatic duct draining into the cystic duct: clinical outcomes and management, Gastroenterol. Res. Pract. (2011) 458915, http://dx.doi.org/10.1155/2011/458915.