

# Intraoperative trans-cholecystic methylene blue injection for delineation of extrahepatic biliary tree during laparoscopic cholecystectomy

Ahmed Mohamed Abdelaziz Hassan, Mohamed Emad Esmat, Hussam Hamdy, Mohamed Abdo, Magdy Elsebae

## ABSTRACT

**Aims:** The incidence of bile duct injury in laparoscopic cholecystectomy is double greater compared to classic open surgery. Cholecysto-cholangiography technique had been suggested as a substitute to cystic duct cholangiography because it is easy, safe and successful. The aim of this work was to assess safety, effectiveness and feasibility of trans-cholecystic Methylene Blue (MB) injection for better delineation of extra hepatic biliary ducts and proper assessment of biliary anatomy. **Methods:** Fifty patients with chronic calculous cholecystitis who are candidates for laparoscopic cholecystectomy were recruited for the study. During the procedure all the bile in the gall bladder was aspirated and diluted MB equal to the amount of aspirated bile was injected slowly into the gall bladder. Intra-peritoneal spillage of MB, surgical time, post-operative complications, in addition to the clear anatomical delineation of extra-hepatic biliary radicles was documented. **Results:** 45 patients

(90%) were females, while five patients (10%) of them were males, with a mean age of  $34.6 \pm 13.74$  years. By using this technique all gall bladders, 48 cystic ducts, and 42 common bile ducts were painted. The mean operative time was  $78.63 \pm 12.37$  minutes and the mean hospital stay was  $1.13 \pm 0.43$  days. **Conclusion:** The intraoperative injection of methylene blue into the gall bladder fundus during laparoscopic cholecystectomy for direct visualization of the gall bladder, cystic duct and common bile duct is a feasible, cheap and easy maneuver without any radiation exposure or special equipments. This technique is proposed as an optional method in case of dissection difficulty of Calot's triangle during laparoscopic cholecystectomy to decrease the main cause of biliary injury.

**Keywords:** Cystic duct, Laparoscopic cholecystectomy, Methylene blue

## How to cite this article

Hassan AMA, Esmat ME, Hamdy H, Abdo M, Elsebae M. Intraoperative trans-cholecystic methylene blue injection for delineation of extrahepatic biliary tree during laparoscopic cholecystectomy. *Edorium J Surg* 2018;5:100031S05AH2018.

Ahmed Mohamed Abdelaziz Hassan<sup>1</sup>, Mohamed Emad Esmat<sup>2</sup>, Hussam Hamdy<sup>1</sup>, Mohamed Abdo<sup>3</sup>, Magdy Elsebae<sup>2</sup>

**Affiliation:** <sup>1</sup>Associate Professor of General Surgery, General Surgery Department, Theodor Bilharz Research Institute, Kornish El-Nile, Warak-Elhadar, Imbaba, Giza, Egypt; <sup>2</sup>Professor of General Surgery, General Surgery Department, Theodor Bilharz Research Institute, Kornish El-Nile, Warak-Elhadar, Imbaba, Giza, Egypt; <sup>3</sup>Assistant Lecturer of General Surgery, General Surgery Department, Theodor Bilharz Research Institute, Kornish El-Nile, Warak-Elhadar, Imbaba, Giza, Egypt.

**Corresponding Author:** Ahmed Mohamed Abdelaziz Hassan, General Surgery Department, Theodor Bilharz Research Institute, Kornish El-Nile, Warak-Elhadar, Imbaba, Giza, 12411, Egypt; Email: ahmedelmaghney@yahoo.com

Received: 30 July 2018

Accepted: 25 September 2018

Published: 25 October 2018

Article ID: 100031S05AH2018

\*\*\*\*\*

doi: 10.5348/100031S05AH2018OA

## INTRODUCTION

Laparoscopic cholecystectomy (LC) is "gold standard" surgical management of symptomatic gallstones.

However, the incidence of bile duct injury in LC is still double greater compared to classic open surgery. The most blamed causative factor is the misidentification of the anatomy, especially by a surgeon who is at the beginning of his learning curve [1–3]. The routine use of Intraoperative cholangiography (IOC) to delineate the extrahepatic biliary anatomy in LC remains controversial and selective use of IOC has been recommended [4, 5]. Biliary tree injuries may be decreased by direct coloration of the cystic duct by a technique in which the methylene blue (MB) is injected into the lumen of gall bladder to delineate the cystic duct and common bile duct. This technique seems easier to perform, without any radiation exposure and less time consuming than conventional IOC [6].

The aim of this work was to assess safety, effectiveness and feasibility of trans-cholecystic methylene blue injection for better delineation of extra hepatic biliary ducts and proper assessment of biliary anatomy for prevention of bile ducts injury during laparoscopic cholecystectomy.

## MATERIALS AND METHODS

This study was done during the period from August 2017 to March 2018 and included 50 consecutive patients with chronic calculous cholecystitis who are candidates for laparoscopic cholecystectomy. None of the patients reported history of jaundice within the last year and had pulmonary or cardiac disease.

All patients had been consented to a laparoscopic cholecystectomy with need for methylene blue injection for better delineation of biliary anatomy for prevention of bile ducts injury during laparoscopic cholecystectomy. All patients were informed that they might pass blue urine in the early post-operative period. The Ethics Committee of Theodor Bilharz Research Institute (TBRI) approved this study.

## Surgical procedure

During laparoscopic cholecystectomy, once the gall bladder fundus freed from adhesions, it was grasped and held tight towards the anterior abdominal wall with the help of two atraumatic graspers introduced via right anterior axillary and subxyphoid trocars. The gall bladder fundus was punctured by a Veress needle which was introduced via the abdominal wall in projection to this area. All the bile in the gall bladder was aspirated (Figure 1 A & B) and 50 percent diluted MB equal to the amount of aspirated bile was injected slowly into the gall bladder (Since the usual capacity of the gallbladder is only about 30–60 ml, so the maximum amount of diluted MB could be injected is about 15–30 mg) (Figure 1C). In order to prevent MB leakage, the gall bladder fundus was held tight interiorly during the withdrawal of the Veress needle and a grasper introduced via the right axillary

trocar was applied immediately to the puncture site and was held so throughout the operation or the puncture site was clipped with a clip (Figure 2). The region was irrigated with saline solution. During cholecystectomy, the gall bladder, cystic duct and common bile duct were visible and delineated with MB dye and the dissection was performed more safely (Figure 3). In order to prevent MB leakage, an endobag was used to extract gall bladder (Figure 4). A closed suction drain was left in the right sub hepatic space and exteriorized through the right lateral trocar site.

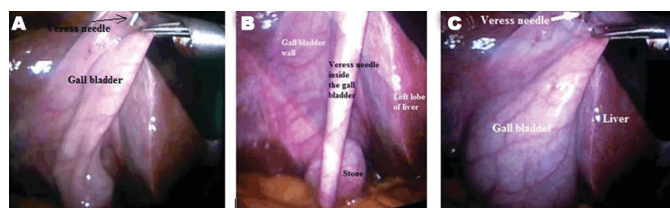


Figure 1: The gall bladder was aspirated (A, B) and 50 percent diluted methylene blue equal to the amount of aspirated bile was injected slowly into the gall bladder (C).



Figure 2: The gall bladder fundus puncture site was clipped with clip to prevent methylene blue leakage.

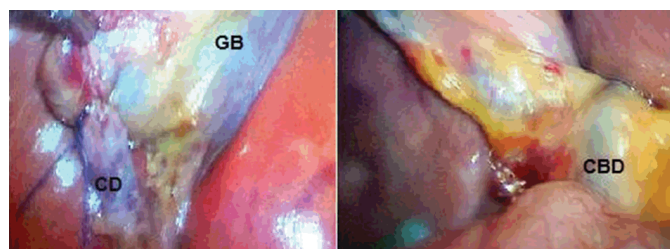


Figure 3: The gall bladder, cystic duct and common bile duct visible and delineated with methylene blue dye.

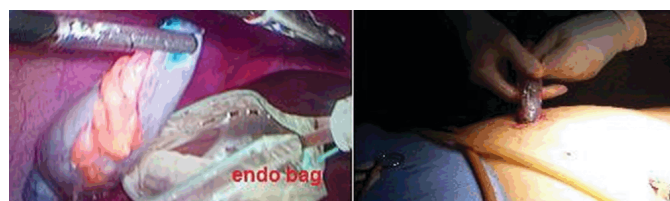


Figure 4: Using of an endobag to extract gall bladder.

## Evaluation

The evaluation based mainly on the clear anatomical delineation of the gall bladder, cystic duct, hepatic ducts and common bile duct. In addition, intra-peritoneal spillage of MB, surgical time, post-operative complications, biliary injury and postoperative hospital stay were documented.

## RESULTS

The study included fifty cases with chronic calculous cholecystitis underwent elective laparoscopic cholecystectomy with trans-cholecystic injection of MB. They ranged in age from 20 to 67 years (mean = 34.6±13.74 years). A 45 patients (90%) were females, while five patients (10%) of them were males. By using this technique all gall bladders, 48 (96%) cystic ducts, while 42 (84%) common bile ducts were painted (Table 1). In nine cases (18%), methylene blue leakage from the gall bladder into the abdominal cavity was observed (Figure 5). The region was irrigated with saline solution. None of the patients developed any complication related to the technique except one patient who developed immediate bluish discoloration of skin and mucous membrane (lips, finger tips) for 15 sec due to inadvertent injection of MB in a vessel in the gall bladder wall during MB injection into GB. The operative time ranged from 60-105 minutes with mean 78.63±12.37 minutes. It was observed that the mean operative time is slightly but insignificantly prolonged in patients which we failed to visualize the cystic duct by MB dye (mean operative time 83.3±10.2

Table 1: Evaluation data of the study

	Mean±SD
<b>Methylene Blue Painting</b>	
Gall Bladder	50±0
Cystic Duct	49±1.41
Common Bile Duct	46±5.65
Intra-operative Methylene Blue spillage	29.5±28.99
Operative time (minute)	78.63±12.37
Hospital stay(day)	1.13±0.43



Figure 5: Methylene blue leakage from the gall bladder into the abdominal cavity was observed during the removal procedure.

versus 77.2±12.8 minutes, p value = 0.24). The hospital stay postoperatively ranged from 1 to 3 days (mean 1.13±0.43 days).

## DISCUSSION

Although the usefulness of IOC to prevent bile duct injury is emphasized by a many authors, its importance still remains debatable and its routine application does not have a critical proficient benefit. Disadvantages of IOC are prolongation of the operative time, radiation exposure, increased cost and false positive results, leading to avoidable CBD exploration and the necessity of perception by a qualified radiologist [7–9].

Therefore, a technique by which MB is injected into the lumen of gall bladder to delineate the cystic duct and common bile duct seems cheap, easier to perform, without any radiation exposure and less time consuming than conventional IOC [6]. In the same time, the usual capacity of the gallbladder is only about 30–60 ml, So the maximum amount of (50 % diluted methylene blue equal to the amount of aspirated bile) could be injected is about 15–30 mg which is very safe (toxic dose is > 5 mg/kg) [6].

By using this technique in our study all gall bladders, 96% of cystic ducts and 84% common bile ducts were painted, which is significantly important. MB leakage from the gall bladder into the abdominal cavity during injection of dye with the need of irrigation with saline, does not affect the procedure and increases the mean operative time but not statistically significant (100.2±3.56 versus 74.32±8.16 minutes & p value = 0.241). Although the biliary tree could be visualized in most cases, the high rate of MB spillage of the present study which could be avoided by clipping gall bladder fundus with clip or tight holding it using non traumatic grasper. Because MB is excreted by the kidneys, the patients should be informed of the likelihood of blue urine in the early post-operative period, which already occurred in three cases only (6%). It was observed that the mean operative time is slightly prolonged in patients which we failed to visualize the cystic duct by MB dye (mean operative time 83.3±10.2 versus 77.2±12.8 minutes, p value = 0.24). With mean operative time 74.31±12.22 minutes (p value = 0.26). The dissection was performed much more safely, since the boundaries of the gall bladder and bile ducts were significantly defined and painted with MB. In cases with no free passages of the dye to the CBD, it might be due to gall bladders being loaded with stones, impacted by a large stone at Hartman’s pouch, or had very thick wall. In our study, MB can outline the bile ducts but without any impact in distinguishing bile duct stones. No biliary injuries were confronted in our cases. The primary cause of biliary injury during laparoscopic cholecystectomy in 97% of cases was a visual intuitive misconception. Faults in technical skill were present in only 3% of injuries [10]. So, our study is concerned to decrease the main cause of biliary injury.

## CONCLUSION

The intraoperative injection of methylene blue into the gall bladder fundus during laparoscopic cholecystectomy for direct visualization of the gall bladder, cystic duct and common bile duct is a feasible, cheap and easy maneuver without any radiation exposure or special equipment. This technique is proposed as an optional method in case of dissection difficulty of Calot's triangle during laparoscopic cholecystectomy to decrease the main cause of biliary injury.

## REFERENCES

1. Martin D, Uldry E, Demartines N, Halkic N. Bile duct injuries after laparoscopic cholecystectomy: 11-year experience in a tertiary center. *Biosci Trends* 2016 Jul 19;10(3):197–201.
2. Karanikas M, Bozali F, Vamvakierou V, et al. Biliary tract injuries after lap cholecystectomy-types, surgical intervention and timing. *Ann Transl Med* 2016 May;4(9):163.
3. Barrett M, Asbun HJ, Chien HL, Brunt LM, Telem DA. Bile duct injury and morbidity following cholecystectomy: A need for improvement. *Surg Endosc* 2018 Apr;32(4):1683–88.
4. Alvarez FA, de Santibañes M, Palavecino M, et al. Impact of routine intraoperative cholangiography during laparoscopic cholecystectomy on bile duct injury. *Br J Surg* 2014 May;101(6):677–84.
5. Flum DR, Koepsell T, Heagerty P, Sinanan M, Dellinger EP. Common bile duct injury during laparoscopic cholecystectomy and the use of intraoperative cholangiography: Adverse outcome or preventable error? *Arch Surg*. 2001 Nov;136(11):1287–92.
6. Sari YS, Tunali V, Tomaoglu K, Karagöz B, Güneyi A, Karagöz I. Can bile duct injuries be prevented? "A new technique in laparoscopic cholecystectomy". *BMC Surg* 2005 Jun 17;5:14.
7. Soliman A, Muller W, Ebner S, Sciniciz G. Routine intra-operative cholangiography for safe laparoscopic cholecystectomy and single stage laparoscopic choledocholithotomy. *The Internet Journal of Surgery* 2008; 17(1):1–9.
8. Atahan K, Gur S, Durak E, Cokmez A, Tarcan E. The feasibility and safety of laparoscopic cholecystectomy approach without the intraoperative cholangiography use: A retrospective study on 750 consecutive patients. *Gastroenterology Res* 2012 Aug;5(4):144–48.
9. Livingston EH. Intraoperative cholangiography and risk of common bile duct injury. *JAMA* 2003 Jul 23;290(4):459; author reply 459–60.
10. Way LW, Stewart L, Gantert W, et al. Causes and prevention of laparoscopic bile duct injuries: Analysis of 252 cases from a human factors and cognitive psychology perspective. *Ann Surg* 2003 Apr;237(4):460–9.

\*\*\*\*\*

## Author Contributions

Ahmed Mohamed Abdelaziz Hassan – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Mohamed Emad Esmat – Substantial contributions to conception and design, Analysis and interpretation of data, Revising the article critically for important intellectual content, Final approval of the version to be published

Hussam Hamdy – Substantial contributions to conception and design, Analysis and interpretation of data, Revising the article critically for important intellectual content, Final approval of the version to be published

Mohamed Abdo – Substantial contributions to conception and design, Analysis and interpretation of data, Revising the article critically for important intellectual content, Final approval of the version to be published

Magdy Elsebae – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article and revising it critically for important intellectual content, Final approval of the version to be published

## Guarantor of Submission

The corresponding author is the guarantor of submission.

## Source of Support

None.

## Consent Statement

Written informed consent was obtained from the patient for publication of this study.

## Conflict of Interest

Authors declare no conflict of interest.

## Data Availability

All relevant data are within the paper and its Supporting Information files.

## Copyright

© 2018 Ahmed Mohamed Abdelaziz Hassan et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

Access full text article on  
other devices



Access PDF of article on  
other devices





INTERNATIONAL JOURNAL OF  
CASE REPORTS AND IMAGES



VIDEO JOURNAL OF  
CLINICAL RESEARCH



VIDEO JOURNAL OF  
BIOMEDICAL SCIENCE



INTERNATIONAL JOURNAL OF  
HEPATOBIILIARY AND  
PANCREATIC DISEASES



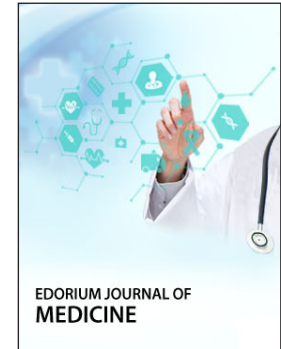
INTERNATIONAL JOURNAL OF  
BLOOD TRANSFUSION AND  
IMMUNOHEMATOLOGY



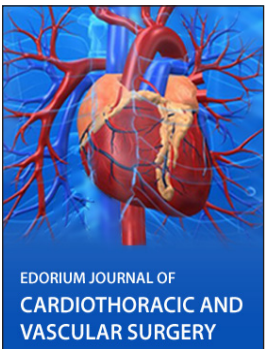
EDORIUM JOURNAL OF  
OPHTHALMOLOGY



**Submit your manuscripts at**  
[www.edoriumjournals.com](http://www.edoriumjournals.com)



EDORIUM JOURNAL OF  
MEDICINE



EDORIUM JOURNAL OF  
CARDIOTHORACIC AND  
VASCULAR SURGERY



JOURNAL OF CASE REPORTS  
AND IMAGES IN ORTHOPEDICS  
AND RHEUMATOLOGY



EDORIUM JOURNAL OF  
PSYCHOLOGY



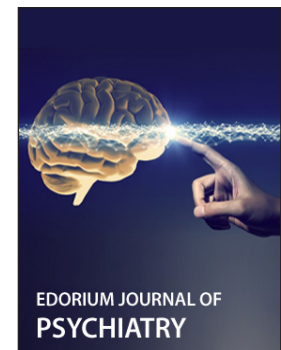
EDORIUM JOURNAL OF  
CELL BIOLOGY



JOURNAL OF CASE REPORTS AND IMAGES IN  
DENTISTRY



EDORIUM JOURNAL OF  
CANCER



EDORIUM JOURNAL OF  
PSYCHIATRY



JOURNAL OF CASE REPORTS AND  
IMAGES IN INFECTIOUS DISEASES



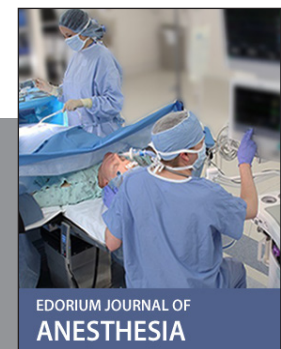
EDORIUM JOURNAL OF  
ANATOMY AND EMBRYOLOGY



EDORIUM JOURNAL OF  
SURGERY



JOURNAL OF CASE REPORTS  
AND IMAGES IN PATHOLOGY



EDORIUM JOURNAL OF  
ANESTHESIA