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Migration of the Plastic Clips of the Cystic Ducts to the Bile Duct Post-Laparoscopic Cholecystectomy: A Case Report

Peter Ian Limas[1*], Barlian Sutedja[2]

[1]Department of Surgery, Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

[2]Gading Pluit Hospital, Jakarta, Indonesia

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***Corresponding author:**
Peter Ian Limas

E-mail address:
peterl@fk.untar.ac.id

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A B S T R A C T

Introduction: Migration of the cystic duct clip into the common bile duct is a rare but significant complication following laparoscopic cholecystectomy. This condition can cause biliary obstruction, cholangitis, and gallstone formation. **Case presentation:** A 60-year-old man presented with symptoms of cholangitis. His medical history included laparoscopic cholecystectomy with choledochoscopy and intraoperative cholangiography. MRCP showed stones and sludge in the common bile duct (CBD), but did not identify a migrated clip. Endoscopic retrograde cholangiopancreatography (ERCP) successfully extracted the migrated clip causing the obstruction. **Conclusion:** Migration of the clip into the common bile duct should be considered in the differential diagnosis of biliary obstruction following laparoscopic cholecystectomy. Early identification through careful imaging and ERCP can facilitate appropriate management and prevent further complications.

1. Introduction

Laparoscopic cholecystectomy has become a standard procedure in the treatment of gallbladder disease, especially cholelithiasis. This procedure offers various advantages over open cholecystectomy, including less postoperative pain, quicker recovery, and better cosmetic results. However, like other surgical procedures, laparoscopic cholecystectomy is not free from the risk of complications. One rare but significant complication is the migration of the cystic duct clip into the bile duct. Migration of the cystic duct clip into the common bile duct is a relatively rare complication, with a reported incidence ranging from 0.1% to 0.3% of all laparoscopic cholecystectomies. Although rare, this complication can cause significant morbidity and require further intervention.[1,2]

Improper clip placement or inadequate use of the clip may increase the risk of migration. For example, a clip that is placed too close to the bile duct or a clip that does not completely cover the cystic duct can become dislodged and migrate. Chronic inflammation and fibrosis around the cystic duct can weaken the tissue and increase the risk of clip migration. This condition often occurs in patients with chronic cholelithiasis or choledocholithiasis. Some types of clips may be more susceptible to migration than others. Metal clips, for example, have been reported to have higher migration rates than absorbable clips. Some patient factors, such as obesity, diabetes mellitus, and advanced age, may also increase the risk of clip migration.[3,4]

After laparoscopic cholecystectomy, a clip is placed in the cystic duct to prevent bile leakage. However, in some cases, the clip can detach from the cystic duct and migrate to the bile duct. This migration can occur immediately after surgery or several months to years later. Once in the bile duct, the clip can cause a variety of problems. The clip can block the bile duct, causing biliary obstruction and cholangitis. Biliary obstruction can cause abdominal pain, jaundice, and fever. Cholangitis is a bacterial infection of the bile ducts that can be life-threatening if not treated quickly. Additionally, migrating clips may act as a nidus for gallstone formation. Gallstones can cause biliary colic pain, biliary obstruction, and pancreatitis.[4,5]

Symptoms of migration of the cystic duct clip into the common bile duct can vary, depending on the degree of obstruction and the presence of complications. In some patients, clip migration may be asymptomatic and only detected incidentally on imaging examination. The pain is usually located in the right upper quadrant of the abdomen and can be colicky or persistent. Jaundice is a yellow discoloration of the skin and eyes caused by increased levels of bilirubin in the blood. Fever can occur due to cholangitis, which is a bacterial infection of the bile ducts. Nausea and vomiting is a symptom that often accompanies abdominal pain and jaundice. The diagnosis of migration of the cystic duct clip to the common bile duct requires a high degree of clinical suspicion and confirmation by imaging. Ultrasound may show dilation of the bile ducts and the presence of clips within the bile ducts. However, ultrasound may not always be able to visualize the clip clearly. Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive modality that can provide detailed images of the biliary and pancreatic ducts. MRCP can identify migrating clips with high accuracy. Endoscopic retrograde cholangiopancreatography (ERCP) is an invasive procedure that allows direct visualization of the bile and pancreatic ducts. ERCP can also be used to remove migrated clips. Management of cystic duct clip migration into the common bile duct usually involves endoscopic removal of the clip via ERCP. This procedure is usually successful and has a low complication rate. In some cases, surgery may be necessary if ERCP is unsuccessful or if the patient experiences serious complications such as bile duct perforation.[5,6]

2. Case Presentation

A 60-year-old man, with a history of laparoscopic cholecystectomy two years previously, came to the emergency department (ER) of a hospital in Jakarta, Indonesia with the main complaint of intermittent right upper abdominal pain, fever, and jaundice that had lasted for three days. Abdominal pain is described as a dull, throbbing discomfort that radiates to the back and worsens after eating fatty foods. The patient also reported experiencing nausea and vomiting for the past two days, as well as decreased appetite. In addition, patients complain that the color of their urine becomes darker and their stools become pale. The patient had a history of laparoscopic cholecystectomy two years previously at the same hospital due to symptomatic cholelithiasis. The surgical procedure went smoothly with no complications reported at that time. The patient also had a history of hypertension that was well-controlled with antihypertensive therapy. There was no history of chronic liver disease, diabetes mellitus, or bleeding disorders. There was no family history of liver disease, gallstones, or other gastrointestinal disorders.

On physical examination, the patient appeared to be slightly sick, with a body temperature of 38.5°C, blood pressure of 140/90 mmHg, pulse of 96 beats per minute, and respiratory rate of 20 breaths per minute. The sclera appeared icteric, and there was tenderness in the right upper quadrant of the abdomen without signs of peritonitis. Other physical examinations did not reveal any significant abnormalities. Laboratory tests showed elevated levels of total bilirubin (5.2 mg/dL), direct bilirubin (3.8 mg/dL), alkaline phosphatase (280 U/L), aspartate aminotransferase (120 U/L), and alanine aminotransferase (95 U/L). Leukocytosis was also found, with a white blood cell count of 12,000/μL. Magnetic resonance imaging

(MRI) of the abdomen with MRCP was performed to evaluate the bile ducts. MRCP showed dilatation of the intrahepatic bile ducts and common bile duct (CBD), with the presence of stones and sludge in the distal CBD. However, no metal clips were identified on the MRCP.

Based on the anamnesis, physical examination, and supporting examinations results, the initial diagnosis of acute cholangitis is established. Biliary obstruction is thought to be the cause of cholangitis, but the cause of the obstruction cannot be ascertained. The patient was hospitalized and given intravenous antibiotic therapy to treat cholangitis. After the patient's condition is stable, ERCP is performed to evaluate and treat biliary obstruction. During ERCP, multiple choledocholithiasis was confirmed, with the largest stone measuring 1 cm in diameter. Additionally, a metal clip was identified in the distal CBD, just above the ampulla of Vateri. The clip was thought to be the clip used to secure the cystic duct during a previous laparoscopic cholecystectomy. The metal clip was successfully extracted using a Dormia basket, followed by sphincterotomy and gallstone extraction. The ERCP procedure went smoothly without complications (Figure 1a-e). The patient was transferred to the inpatient room for further observation and monitoring. After ERCP, the patient's symptoms improved significantly. Abdominal pain, fever, and jaundice are reduced. Laboratory tests showed decreased levels of bilirubin, alkaline phosphatase, and aminotransferase. The patient was discharged after three days of hospitalization with instructions to continue oral antibiotic therapy for seven days. The patient underwent a control examination two weeks after discharge. At that time, the patient had no complaints and physical examination showed no abnormalities. Laboratory tests showed normalization of liver function parameters.

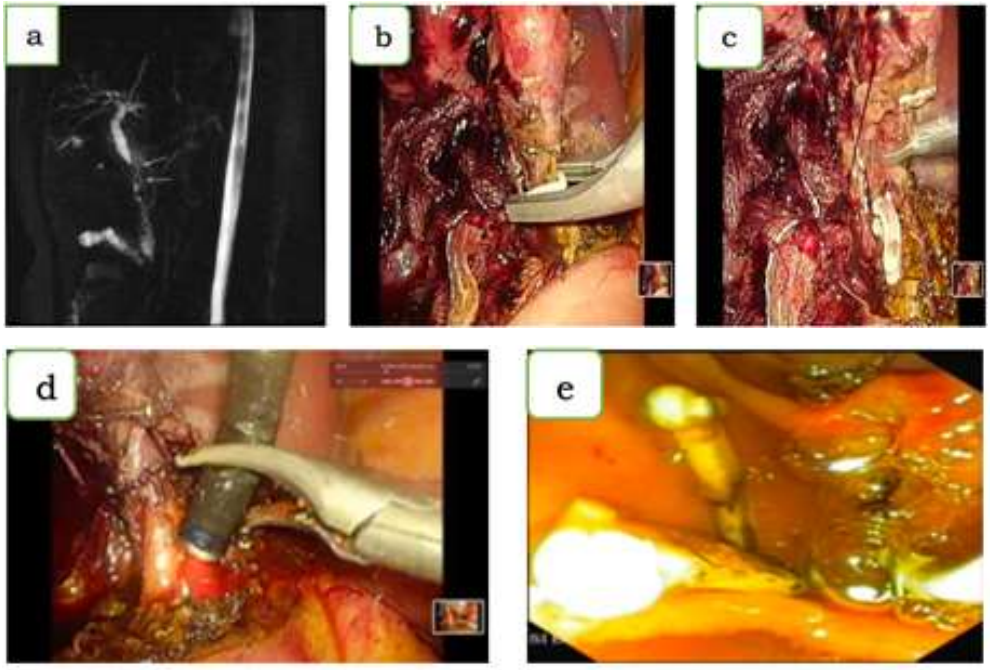

Figure 1. ERCP procedure; (a) Arrows showing ‘stones’ on MRCP; (b) Application of plastic clip during cholecystectomy; (c) Final position of two cystic duct clips; (d) Choledochoscopy to verify bile duct clearance; (e) Two cystic clips in the duodenum after extraction from the common bile duct.

3. Discussion

Migration of the cystic duct clip into the common bile duct is a rare but potentially serious complication following laparoscopic cholecystectomy. This incidence is estimated to occur in 0.08% to 0.3% of all laparoscopic cholecystectomy. Understanding the pathophysiology of clip migration is critical to identifying risk factors and developing effective prevention strategies. Migration of the cystic duct clip into the common bile duct following laparoscopic cholecystectomy is a rare complication but has significant clinical consequences. This condition can trigger biliary obstruction, cholangitis, gallstone formation, and even acute pancreatitis. Deeply understanding the pathophysiological mechanisms underlying clip migration is crucial for identifying risk factors, developing effective prevention strategies, and improving patient clinical outcomes.[7,8]

Technical errors during laparoscopic cholecystectomy procedures are one of the main factors contributing to clip migration. Improper placement of the clip in the cystic duct is the most frequently reported cause. Ideally, the clip should be placed proximal to the cystic duct, as close as possible to the junction with the common bile duct. Too distal placement of the clip may leave a portion of the cystic duct unprotected, making it susceptible to erosion and clip migration. Using clips that are not the correct size can also increase the risk of migration. A clip that is too small may not completely close the cystic duct, while a clip that is too large can damage the surrounding tissue and trigger an inflammatory reaction that accelerates erosion. Therefore, selecting the appropriate clip size based on the diameter of the cystic duct is very important. Failure to close the clip properly can also lead to migration. Clips that are not tightly closed may dislodge from the cystic duct due to intraluminal pressure or peristaltic movements. Therefore, the surgeon must ensure that the clip is completely closed and that no gaps are left. Clip quality is another important factor influencing migration risk. Clips made from materials that degrade easily or have weak locking mechanisms are more susceptible to failure and dislodging from the cystic duct. Several studies have reported that titanium clips have a lower migration rate compared to clips made from other materials, such as stainless steel or absorbable. Additionally, the clip design can also influence the risk of migration. Clips with an ergonomic design and strong locking mechanism can provide better security and reduce the chance of dislodging. Therefore, the selection of high-quality clips with optimal design is highly recommended.[9,10]

Erosion of tissue around the clip is another pathophysiological mechanism that can cause migration. This process can be triggered by several factors, including: Normal post-operative inflammatory reactions that can cause tissue damage around the clip and weaken its attachment. Infection in the bile duct can accelerate tissue erosion and increase the risk of clip migration. Some patients can experience a foreign body reaction to the clip, which can trigger chronic inflammation and tissue erosion. Over time, tissue erosion can cause the clip to detach from the cystic duct and migrate into the bile duct. This process can be accelerated by intraluminal pressure and peristaltic movements. Apart from the factors mentioned above, several other risk factors can also increase the likelihood of clip migration, including: Elderly patients tend to have tissue that is weaker and prone to erosion; Obesity can increase intra-abdominal pressure and increase the risk of clip migration; Diabetes mellitus can impair wound healing and increase the risk of infection, both of which can accelerate tissue erosion; Patients with a history of previous bile duct surgery may have scar tissue which may increase the risk of clip migration.[11,12]

Symptoms of cystic duct clip migration to the bile duct vary greatly, ranging from asymptomatic to severe, life-threatening symptoms. Migrating clips can become lodged in various parts of the bile duct, including the cystic duct, hepatic duct, or common bile duct. The location of the clip may affect the type and severity of symptoms. For example, a clip that gets stuck in the cystic duct may not cause significant

symptoms, whereas a clip that blocks the common bile duct can cause complete biliary obstruction and more severe symptoms. The size of the clip also plays an important role in determining symptoms. Smaller clips may not cause significant obstruction and may remain asymptomatic. Conversely, larger clips can cause partial or total obstruction, resulting in symptoms such as abdominal pain, jaundice, and cholangitis. Biliary obstruction is the main complication of clip migration. The degree of obstruction can vary from mild to severe, depending on the location and size of the clip. Biliary obstruction can cause a variety of symptoms, including Pain is usually located in the right upper quadrant of the abdomen and can be colicky or persistent. This pain is caused by increased pressure in the bile duct due to obstruction; Jaundice is a yellow discoloration of the skin and eyes caused by increased levels of bilirubin in the blood. Bilirubin is a yellow pigment formed from the breakdown of red blood cells. Biliary obstruction prevents bilirubin from being excreted into the intestines, so it accumulates in the blood and causes icterus; Fever can occur due to bacterial infection of the bile ducts (cholangitis). Cholangitis is a serious complication of clip migration that requires immediate treatment; Cholangitis is a bacterial infection of the bile ducts that can cause symptoms such as fever, chills, abdominal pain, jaundice, and changes in mental status. Cholangitis can progress to sepsis, a life-threatening condition.[13,14]

Diagnosis of clip migration is often challenging because symptoms are nonspecific and overlap with other conditions. A history of laparoscopic cholecystectomy and symptoms consistent with biliary obstruction should raise clinical suspicion for clip migration. Physical examination may reveal tenderness in the right upper quadrant of the abdomen, jaundice, and fever. Laboratory tests may show elevated levels of total bilirubin, direct bilirubin, alkaline phosphatase, and aminotransferase. Imaging plays an important role in the diagnosis of clip migration. Ultrasonography is the initial imaging modality that can detect bile duct dilation, which is a sign of biliary obstruction. However, ultrasound may not be able to visualize the clip itself. CT scans can provide more detailed information about the bile ducts and surrounding organs. A CT scan can help identify the cause of biliary obstruction, including a migrated clip. MRCP is a non-invasive imaging technique that uses MRI to visualize the bile ducts. MRCP can provide a clear view of the bile ducts and can help identify migrating clips. ERCP is an invasive procedure that uses an endoscope and fluoroscopy to visualize the bile ducts. ERCP can not only diagnose clip migration, but can also be used to remove the clip. ERCP is the gold standard for diagnosis and therapy of clip migration. During ERCP, an endoscope is inserted through the mouth, esophagus, stomach, and duodenum into the bile duct. Fluoroscopy is used to guide endoscopes and other instruments. ERCP allows direct visualization of the migrating clip and assessment of the extent of biliary obstruction. Additionally, ERCP can be used to elevate clips using a variety of techniques, such as Dormia baskets, balloons, or snares. In some cases, mechanical or laser lithotripsy may be necessary to break up the clip before extraction. Although ERCP is a powerful tool, diagnosis of clip migration remains challenging in some cases. Small clips may be difficult to visualize on imaging, especially if there are stones or mud in the bile duct. Additionally, the symptoms of clip migration can resemble other conditions, such as choledocholithiasis or biliary stricture. Therefore, it is important to have a high clinical suspicion of clip migration in patients with a history of laparoscopic cholecystectomy and symptoms of biliary obstruction. If clip migration is suspected, ERCP should be considered for definitive diagnosis and therapy. Migration of the cystic duct clip into the common bile duct is a rare but potentially serious complication of laparoscopic cholecystectomy. Symptoms of clip migration can vary, depending on the location and size of the clip, as well as the presence or absence of biliary obstruction. Diagnosis of clip migration is often difficult and requires a high degree of clinical suspicion, as well as careful imaging. ERCP is the gold

standard for the diagnosis and therapy of clip migration.[15,16]

Migration of the cystic duct clip into the bile duct is a complication after laparoscopic cholecystectomy that requires careful and individualized management. The appropriate management strategy depends on several key factors, including the location and size of the clip, the presence or absence of symptoms, and any complications that may arise. The first step in the management of clip migration is a thorough evaluation of the patient. This includes a detailed history to identify symptoms that may be associated with clip migration, such as abdominal pain, jaundice, fever, and discoloration of urine or stool. A physical examination is performed to assess signs of biliary obstruction, such as tenderness in the right upper quadrant of the abdomen, hepatomegaly, and jaundice. Laboratory tests, including liver function tests and inflammatory markers, help determine the severity of biliary obstruction and the presence of infection. Diagnostic imaging, such as ultrasonography, CT scan, MRCP, and ERCP, is essential to confirm the diagnosis of clip migration, determine the location and size of the clip, and evaluate the extent of biliary obstruction. Based on the results of the initial evaluation, management strategies can be determined. In asymptomatic patients with small clips that are not causing obstruction, observation may be an appropriate option. However, in patients with symptoms or biliary obstruction, active intervention is necessary to remove the clip and resolve any complications that may arise. ERCP is the primary modality in the diagnosis and treatment of cystic duct clip migration. This procedure allows direct visualization of the bile duct and identification of the migrated clip. In addition, ERCP provides direct access to the bile ducts to perform various therapeutic procedures, including clip extraction. During ERCP, the endoscope is inserted through the mouth, past the esophagus and stomach, until it reaches the duodenum. Next, a small catheter is inserted through the endoscope into the bile duct. Radiopaque contrast is injected through the catheter to visualize the bile ducts on fluoroscopy. Once the clip is identified, various instruments can be used to extract it.[16,17]

The Dormia basket is an instrument in the form of a small wire basket that can be opened and closed. This basket is inserted through the endoscope and guided onto the clip. Once the clip is in the basket, the basket is closed and pulled out along with the clip. An extraction balloon is a small balloon that can be inflated and deflated. This balloon is inserted through the endoscope and guided onto the clip. Once the clip is near the balloon, the balloon is inflated to clamp the clip, then pulled out along with the clip. A snare is a wire snare-shaped instrument that can be used to catch clips. The snare is inserted through the endoscope and guided into the clip. Once the snare is wrapped around the clip, the snare is pulled to clamp the clip and pull it out. In some cases, the clip may be difficult to extract directly due to its large size or difficult to reach position. In this situation, mechanical or laser lithotripsy can be used to break the clip into smaller fragments, making extraction easier.[17,18]

Although ERCP is the primary modality for clip migration management, there are some situations where ERCP may fail or may not be possible. In such cases, surgery may be necessary to remove the clip. If the clip cannot be extracted via ERCP due to its large size, difficult to reach position, or complications during the procedure. In patients with abnormal bile duct anatomy, uncontrolled coagulation disorders, or allergy to radiopaque contrast. Some patients or surgeons may prefer surgery to ERCP for various reasons, such as previous experience or personal preference. Surgery can be performed laparoscopically or open, depending on the surgeon's preference, the patient's condition, and the complexity of the case. Laparoscopic surgery has several advantages over open surgery, such as less postoperative pain, quicker recovery, and better cosmetic results. However, open surgery may be necessary in complex cases or if complications occur during laparoscopic surgery.[18,19]

Cystic duct clip migration can cause a variety of complications, including biliary obstruction, cholangitis, pancreatitis, bile duct perforation, and gallstone formation. Management of these complications requires an individualized and multidisciplinary approach. Biliary obstruction can be treated with ERCP or surgery to remove the clip and restore bile flow. If the obstruction causes cholangitis, intravenous antibiotics are needed to treat the infection. Pancreatitis may result from obstruction of the pancreatic duct by the clip. Treatment includes fasting, intravenous fluids, and pain management. In severe cases, ERCP or surgery may be necessary to remove the clip and resolve the obstruction. Bile duct perforation is a serious complication that requires immediate treatment. ERCP may be used to place a biliary stent to close the perforation and facilitate healing. In severe cases, surgery may be necessary to repair the perforation. Gallstones can form as a result of bile stasis caused by clip migration. ERCP can be used to remove gallstones. In severe cases, cholecystectomy may be necessary. Management of cystic duct clip migration to the common bile duct requires an individualized and multidisciplinary approach. ERCP is the primary modality for diagnosis and therapy, with a variety of clip extraction techniques available. Surgery may be an alternative if ERCP fails or is not possible. Handling complications that may arise is very important to prevent morbidity and mortality. Prevention of clip migration begins with careful surgical technique during laparoscopic cholecystectomy. Proper clip use, correct placement, and secure closure are essential. The use of absorbable clips or clips with a polymer coating can reduce the risk of migration. In addition, the use of monopolar or bipolar energy to divide the cystic duct can reduce the need for clips and thereby reduce the risk of migration.[19,20]

The case we report shows several important aspects regarding clip migration. First, clip migration can occur even after apparently successful laparoscopic cholecystectomy, as demonstrated by normal intraoperative choledochoscopy and cholangiography in our patient. Second, clip migration can cause biliary obstruction and cholangitis, even several years after surgery. Third, diagnosis of clip migration can be difficult and requires a high degree of clinical suspicion, as well as careful imaging. In our case, MRCP failed to identify the migrated clip, possibly due to the small size of the clip or artifacts from stones and mud in the bile duct. ERCP was essential for the diagnosis and therapy of clip migration in our patient. This procedure allows direct visualization of the clip and safe and effective extraction. Migration of the cystic duct clip into the common bile duct is a rare but significant complication of laparoscopic cholecystectomy. This condition can cause biliary obstruction, cholangitis, and gallstone formation. Early diagnosis and appropriate management are essential to prevent further complications. Surgeons must be careful in placing clips during laparoscopic cholecystectomy to minimize the risk of migration. The use of high-quality clips and proper closing techniques are also important. In patients with symptoms of biliary obstruction after laparoscopic cholecystectomy, clip migration should be considered in the differential diagnosis. Imaging, such as MRCP and ERCP, is critical for identifying migrating clips and planning appropriate management. Prevention of clip migration begins with careful surgical technique. Proper clip use, correct placement, and secure closure are essential. The use of absorbable clips or clips with a polymer coating can reduce the risk of migration. In addition, the use of monopolar or bipolar energy to divide the cystic duct can reduce the need for clips and thereby reduce the risk of migration.[17,19]

4. Conclusion

Migration of the cystic duct clip into the common bile duct is a rare but potentially serious complication of laparoscopic cholecystectomy. Early diagnosis and appropriate management are essential to prevent further complications. ERCP remains the primary modality for the diagnosis and therapy of clip migration.

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