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## RESEARCH ARTICLE

# STUDY OF POST CHOLECYSTECTOMY BILIARY LEAKAGE AND ITS MANAGEMENT

***Dr. Deepak Kumar, Dr. Aftab Ahmed and Dr. Rajesh Kumar**

Department of Surgery, Rajendra Institute of Medical Sciences, Ranchi, India

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**ABSTRACT**

The biliary tract is a complex organ system that performs the simple though vital task of collecting, storing, and delivering bile to the gastrointestinal tract. Diseases of the biliary tract can be extremely painful, debilitating, and occasionally life threatening. the complex development of the liver and biliary system in utero can result in multiple anatomic variations. An absolute knowledge of these anatomic variations with careful dissection and identification of structures at the time of surgery is a minimal requirement for the safe performance of any hepatobiliary operation. Because of the unforgiving nature of the biliary system, errors in technique or judgment can be disastrous to the patient, resulting in lifelong disability or death. For this reason, a high premium exists on performing the correct procedure, without technical misadventure, the first time. Equally important is the ability to recognize iatrogenic injury so that prompt repair or referral to a surgeon who has expertise in hepatobiliary surgery can be instituted. Positive outcome requires a balance between sound judgement, technical acumen, and attention to detail. Additionally, the surgeon of today must be able to integrate surgical options with the broadening array of radiologic and endoscopic treatment options available in the management of patients who have these disorders. Also because of the great frequency with which the operation is performed, cholecystectomy remains the greatest source of post-operative biliary injuries. In a review of more than 42,000 open cholecystectomies performed in the United Statess in 1989, the incidence of incidence of biliary injuries was documented to be 0.2%. Strasberg and associates reported a 0.3% incidence of injuries in a literature review of more than 25,000 open cholecystectomies since 1980. The advent and preference for laparoscopic cholecystectomy has refocused attention on this issue, however because of the significant increase in the number of injuries. Several studies worldwide have documented a marked increase in the frequency of bile duct injuries associated with the laparoscopic approach, ranging from 0.4% to 1.3%. Also in a review of nearly 125,000 laparoscopic cholecystectomies reported in the literature in the years 1991-1993, Strasbeg and colleagues reported an overall incidence of biliary injuries of 0.85%.



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## INTRODUCTION

The biliary tract is a complex organ system that performs the simple though vital task of collecting, storing, and delivering bile to the gastrointestinal tract. Diseases of the biliary tract can be extremely painful, debilitating, and occasionally life threatening. the complex development of the liver and biliary system in utero can result in multiple anatomic variations. An absolute knowledge of these anatomic variations with careful dissection and identification of structures at the time of surgery is a minimal requirement for the safe performance of any hepatobiliary operation. Because of the unforgiving nature of the biliary system, errors in technique or judgment can be disastrous to the patient, resulting in lifelong disability or death. For this reason, a high premium exists on performing the correct procedure, without technical misadventure, the first time. Equally important is the ability to recognize iatrogenic injury so that prompt repair or referral to a surgeon who has expertise in hepatobiliary surgery can be instituted. Positive outcome requires a balance between sound judgement, technical acumen, and attention to detail. Additionally, the surgeon of today must be able to integrate surgical options with the broadening array of radiologic and endoscopic treatment options available in the management of patients who have these disorders. Also because of the great frequency with which the operation is performed, cholecystectomy remains the greatest source of post-operative biliary injuries. In a review of more than 42,000 open cholecystectomies performed in the United Statess in 1989, the incidence of incidence of biliary injuries was documented to be 0.2%. Strasberg and associates reported a 0.3% incidence of injuries in a literature review of more than 25,000 open cholecystectomies since 1980. The advent and preference for laparoscopic cholecystectomy has refocused attention on this issue, however because of the significant increase in the number of injuries. Several studies worldwide have documented a marked increase in the frequency of bile duct injuries associated with the laparoscopic approach, ranging from 0.4% to 1.3%. Also in a review of nearly 125,000 laparoscopic cholecystectomies reported in the literature in the years 1991-1993, Strasbeg and colleagues reported an overall incidence of biliary injuries of 0.85%.

****Corresponding author: Dr. Deepak Kumar,***
Department of Surgery, Rajendra Institute of Medical Sciences, Ranchi, India

**Aims and Objectives**

1. To study the incidence of biliary leak following cholecystectomy.
2. To study the risk factor for bile leak after cholecystectomy.
3. To study the morbidity and mortality rates after biliary leak.
4. To study various aspects of management after biliary leak.

## Review of Literature

**Historical review**

Gallstone disease, caused by genetic predisposition, dietary habits and environmental conditions has occurred throughout human history. The earliest known gallstone dates back to ancient Egypt, discovered in the mummy of a priestess of Amen (1085-945 BC) and unfortunately destroyed during the bombing of London during World War II. The Greek physician Alexander Trallianus (525-605) was the first to describe "calculus" within the biliary ducts. With the revival of human dissection during the 15th and 16th century, gallstones anti their clinical consequences were described. In 1546, Marcellus Donatus of Mantua, Italy, published a thesis on biliary tract pathology with descriptions of stones expulosed from the gastrointestinal tract through vornits and stool. In 1676 Joenisius removed gallstones from a spontaneous biliary fistula thereby describing the first cholecystolithotomy. The first steps of surgically addressing gallstones were taken by John S. Bobbs, Professor of Surgery at the Medical College of Indiana, USA. On June 15, 1867 he performed the first cholecystostomy in a patient operated for what he though might be an ovarian cyst. He opened the gallbaldder and removed around 50 gallstones. The patient had an uneventful recovery and a dramatic relief of pain, Carl Langenbuch was credited to have performed the first surgical removal of the gallbladder, a cholecystectomy, in 1882. Believing that stones can reform and thus the bladder had to be removed, he adopted the technique that essenjtially has beeen the treatment of choice to this day. During the following decades, steps were taken to improve diagnosis and treatment of gallstone related complications. The novel technique of radiology discovered by Wilhelm Conrad Rontgen (1845-1923) enabled radiological contrast-enhanced studies of the gallbladder. Cholangiography was first attempted via the gallbladder in 1921 but due to frequent bile leakage not clinically feasible until the development of the transhepatic route, in 1952. Intraoperative cholangiography (IOC) during cholecystectomy, a radiologic constrast-based examination of the bile duct was first described in 1937 by Mirizzi, to help delineate the anatomy of the biliary tree in case of advanced biliary disease. During the cholecystectomy, a radiologic contrast-based examination of the bile duct was first described in 1937 by Mirizzi, to help delineate the anatomy of the biliary tree in case of advanced biliary disease. During the second part of the 20th century, the cholecystectomy became a routine proceudure performed in millions of patients all over the world. Even though methods for minimal invasive cholecystectomies were developed during the 1980s, such as mini-laparotomy, with a very small subcostal incision, few could predict the dramatic paradigm shift with tghe introduction of the laparoscopic cholecystectomy. Prior to 1990, the only field in medicine routinely using laparoscopy was gynaecology.

**Bile duct injury at cholecystectomy**

Chyolecystectomy remains the greatest source of postoperative biliary injuries. Open cholecystectomy has long been associated with a modest incidence of biliary injuries when compared to laparoscopic cholecystectomy. There are several reaons that the bile duct is at increased risk of injury during laparoscopic cholecystectomy compared with open cholecystectomy. It has long been argued that surgeon inexperience is a major culprit, and that with increased familiarity with the procedure, the number of injuries will decrease : the so-called `learning curve effect'.

**Pathogenesis**

There are several factors associated with an increased risk of bile duct injury at cholecystectomy, some of which are general and some unique tothe laparoscopic approach. Ultimately, however, the final common pathway of most injuries is either a technical error or misinterpretation of the anatomy.

**Misinterpretation of the anatomy such as**

I. Misidentification of the bile ducts as the cystic duct.
II. Misidentification of the common bile duct as the cystic duct.
III. Misidentification of an aberrant right sectoral hepatic duct as the cystic duct.

**Technical causes**

1. Failure to occulde securely the cystic duct.
2. Plane of dissection away from gallbladder wall into the liver bed.
3. Injudicious use of electrocautery for dissection or bleeding control.
4. Excessive traction on cystic duct with tenting upwards of common hepatic duct.
5. Injudicious use of clips to control bleeding.
6. Improper techniques of ductal exploration.

**Anatomical variations**

Anomalies of the cystic duct insertion into the common hepatic duct are seen most commonly. (Balija *et al*., 1999; Hermann, 1979)

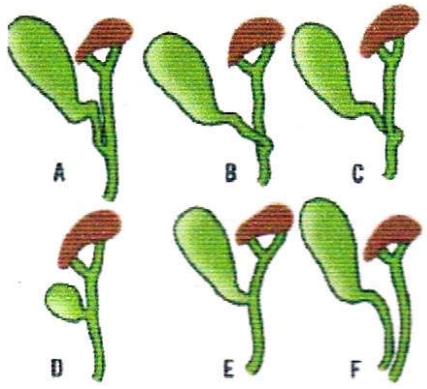



**Fig.1. Anatomical variations**

The cystic duct joints the hepatic duct at an angle of about 40$^{o}$ in 64-75% of individuals (Fig. 1A). In 17-23%, the cystic duct parallels the hepatic duct for a longer or shorter distance and

may even enter the doodenum separately. This is called "absence" of the common bile duct, and is shown in Fig. 1F. In 8-13, the cystic duct may pass inferior toor superior to the common hepatic duct to enter the latter on the left side as shown in Figs. 1B, C. In the parallel type of junction, the common duct is at risk from the surgeon attempting to ligate the cystic duct. If the long parallel portion of the cystic duct is left in place, cystic duct remnant syndrome with various sequelae may result. Less frequently, the gallbladder is sessile with little or no cystic duct (Figs, 1D, E)

**Laparoscopic specific**

Several technical factors, specific to laparosopic cholecystectomy, predispose to biliary injury. Mistaking the common duct for the cystic duct is a freequent techynical error. In the most common sequence of events that follows, a long length of the common duct is excised up to the poximal common hepatic duct, which is either occulded or left to drain bile into the peritoneal cavity. This devastating injury, referred to as the `classic' laparoscopic injury and rarely seen at open cholecystectomy (Adamsen *et al*., 1997; Chow *et al*., 1997), may also be associated with damage to the right hepatic artery. Less severe injuries may also occur, such as lacertaions of the duct wall or near complete transections. Proper exposure is essential to avoid injuries arising from such anatomical misinsterpretations. Maximum cephalad traction on the gallbaldder fundus is necessary to expose the cystic duct and Calot's triangle. The dissection should be maintained close to the gallbaldder wall, and the cystic duct should be divided as close as possible to its junction with the gallbladder (Courtney *et al*., 2012). Bile leakage occurs with greater frequency after laparoscopic cholecystectomy than after open cholecystectomy, which may be related to the use of clips rather than ties (Kasper *et al*., 2004). Clips are less secure than sutures and may become dislodged if improperly placed of if manipulated after placement. Also, incomplete occulsion may occur if clips are placed across a thickened, rigid cystic duct or a cystic duct containing stones or if other tissues are included. When placing clips, it is important that the tips met in order to ensure adequate occulsion. Also, using electrocautery in areas adjacent to clips should be avoided as this may result in condiitons of thermal energy to the adjacent common duct and delayed biliary structure. Other introperative factors that may contribute to bile duct injury include dissection too deep into the liver pafrenchyma, and failure to distinguish betwen the cystic duct and the common hepatic or common bile duct. Since its introduction, laparoscopic cholecystectomy has become the gold standard treatment for gallstone disease. However, the incidence rate of bile duct injury (BDI) has risen from 0.06% to 0.3% (Davidoff *et al*., 1992). In initial studies on the removal of laparoscopic gallbladder, complications such as bleeding, wound infection, respiratory insufficiency, trocar injury to the intra-abdominal viscera, major vascular injury, and bile leaking accounted for reported morbidity rate ranging from 1.0% to 8.0% (Farquharson's Text Book Of Operative Surgery, 2014). Despite the completion of the learning curve and the recognition of preventive maneuvers to avoid ductal injury during laparoscopic cholecystectomy, the incidence rate of BDI remains unchanged. (Courtney *et al*., 2012) In addition, injuries of the bile duct system after laparoscopic cholecystectomy are more complex than that after an open approach, causing significant morbidity and even death (Anand, 2011; Davidoff *et al*., 1992; Farquharson's Text Book Of Operative Surgery, 2014)

**Classification of bile duct injury**

**Bismuth classification**

The first classification of bile duct injury is authored by H. Bismuth in 1982.The Bismuth classification is a simple classification based on the location of the injury in the biliary tract. This classification is very helpful in prognosis after repair. This classification included five types of bile duct injuries according to the distance from the hilar structure especially bile duct bifurcation, the level of injury, the involvement of bile duct bifurcation, and individual right sectoral duct. (Cuschieri *et al*., 1991) Type I involves the common bile duct and low common hepatic duct (CHD) >2 cm from the hepatic duct confluence. Type II involves the proximal CHD <2 cm from the confluence. Type IIIis hilar injury with no residual CHD confluence intact. Type IV is destruction of the confluence when the right and left hepatic ducts become separate. Type Vinvolves the aberrant right sectoral hepatic duct alone or with concomitant injury of CHD. However, the Bismuth classification does not include the wide spectrum of possible biliary injuries. (Bektas *et al*., 2007)

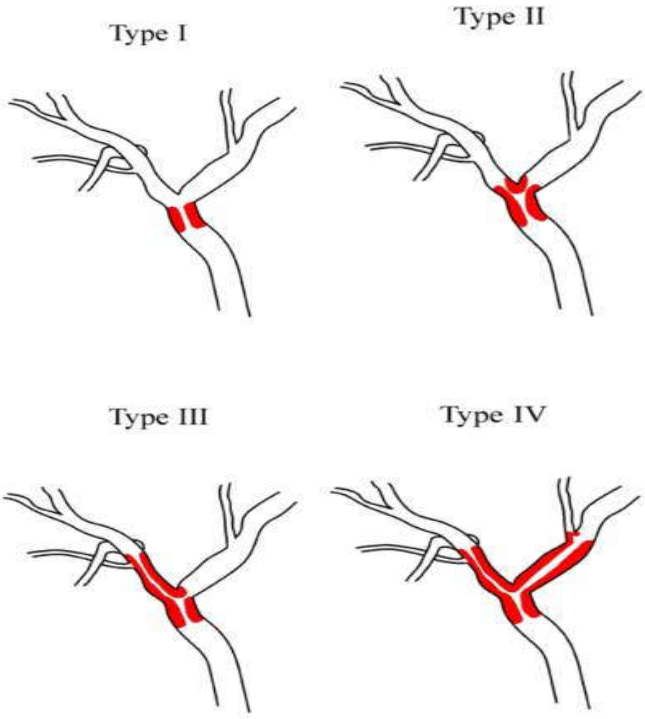



**Fig. 2. Bismuth classification**

**Strasberg classification**

Strasberg *et al* have proposed a comprehensive classification system that incorporates Bismuth's scheme but is much broader in scope. Injuries are classified as Type A to Type E, with the latter representing biliary stricutures and further subdicvided as E1 to E5 according to the Bismuth classification. Tye A injuries are bile leaks from minor ducts still in continuity with the common bile duct. This encompasses the most common causes of biliary leaks seen after laparoscopic cholecstectomy, namely leakage from the cystic duct and from a subvesical duct of Luschka. Type B injuries involve occulsion of part of the biliary tree, which for practical purpose almost always is an aberrant right sectoral hepatic duct. When this duct is transected without ligation, the

injury is termed Type C, reflecting the differences in presentation and management between the two. A lateral injury to an extrahepatic bile duct is termed type D, which is similar to Type A injuries in that the extrahepatic biliary tree remains in continuity but is classified separately to underscore the greater severity and potential need for major reconstruction.Most surgical series focus on management of Type E biliary strictures while endoscopic and radiologic reports are mainly concerned with the treatment of biliary leaks. Type A injuries may be the most common, but it would appear that many are managed successfully without referral and are thus underrepresented in reports from major centers. (Russell *et al*., 2000)

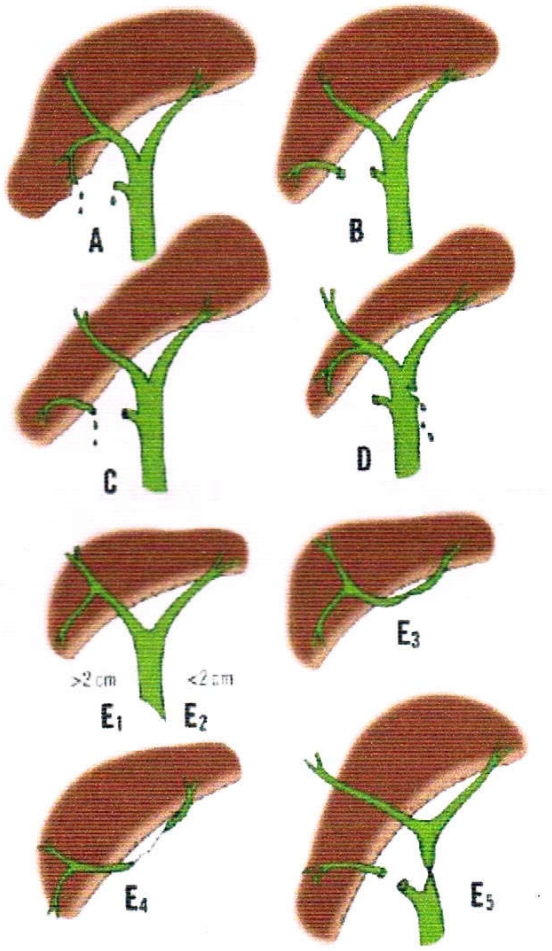



**Fig. 3. Strasberg classification(48) (A) Bile leak from cystic duct stump or minor biliary radical in gallbladder fossa. (B) Occluded right posterior sectoral duct. (C) Bile leak from divided right posterior sectoral duct. (D) Bile leak from main bile duct without major tissue loss. ($E_1$) Transected main bile duct with a stricture more than 2 cm from the hilus. ($E_2$) Transected main bile duct with a stricture less than 2 cm from the hilus. ($E_3$) Stricture of the hilus with right and left ducts in communication. ($E_4$) Stricture of the hilus with separation of right and left ducts. ($E_5$) Stricture of the main bile duct and the right posterior sectoral duct**

## Stewart way classification

Bile duct injuries fall into four classes based on the Stewart-Way classification. (Davidoff *et al*., 1992) Class I injury occurs when CBD is mistaken for the cystic duct, but the error is recognized before CBD is divided. Class II injuries involve damage to CHD from clips or cautery used too close to the duct. This often occurs in cases where visibility is limited due to inflammation or bleeding. Class III injury, the most common type, occurs when CBD is mistaken for the cystic duct. The common duct is transected and a variable portion including the junction of the cystic and common duct is excised or removed. Class IV injuries involve damage to the right hepatic duct (RHD), either because this structure is mistaken for the cystic duct, or because it is injured during dissection (Fig. 4). Both complex bileduct and vascular injuries were included in the Stewart-Way classification. (Bektas *et al*., 2007; Van Damme and Bonte, 1985)

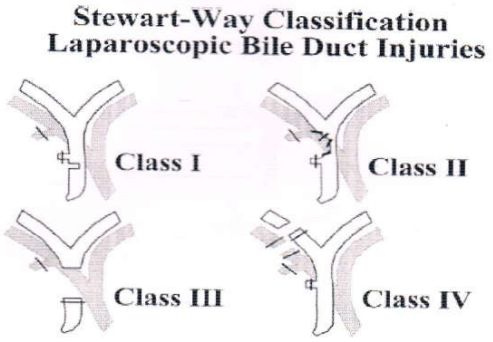



**Fig. 4. Stewart-Way Classification**

## Hannover classification

Bektas *et al*. proposed a new classification system named Hannover classification after comparing the classification of bile duct injury for consecutive 72 iatrogenic bile injuries after laparoscopic cholecystectomy. In the Hannover, bile duct injuries were divided into five types from A to E. (Deziel *et al*., 1994) Type A is peripheral bile leakage. Type B is stricture of CHD or CBD without injury. Type C is lateral CHD or CBD injury. Type D is total transection of CHD. Type E is bile duct stricture of the main bile duct without bile leakage at postoperative state. Vascular injuries are included in Type C and Type D (Fig. 5). The advantage of the Hannover classification is that it has a high level of statistical significance to demonstrate the association between the discrimination of classifiable injury patterns and the surgical treatments chosen. Other classification systems could only distinguish fewer injury patterns. Furthermore, with the Hannover classification, there were significant associations between the discrimination of specific injury patterns and the resection of liver tissue as well as resection of the bifurcation of the hepatic duct. This Hannover classification provides discriminators for the localization of tangentially or completely transected bile ducts above or below the bifurcation of the hepatic duct, which is a major drawback of other classification systems. (Bektas *et al*., 2007)

## McMahon classification

McMahon *et al*. proposed another classification of bile duct injuries after laparoscopic cholecystectomy. They classified the injury by the width of bile duct injury. Based on the McMahon classification, lacerations under 25% of the common bile duct (CBD) diameter or cystic-CBD junction was classified as minor injury, whereas transection or laceration over 25% of CBD diameter and postoperative bile duct stricture were classified as major injury. (Lillemoe *et al*., 1997)

## Clinical presentation

Most patients with postcholecystectomy biliary injuries, if not diagnosed at operation, present early in the postoperative until after operation. Like bile leaks, these injuries are more often diagnosed within the first few postoperative weeks.

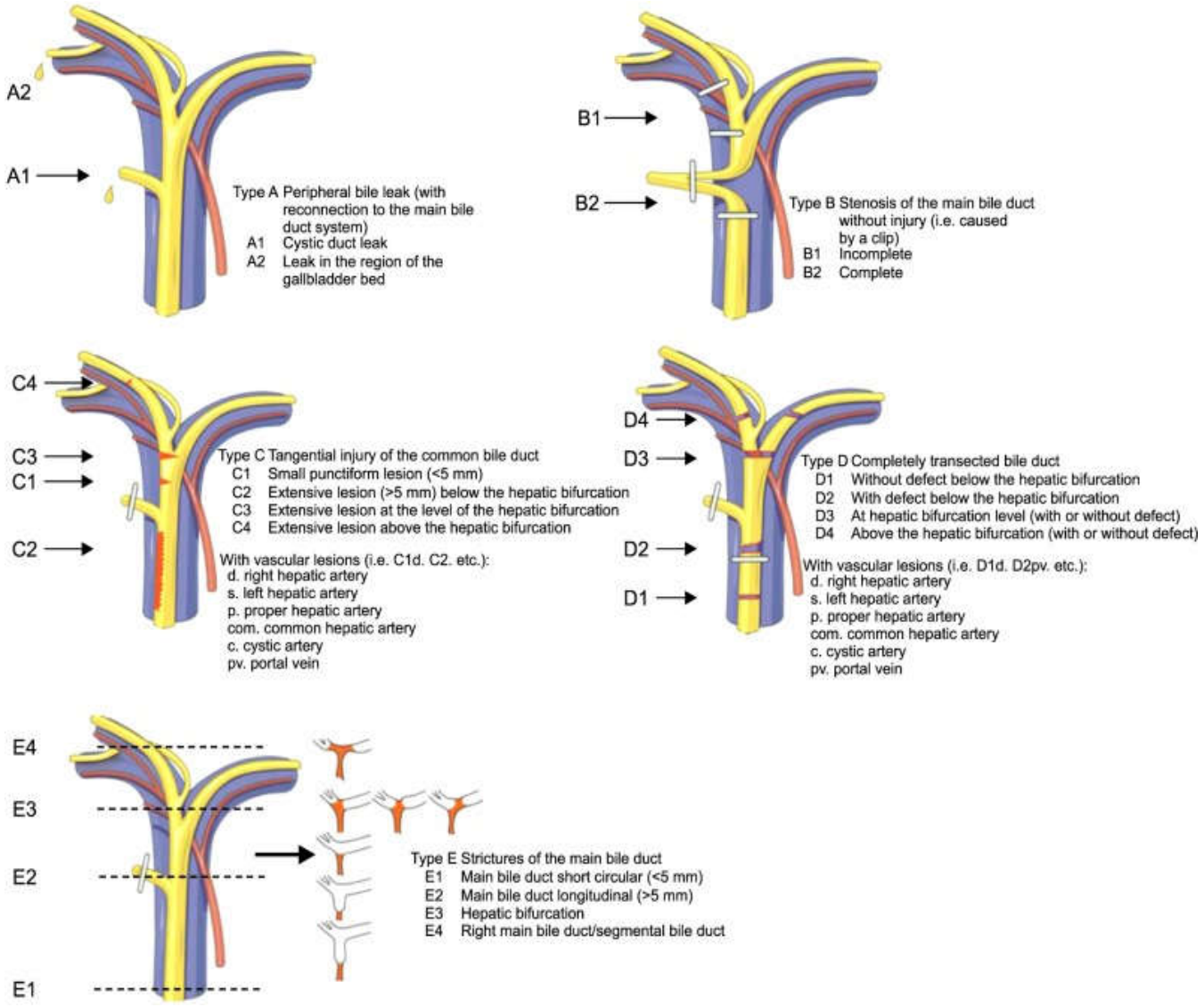



**Fig.5. Hannover classification (Deziel *et al*., 1994)**

period. After open cholecystectomy, only about 10% of injuries are suspected after the first week but nearly 70% are diagnosed within the first 6 months after operation. By contrast, injuries after laparoscopic cholectomy appear to be recognized somewhat earlier. (Adamsen *et al*., 1997; Anand, 2011) This probably reflects differences in the pattern of injuries between the two approaches combined with a heightended awarness of the potential for injury at laparoscopy. Patients with significant bile leaks (Types A, C and D) generally present within the first week after operation but some may not become apparent for several weeks and very few are diagnosed intraoperatively (Cuschieri *et al*., 1991; Pitt *et al*.,1989). Most patients have abdominal pain coupled with fever or other signs of sepsis, which is most common, or bile leakage from an incision. A small number of patients have neither of these signs and symptoms but rather have non-specific complaints of weakness, fatigue or anorexia. (Newman and Horthrup, 1963) Elevated alkaline phosphatase levels are characteristic as is mild hyperbilirubinemia but markedly elevated serum bilurubin levels (>3 mg/dL0 are uncommon. (Hemant Sharma, 2011) Major injuries to the common duct (type E injuries) are more likely to be discovered intraoperatively, although the majority remain unrecognized However, patients with a solwly evolving stricture may not come to attention for several months, which is distinctly uncommon for patients with bile leaks.Most patients with these injuries present with jaundice, often coupled with pain and occasionally sepsis (Courtney *et al*., 2012). It is important to recognize, however, that jaundice is not always present early in the course of the illness. In some patients, the stricuture may evolve slowly or cause only partial obstruction. Such patients may have non-specific complaints, pruritis, or derangements in liver function tests, any or all of which should prompt an investigation. In addition, patients with an isolated right sectoral hepatic duct injury (Type B) or an internal biliary fistula may present with a history of unexplained fevers, pain or general debilitation. The findings on physical examination are often non-specific. Jaundice, if present, is usually obvious and there may be multiple skin excoriations from pruritis. Abdominal distention and pain may be seen in patients with bile peritonitis, shereas focal tenderness is more suggestive of a localized collection or abscess. Hepatomegaly maty be seen with longstanding biliary obstruction. Splenomedgaly or other signs of portal hypertension are uncommon but, if present, should alert the surgeon to the possibility of concomitant portal

venous injury or severe underlying hepatocellular damage. (Farquharson's Text Book Of Operative Surgery, 2014)

**Diagnostic protocol**

The first step is to perform an abdominal ultrasound to investigate the presence of ductal dilatation or fluid collections (Cuschieri *et al*., 1991). Biliary dilatation is often absent (in our series in 71% of cases) because the biliary system is decompressed by the leak (Chow *et al*., 1997). In the event of fluid collections, percutaneous needle aspiration may differentiate an abscess from a biloma. When ductal dilatation is present or needle aspiration yields bile, an ERCP should be the next diagnostic procedure.At ERCP, care should be taken that the whole biliary system is visualized. (Bektas *et al*., 2007) Bile leaks associated with the anatomical variant of a low-inserting right segmental hepatic duct can be particularly difficult to diagnose and ERCP results are often interpreted falsely as 'normal', with no leaks demonstrated (The Southern Surgeons Club, 1991).

**Management**

In the early 1990s when both laparoscopic cholecystectomy and minimally invasive techniques were in their infancy, bile leaks were managed conservatively; if the patient did not improve, a laparotomy was often performed. Management was anecdotal and based upon the experience of the surgeon. However, with the advent of improved radiological percutaneous drainage, therapeutic endoscopic retrograde cholangiography (ERC) and increased confidence with laparoscopic techniques including suturing, it became clear that bile leaks could be managed in a minimally invasive manner, potentially reducing morbidity and mortality. Prompt access to the full range of techniques is important, as is a structured approach. In 1998, the hepatobiliary unit at Leicester Royal Infirmary (LRI) introduced a protocol for the minimally invasive management of bile leaks. From the endoscopists stand point, biliary injuries during LC can result in bile leaks, biliary stricture formation, or both. Bile leaks are divided into: 1) low grade (LG), where the leak can only be identified after complete opacification of the intrahepatic biliary system and 2) high grade (HG), where the leak can be observed before intrahepatic opacification (Stewart and Way, 1995; Strasberg *et al*., 1995). The most common sites of postcholecystectomy bile leak (PCBL) are the cystic duct stump and the duct of Luschka, which tend to be LG and often resolve spontaneously. The duct of Luschka refers to an accessory bile duct that is in close proximity to the gallbladder body and can be injured during LC. Other types of PCBLs range from direct hepatic duct injury and leak to complete bile duct transection and are usually HG. Endotherapy is the standard of care in the management of LG and HG bile leaks (Hemant Sharma, 2011). The main goal of endoscopic therapy is to reduce the transpapillary pressure gradient to facilitate preferential bile flow through the papilla as opposed to the site of the leak, providing time to the biliary tree injury to heal. This is most commonly achieved by placing a transpapillary stent with or without sphincterotomy. Another approach includes placement of a nasobiliary drain to decompress the biliary system without a sphincterotomy. This approach offers the advantage of repeat cholangiography without the need of another ERCP. Its use, however, has been limited due to poor patient tolerance, tube displacement and need for hospitalization until the tube is removed. A variety of endoscopic approaches have been proposed for the management of PCBL. Sandha *et al* proposed an algorithm for their management based on the grade of leak in a non-randomized setting. They concluded that endoscopic biliary sphincterotomy (EBS) alone without stent placement is a viable treatment option for most patients with LG leaks, unless there is a compelling indication for stent insertion such as retained stone, biliary injury with stricture formation, coagulopathy precluding EBS, or sepsis necessitating immediate closure of the leak. All HG lesions were successfully treated with EBS and stent placement. The study did not address whether EBS alone had an equally favorable outcome as biliary stent placement in patients with LG leaks.

Spontaneous resolution of bile leakage has been described in patients with external drains (The Southern Surgeons Club, 1991). Some have therefore advocated a 'wait-and-see' policy in these patients and this seems justified in clinically stable patients without evidence of sepsis or peritonitis. However, if percutaneous bile leakage persists or the patient's clinical condition deteriorates, an ERCP/MRCP is indicated. This will establish the diagnosis and will allow for effective therapeutic intervention in most of them (Chapman *et al*., 1995). Patients with bile leakage from the cystic duct or peripheral hepatic radicles are treated by insertion of a short biliary stent to lower the pressure of the biliary system by bypassing the biliary sphincter (Stewart and Way, 1995; Strasberg *et al*., 1995). The stent is preferably inserted without endoscopic sphincterotomy unless this is necessary to extract bile duct stones or gain biliary access. Endoscopic treatment is effective in 90% of the patients with type A lesions, although 15–20% will require additional percutaneous drainage of a biloma. Insertion of a stent does give the patient the burden of a second endoscopic intervention for removal of the stent but prevents a sphincterotomy that may cause acute and late complications. Placement of a nasobiliary tube is another option in treating leakage from minor bile ducts: closure of the leak can be monitored by repeating cholangiography, low pressure suction can be applied, and drain removal does not require an additional endoscopy (Farquharson's Text Book Of Operative Surgery, 8th edition, 2014; Flum *et al*., 2003)

Bile leakage from major bile ducts may be more challenging to treat endoscopically. Extensive duct damage and leakage can make it difficult to pass a guidewire into the proximal biliary system. The presence of clips and stenoses (due to inflammatory reactions in the hepatoduodenal ligament) may also hamper passage into the proximal hepatic system or insertion of stent. In case ERCP fails, PTC and rendezvous procedure should be the next step. Endoscopic treatment is successful in approximately 75% of patients with leakage from major bile ducts (Stewart and Way, 1995). An important late complication of bile leakage from major bile ducts is a secondary stenosis at the site of the leak. Insertion of a stent not only adequately seals the bile leakage but also allows for prevention or treatment of secondary ductal stenosis. Most postoperative bile duct strictures are short (less than 10 mm in length) and situated distal to the confluence of right and left hepatic ducts. Postoperative strictures are usually classified according to Bismuth by their position relative to the hepatic confluence (Bismuth, 1984; Pitt *et al*., 1989). Options for therapy include surgery, percutaneous balloon dilation and stenting, and endoscopic stenting, if necessary combined with balloon dilation. Patients with complete transection of the bile duct are not amenable to endoscopic treatment because the distal and proximal biliary systems are not in continuity. These

patients should undergo reconstructive surgery: Roux-en-Y-hepaticojejunostomy is the procedure of choice. The outcome of surgical management of these lesions is influenced by a variety of factors including: proximal extent of the injury, type of reconstructive procedure performed, experience of the performing surgeon, timing of intervention, presence of proximal dilation and local inflammation at the time of the procedure, condition of the patient, and the length of follow-up. The timing of the procedure is a key factor determining the outcome of reconstructive surgery. (Sicklikc *et al*., 2000)

**Andersson (1988):** In 1969-1986 intraperitoneal accumulation of bile occurred in 21 patients after elective cholecystectomy or choledochotomy (n = 16) or percutanceous fine-needle cholangiography or biopsy (n = 5). the cause was established in all but one of the surgical cases, viz. T-tube removal (8), injury to the common bile duct (3), unrecognized aberrant bile duct (3) and leakage from liver biopsy (1). The intraperitoneal accumulation of bile led to laparotomy in 19 cases, when the median amount of bile found was 500 ml (range 100-3,500 ml). Mortality was nil and only few ands relatively minor complications could be attributed to the accmulation of bile-pleural effusion (2 cases) wound rupture (1), lower-limb venous thrombosis (1) and sttricutred hepatojejunostomy (1). There were no infectious complications. It is concluded that intraperitoneal accumulation of bile alone after elective surgical or invasive diagnostic procedures does not usually lead to severe complications, and that it seems distinctly less noxious than the bile peritonitis associated with acute cholecystitis.

**Cuschieri *et al*. (1991):** A retrospective suvey of 7 European centers involving 20 surgeons who undertook 1,236 laparoscopic cholecystectomies was pefformed. The procedure was completred in 1,191 patients. Conversion to open cholecystectomy was necesssary in 45 patients (3.6%) either because of technical difficulty (n=33), the onset of complications (n = 11), or instrument failure (n=1). There were no deaths reported, and the total postoperative complication rate was 20 of 1,203 (1.6%), with 9 being serious complications requiring laprtomy. The total incidence of bile duct damage was 4 of 1,203. The median hospital stay was 3 days (range : 1 to 27 days) and the median time to return to full activity after discharge was 11 days (range : 7 to 42 days).

**Morgenstern L, Wong L Berci G. (1992):** Records of 1200 consecutive open cholecystectomies, performed by a teaching service of a large, urban hospital in the years immediately preceding the laparoscopic era, were reviewed for morbidity and mortality rates. The mortality rate in this series was 1.8%, chiefly in the older age groups. Only two ductal injuries were incurred. A review of published series from 1952 through 1990 revealed a mean mortality rate of 1.53%. These recent observations on the morbidity and mortality after open operation should provide a useful standard of comparison with ongoing similar studies of laparosocpic cholecystectomy.

**Ray CE Jr (1993):** Laparoscopic cholecystectomy is rapidly becoming an acceptable alternative to traditional open cholecystectomy. Laparoscopic procedures are associated with shortened recovery periods and hospital stays and the cosmetic benefit of smaller scars. Early results from laparoscopic cholecystectomies suggested a high rate of complications; howevcer, recent studies have shown that, in experienced hands, the complication rates of open and laparoscopic procedures are comparable. Complcations differe somewhat between the two types of operations. In laparoscopic cholecystecctomy, complications are associated with virtually every aspect of the procuedure. The purpose of thhis essay is to illustrat the imaging findings of the complications that occur in patients undeergoing laparoscopic cholecystectomy.

**Sheng (1994):** Leaks were diagnosed in 59 allografts in 59 patients. The prevalence of leaks after liver transplantation, as depicted on cholangiograms, was 4.3% (59 of 1,363 grafts). Sixteen of 21 patients with anastomotic leaks needed 17 surgical repairs, four leaks were surgically drained without repair, and one was treated with percutaneous biliary catherer drainage. Twelve of 2 patients with Tube exist-site leaks underwent T-tube drainage. Seven underwent surgical repair or drainage, one died, and one underwent retransplantation. Nine of 13 patients with leaks from bile duct necrosis required retransplantation.

**Shea *et al* (1996):** Outcomes of laparoscopic cholecystectomy are examined for 78,737 patients reported on in 98 studies and compared with outcomes of open cholecystctomy for 12,973 patients reported on in 28 studi 3s. Laparoscopic cholecystectomy appears to have a higher common bile duct injury rate and a lower mortality rate. Estimated rates of other complications after laproscopic cholecystectomy generally were low.

**Neidich (1996):** Fourteen patients with symptomatic bile duct leaks following laparoscopic cholecystectoimy were treated using endotherapeutic techniques. Patients presented with abdominal pain, liver test abnormatlities, jaundice, leukocytosis, and fever. Twelve leaks originated from cystic duct stumps and two from right posterior hepatic ducts. Distal biliary obstruction, which may have promoted leakage, was present in five patients. Treatment methods included stent insertion with endoscopic sphincterotomy (ES), stent insetion without ES, and nasobiliary tube (NBT) placement without ES. Eleven of 14 patients had prompt resolution of their bile leks following initial endotherapy. Three patients with continued leakge underwent successful repeat endoscopic retrograde cholangipancreatography 4-5 days after the initial examination. Cholangiographic evidence of leak clousre was documented in all patients, and all remained asymptomatic during an average follow-up period of 18.5 months. Endoscopic therapy is safe and effective treatment for clinically significant bile leaks following laprasocopic cholecstectomy. In our small group of patients, NBT alone did not appear to be as effective and endoprostheses with or without ES. The ideal endoscopic treatment method has not yet been established but will likely vary dpending on the site and specific nature of the injury and any concomitant biliary ductal pathology.

**Chow *et al*. (1997):** Patients presented from 0 to 150 days after cholecystectomy (median =2) with pain (n=17), fevcer (n=8), bile leakage in a surgical drain (n=4), elevcatd licvr tests (n=8), and nausea and vomiting (n=4). Fourteen patients had diagnostic imaging before endoscopic management. ERCP findings included cystic stump leak (n=12), including one with a colocutaneous biliary fistula, gallabladder fossa leak (n=3), right hepatic branch leak (n = 1), or no leak (n=3). Three patients had choledocholithiasis. NBT drainage was used for a mean of 3.9 days (ranfge 1-12 days). Fourteen patients had radiographic evidence of leak closure. One patient ultimatly required surgical correction for a chronic colocutaneous biliary

fistula. There were no early or late endoscopic complications (e.g., dense adhesions) and were not the reult of injury.

**Tzovaras and Peyser (2001):** Studied minimally invasive management of bile leak after laparosocopic cholecystectomy. Only one patient required primary surgical treatment following diagnosis of a major duct injury. The other 20 were rtreated by a combination of sphicncterotomy (including a stent in most) polus percutaneous drainage in six., In 19 of 20, this minimal access approach stopped the leak.

**Vitllas *et al.* (2001):** Mangafodipir trisodium (Teslascan), a hepathobiliary conterast agent, has the potential of providing functional biliary imaging similar to hepatobiliary scientigraphy. To our knowledge, the potential role of this biliary contrast agent in the detection of bile duct leaks has not been reported. In this case report, we report the first case of a bile duct lak diagnosed with enhanced MRI with managafodipir trisodium in a patient following laparoscpopic cholecystectomy. Our case illustrates that functional MR cholangiography images can be successfully acquired by using a post-managafodipir fat-suppressed GRE technique and that bile duct leaks can be detected.

**Hemant Sharma and George Bird (2011):** Done endoscopic management of postcholecystectomy biliary leaks. 46 patients were identified, of whom 42 respondned well to endoscopic treatment. Four patients ultimately needed surg4ry, of whom three had recurrent stricutres. One patient had coplete transection of the biliary duct and endoscopic treatment was not attempted.

**Anand (2011):** A prospective analysis was performed on all patients with an introgrenic BDI between June 2008 to July 2010. Retrospective satudy for BDI during the period Junary 2006 to May 2008 was done using the available hospital records. For the injuries sustained during cholescystectomy timing of cholecystectomy after the onset of symptoms (<72 hours or >72 hours) gender, age, presence of aberrant anatomy (extra-hepatic bile duct and vascular anatomy), presenc of gall stone pancreatitis, acute cholecystitis or cholangitis, time getween cholecystcotomy and recognition of BDI, time from injury to definite management, type of injury, endoscopic retrograde cholangiography and stenting and definitive repair were noted.

## MATERIALS AND METHODS

A prospective analysis was done on all cholecystectomy patient from September 2014 to September 2016. The case papers, operative and post operative records were scrutinised and data collected. All the cholecystectomy patients were observed in the post-operative period for presence of biliary leakage as evidenced by bilious fluid drainage in the drain tube. In our study **inclusion criteria** are as :-

1. 50 ml or more or lasting for 2 days ore more
2. Failure to recover along expected lines
3. Abdominal pain
4. Sepsis etc were also observed.

**Exclusion criteria**

Biliary leakage occurring as a complication of other surgeries apart from cholecystectomy:

- Cholecystectomy with CBD exploration
- As a complication of ERCP
- Urological procedures
- Gynaecological procedures
- Penetrating and blunt injuries to the abdomen.

**Each case was studied as per the following plan**

1. Age
2. Sex
3. Religion
4. Indication for cholecystectomy
5. Open or lap cholecystectomy
6. Method of approach-fundus first or classical
7. Post operative symptoms
6. Type of complication
7. Amount of collections in drain per day
8. Treatment given

**Investigations done**

1. Total leucocyte count
2. Differential count of WBC
3. Bleeding time
4. Clotting time
5. Prothrombin time
6. Activated prothrombin time
7. Livr function test
8. Serum electrolyte
9. Ultrasonography abdomen and pelvis
10. Computed tomography of abdomen and pelvis
11. Magnetic Resonance Cholangiography & Pancreatography

## OBSERVATION AND RESULTS

Bile leakage was seen in 13 patients, being 7 women and 6 men, ranging in age from 33 to 71 years. Cholecystectomy was performed electively for symptomatic cholelithiasis in 10 of these patients (76.9%), for acute cholecystitis in 2 of the case (15.3%) and for GB lump in one of the case (7.6%). All 13 patients recovered uneventfully with similar hospitalization. Of the 13 postoperative bile leaks 2 had undergone lap cholecystectomy and 11 had undergone open cholecystectomy. Of the two postoperative bile leaks after lap cholecystectomies one was found to have bile duct injury and of the eleven postoperative bile leaks after open cholecystectomies two was found to have bile duct injury on MRCP. In the present study of 13 cases of postoperative bile leaks, fundus first method was used in one of the two cases of lap cholecystectomy and four of the eleven cases of open cholecystectomy. Classical procedure was done in remaining cases. Present study stated that pain abdomen mostly in the right upper quadrant,vomiting and jaundice were the most common postoperative symptoms of biliary leaks.Nausea and vomiting usually precede the jaundice and more commonly appreciated in the early postoperative period. Jaundice invariably develops and is more pronounced with ductal obstruction and sepsis.It is less noticeable with intraperitoneal bile alone or bile leak without any ductal obstruction.

Bile leakage was diagnosed as persistent drainage of bile-stained fluid from the drainage tube in all the patients. Abdominal drain was placed in all the cases to detect post operative bile leaks that had resulted in controlled fistula with almost no signs of localised or generalized peritonitis.

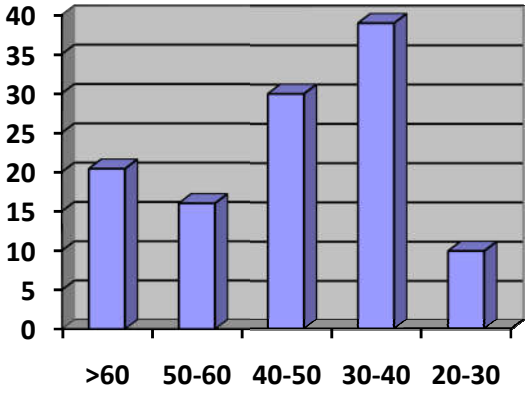
**Table 1. Analysis of symptoms**

| Symptoms | No of cases | % |
|---|---|---|
| Pain abdomen | 10 | 76.9 |
| vomiting | 6 | 46.1 |
| jaundice | 3 | 23.0 |
| fever | 6 | 46.1 |
| ileus | 2 | 15.3 |
| cholangitis | 1 | 7.6 |
| peritonitis | 1 | 7.6 |

Subdiaphragmatic collections are seen in only 16% of cases on usg of abdomen and generalized peritoneal collections in 7 % (i.e one case) due to blockage of drain.No collection is seen in about 75% of cases due to free flow of bile through the drains.In seven of the cases leaks subsided by 6th POD and drains were removed by 6th POD in which bile duct injury was noted in one of the case and in one case leak persist for 14 days and drains were removed by 14th POD in which bile duct injury was noted.one case with complete bile duct injury had persistent leak beyond 14 days which was reoperated and Roux-en-Y choledochojejunostomy done. In the study 62%(n=8) of the patients were treated conservatively who require no therapy and surgical placement of the drain itself was sufficient.Endoscopic management with stenting was not indicated in any of the patient.Reexploration with primary repair over T-tube was required in 15%(n=2) of patient with bile leaks. Reexploration with cystic duct ligation was required in 15%(n=2) of patient and Reexploration with Roux-en-Y choledochojejunostomy was required in 8%(n=1) of patient.

Among the 100 cases, 73% of the females underwent cholecystectomy.

Patients underwent Cholecystectomy for Indication of Chronic Cholecystitis were 54% and for acute cholecystitis 36%.



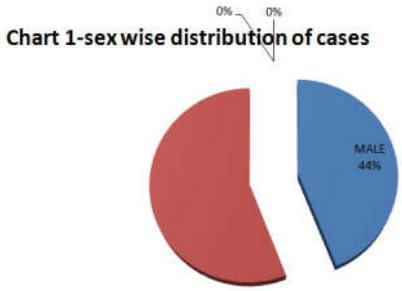




Chart 1-sex wise distribution of cases

**Table 2. Clinical features of the 13 patients with bile leakage**

| Case | Age/sex | Onset of bile leak | Etiology | Treatment |
|---|---|---|---|---|
| 1 | 48/M | Within 6 hr | Cystic duct stump leak | Laparotomy and cystic duct ligation |
| 2 | 58/M | Within 6 hr | cystic duct stump leak | Laparotomy and cystic duct ligation |
| 3 | 71/F | 1 day | CBD injury | Laparotomy and choledochotomy with T tube |
| 4 | 57/F | 1 day | Not known | conservative |
| 5 | 39/M | 1 day | Not known | conservative |
| 6 | 65/M | Within 6 hr | CBD injury | Laparotomy and choledochotomy with T tube |
| 7 | 37/M | Within 12 hr | CBD transection injury (Strasberg E injury) | Laparotomy and Roux-en-Y choledochoje-junostomy |
| 8 | 44/F | within 6 hr | CBD injury | conservative |
| 9 | 52/F | within 6 hr | Liver bed leakage | conservative |
| 10 | 68/M | 1 day | Not known | conservative |
| 11 | 42/F | 1 day | CBD injury | conservative |
| 12 | 33/F | Within 6 hr | Liver bed leakage | conservative |
| 13 | 52/F | Within 6 hr | CBD injury | conservative |

**Table 3. Age wise incidence of cholecystectomy**

| Range of Age | Incidence | |
|---|---|---|
| | Number | Percentage |
| > 60 yrs | 33 | 5 |
| 50-60 | 109 | 16 |
| 40-50 | 204 | 30 |
| 30-40 | 265 | 39 |
| 20-30 | 68 | 10 |

Among the cases, the patient underwent cholecystectomy between the age of 30-40 & 40-50 were 39% and 30% respectively.

**Table 4. Sex wise incidence of cholecystectomy**

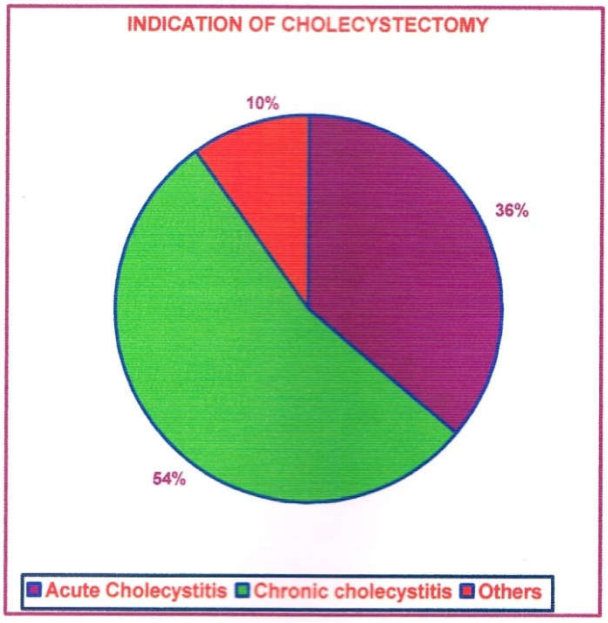
| Sex | Incidence | |
|---|---|---|
| | Number | Percentage |
| Male | 180 | 27 |
| Female | 499 | 73 |

**Table 5. Indications of cholecystectomy**

| Indication | Incidence | |
|---|---|---|
| | Number | Percentage |
| Acute Cholecystitis | 244 | 36 |
| Chronic Cholecystitis | 366 | 54 |
| Others | 69 | 10 |

**Table 6. Post-operative result among all the cases of cholecystectomy**

| Post operative result | Incidence | |
|---|---|---|
| | Number | Percentage |
| Uneventful | 536 | 79 |
| Complications | 143 | 21 |




Out of 679 cases, 79% patients did not show any complications whereas 21% patients had complications.

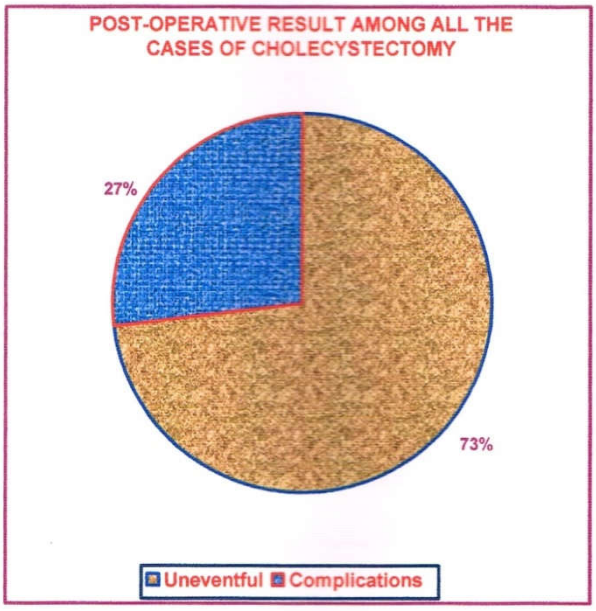



**Table 7. Distribution of types of complications**

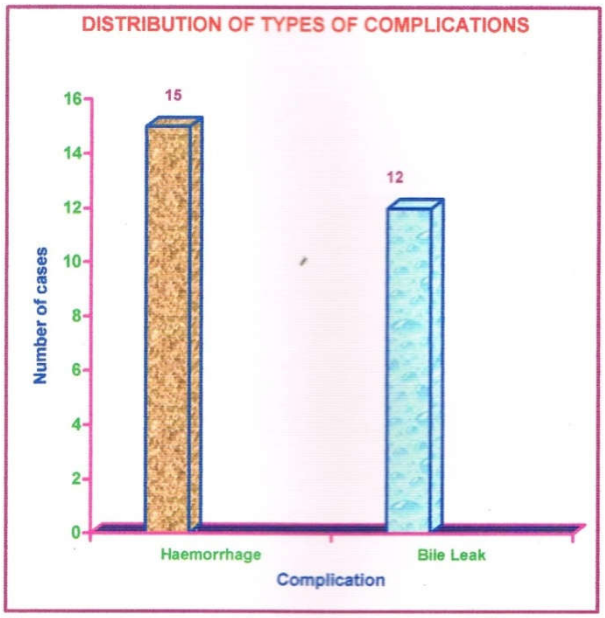
| Complication | Incidence |
|---|---|
| Haemorrhage | 8 |
| Bile Leak | 13 |

Out of 679 cases, 8 cases show complications in the form of Haemorrhage & 13 cases are of biliary leak.

**Table 8. Age wise incicence of biiliary leakage**

| Range of Age (years) | Biliary Leak |
|---|---|
| 60-70 | 1 (7.6%) |
| 50-60 | 1 (7.6%) |
| 40-50 | 4 (30.7%) |
| 30-40 | 5 (38.4%) |
| 20-30 | 2 (15.3%) |

Biliary leak were seen in the age group of 30-40 & 40-50 were 5 (38.4%) and 4 (30.7%) respectively.



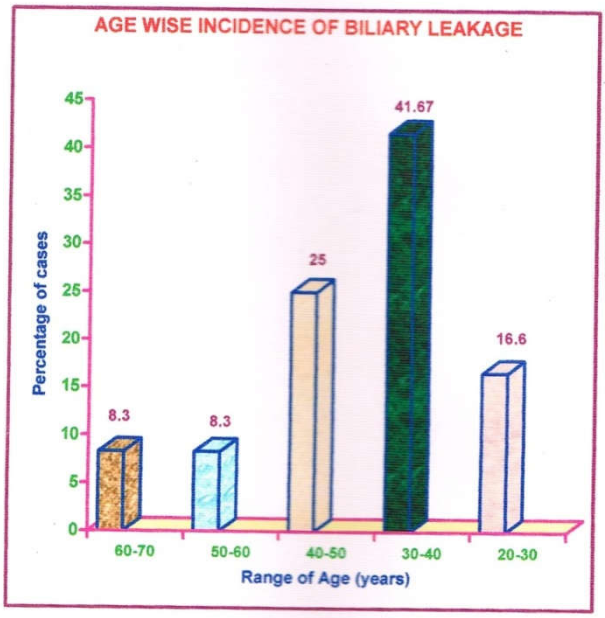




**Table 9. Sex wise incidence of biliary leakage**

| Sex | Incidence | |
|---|---|---|
| | Number | Percentage |
| Male | 5 | 38.4 |
| Female | 8 | 61.5 |

Out of 13 patients, 8 female patients had biliary leak.

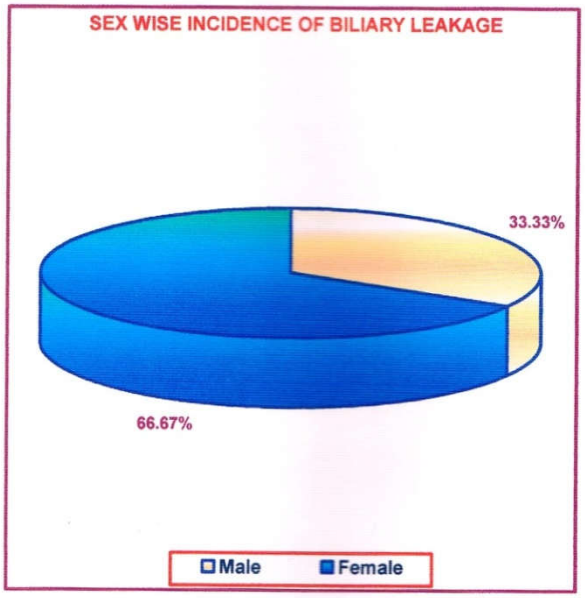
**Table 10. Religion wise incidence of biliary leakage**

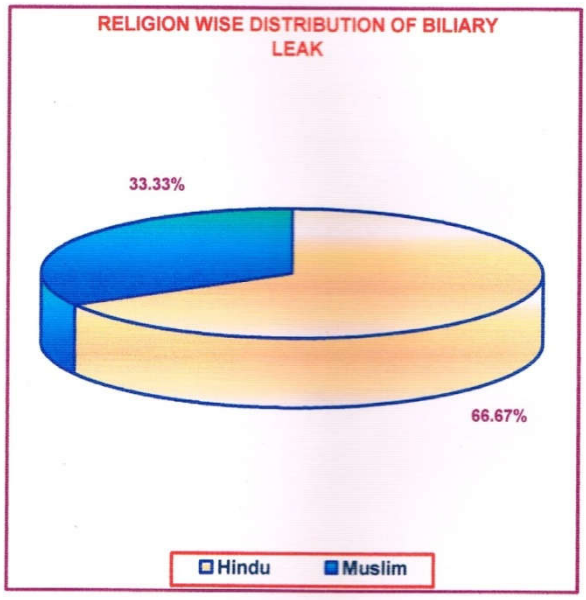
| Religion | Incidence | |
|---|---|---|
| | Number | Percentage |
| Hindu | 9 | 66.6 |
| Muslim | 4 | 33.3 |

**Table 11. Indication of surgery causing biliary leak**

| Indication of Surgery | Biliary Leak |
|---|---|
| Acute Cholecystitis | 8 (61.5%) |
| Chronic Cholecystitis | 3 (23.0%) |
| Others | 2 (15.5%) |

Biliary Leak was seen in Acute cholecystitis 8 (58%) and chronic cholecystitis 3 (23%).



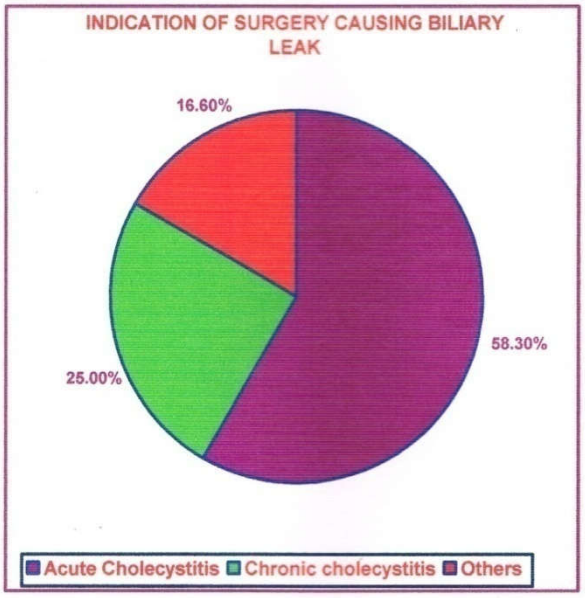




**Table 12. Causes of biliary leakage**

| Causes | Biliary Leak |
|---|---|
| Cystic duct Stump | 2 (15.3%) |
| CBD Injury | 3 (23.0%) |
| Liver Bed | 6 (46.1%) |
| Undiagnosed | 2 (15.3%) |

Out of 13 cases, 46% leak was due to liver bed injury, 25% due to CBD injury whereas Cystic duct Stump ligature & Undiagnosed causes had 15% each.

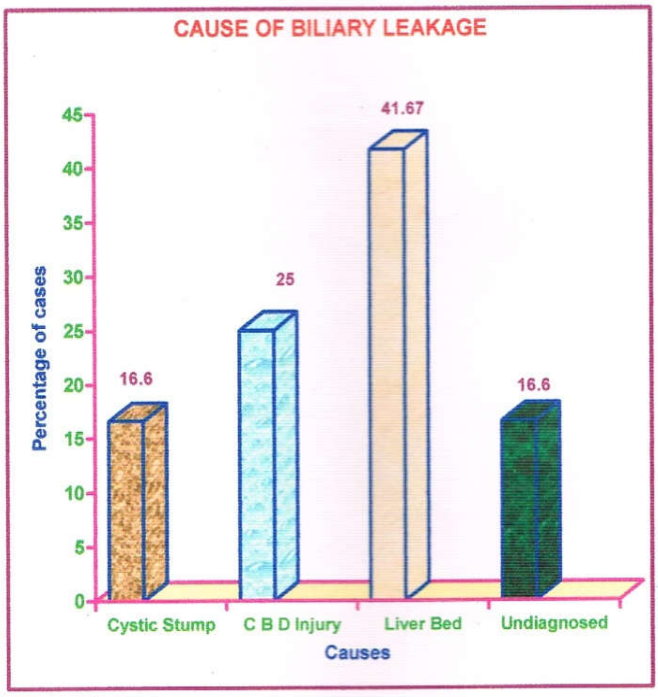



**Table 13. Lap vs open Cholecystectomy**

| Operations | Total case | No of leaks | % | Bile duct injuries | % |
|---|---|---|---|---|---|
| Lap | 152 | 2 | 1.3 | 1 | 0.5 |
| Open | 527 | 11 | 2.0 | 2 | 0.3 |

**Table 14. Treatment given to causes of biliary leak**

| Proedure | % of Treatment |
|---|---|
| Conservative | 8 (61.5%) |
| Endoscopic stenting+Sphincterotomy | 0 |
| Rexploration and cystic duct ligation | 2(15.3%) |
| Primary Repair over T-tube | 2 (15.3%) |
| Roux-en-y choledochojejunostomy | 1 (7.6%) |

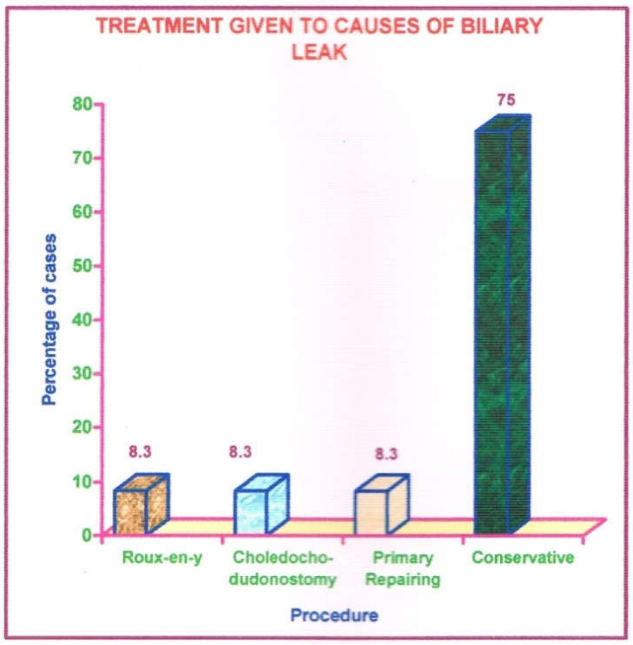
Out of 13 cases of Biliary Leakage, most of the patients, 61% were managed conservatively whereas in few cases, Roux-en-y choledochojejunostomy, Choledochodudonostomy & Cystic duct ligation and Primary repair over T tube was done.

## DISCUSSION

This study consists of 679 patients who had underwent cholecystectomy in the department of surgery of Rajendra insitute of medical sciences, Ranchi during the period of September 2014-September 2016. 527 patients undergone open and 152 patients undergone lap cholecystecomy.

**Table 3 : Age wise incidence of cholecystectomy**

Maximum number of the patients were underwent cholecystectomy (open or laparoscopic) between the age of 30-40 and 40-50 yrs of age.



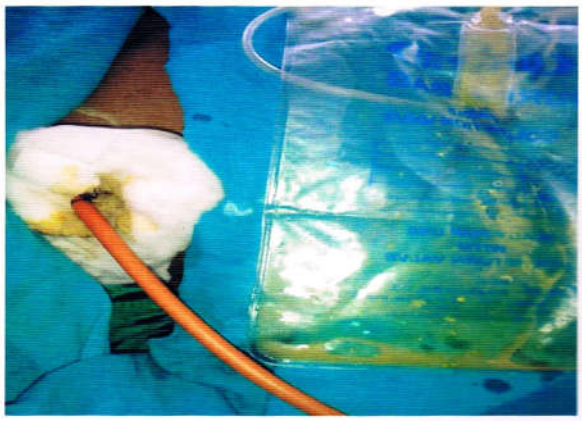



**Fig. 6. Postoperative bile leak**

The above observation shows that peak age of incidence of different indication of cholecystectomy to be in the age group of 30-40 and 50-60, as the gall stone disease being more common cause after the age of 20.
Decamp (1932) reported 60 percent of his cases were between 30-60 yrs of age.
Udape and Prasad (1957) and Tiwari *et al* have also reported maximum incidence to be 40-50 yrs. We have also found similar age incidence in our study.

**Table-4 : Sex wise incidence of cholecystectomy**

A study of sex incidence shows that gall stone disease was four fold more comon in female in comparison to male.
Decamp (1952) reported 4:1 ratio.
Udupe and Prasad (1957) reported 3.5:1 ratio and Tiwari *et al* reported 3:1 female to male ratio.
Norrby *et al* (1983) reported 66% female and 24% male in his series which is slightly lower than that we observed. All these figures clearly indicate female preponderance in acute cholecystitis and chronic cholecystitis.

**Table-5 : Indication of cholecystectomy**

Maximum number of patients underwent cholecystectomy (Open or laparoscopic) for the indication of symptomatic cholelithiasis and chronic calculus cholecystitis (90.5%). Acute cholecystittis comprised only 6% of cases, remaining cases for GB lump and other causes.
As the above data support that the common indication for cholecystectomy is the chronic calculus cholecystitis.

**Table-6 : Showing post operative redsults**

In post operative period only 21 cases were eventufl and most of them were without any complication.

**Table-7 : Showing type of complications**

In post operative period most common complication was observed as haemorrhage 08 (38.1%) and bile leak as 13 (61.9%).
In out study incidence of bile leak was more as compare to other author studie.Wide range of complication rate has been documented by various authors. Dubois *et al* (1990) reported a complication rate of 6%. Najningier B *et al* (1997) reported serious complication rate of 2.9%. Vogelback P *et al* (1992) reported no major complication. The Southern Surgeon Club (1991) reported a complication rate of 5.1%).

**Table 8 : Age wise incidence of biliary leakage**

Maximum number of the leakage is observed between the age group of 30-40 and 40-50, 5 (41.6%) and 3 (23%) respectively, as the gall stone disease is common in the age group of 30-50. Thus, after cholecystectomy, biliary leakage has been observed maximum betrween the age group of 30-50.

**Table-9 : Sex wise incidence biliary leakage**

Maximum number of leakage was observed in male patients. On 679 cases who underwent cholecystctomy, 499 cases were female and biliary leakage observed was 8(1.60%) and 180 cases were male in which biliary leakage was observed in 5 (2.77%). The percentage of leak is more in male as compare to female may be because of more anatomical variations, deep liver bed and more difficulty in dissection of Calot's triangle in male.
Kayaalp C *et al* (2002) reeported 40% biliary leakage in male.
Norrby *et al* (1983) reported 66% female and 24% male in his series.

**Table-10 : Sex wise incidence biliary leakage:**

Bile leak incidence was more in hindu than muslim patient.

**Table-11 : Indication of surgery causing biliary leak**

The above data shows that maximum number of the leak was observed in acute cholecystitis 8 (61.5%), chronic cholecystitis 3 (23.0%) and other 2 (15.5%).
This observation shows that anatomy of the Calot's triangle was not clear, inflammation of gall bladdeer and ahension to the neighbouring structures was more observed in acute

cholecystitis causing difficulty performing cholecystectomy leading to more biliary leakage as in the form of bile duct injury, cystic duct stump, oozing from liver bed and undiagnosed causes.

**Table-12 & 14: Distribution of types bile leak and Management**

The causes for biliary leak in our study was observed as slipping of ligature of cystic duct stump, CBD injury, liver bed injury and undiagnosed causes and the percentage of incidence of above causes being 2 (15.3%), 3 (23.0%), 6 (46.1%) and 2 (15.3%) respectively.

Most of the biliary leakage patients 62% (N=8) were managed conservatively (75%) and very few through surgical intervention like Roux-en-y, choledochodudonostomy and primary repiairng.

Southern surgeon club (1991) reported CBD or hepatic duct injury 0.5%. Wise JN *et al* (2005) repoted major bile leak occurred in 3% of patient and minor leak occurred with equal frequency.

2% mortality was observed in our study.

Wilson P *et al* (1991), Spangerberger *et al* (1990), Cushier *et al* (1991) reported zero mortality.

But some author documented some mortality during cholecystectomy such as Linderberg F *et al* (1997) reported a mortality rate of 0.08%, Mc burry *et al* (1991) also reported mortality rate of 1.7%.

**Table-13 : Biliary leak in open vs lap cholecystectomy**

The rate of bile duct injury after laparoscopic cholecystectomy and open cholecystectomy was noted 0.5% and 0.3% respectively.The overall incidence of the bile leakage in our series was 1.3 % (2/152) with lap cholecystectomy and 2.0% (11/527) with open cholecystectomy.

**Summary**

1. In our study, the peak age of cholecystecotmy was between 30-50 yrs.
2. The male : female ratio was found out as 4:1.
3. Indiation for cholecystectomy was more in chronic cholecystitis.
4. In case of severe inflammation and adhesions,fundus first method carries least duct injury.
5. Most of the biliary leakage was seen in 30-50 yrs of age.
6. Male preponderance in biliary leakage was seen.
7. Most of the biliary leakage was observed in acute cholecystitis.
8. Most of the biliary leakage was due to liver bed injury.
9. Bile duct injury incidence is more in lap than open cholecystectomy.
10. Drain amount usually becomes nil by 6$^{th}$ POD. Cases which continued to drain after 5-7 days approximately should be suspected as having duct injury and subjected to MRCP or ERCP.
11. Most of the patients of postoperative biliary leakage were managed conservatively and by endoscopic procedures and rarely requiring reoperation.
12. 2% mortality was observed.

**Conclusion**

- Pain abdomen,jaundice,nausea and vomiting are the major complaints in case of bile leaks.
- Pathologically chronic cholecystitis is more common cause of bile leak then acute cholecystitis because of fibrosis at callots triangle.
- Incidence of post operative bile leaks is almost the same in open and laparoscopic cholecystectomy.
- Routine placement of drains is must because it permits postoperative evacuation of serosanguinous exudates and monitoring of bleeding or leakage of bile.Abdominal collections,bilomas or subhepatic abscess are reported less with the placement of drains.
- Postoperative biliary leakage is more commonly due to injury to the liver bed which was managed conservatively.
- Most of the patients of postoperative biliary leakage were managed conservatively and by endoscopic procedures and rarely requiring reoperation.

**Patient's consent form**

I do hereby voluntary agree to participate in the study titled "Study of post cholescystectomy biliary leakage and its management'.

I have been counseled appropriately about the study. I also agree to share the necessary information required for this study.

**Signature of Patient/Attendent**

Name :

Date :

## REFERNECES


Adamsen S, *et al*, 1997. Bile duct injury during laparoscopicholecystectomy : a prospective nationwide series. *J. Am Coll Surg*., 184: 571-578.

Anand. Profile of bile duct injury occurring as a complication of laparoscopic / open bile duct injury, 2011.

Andersson R, Tranberg KG, Bengmark S. 1988. Isolated intraperitoneal accumulation of bile after surgical or diagnostic procedures. May-Jun; 154 (5-6) : 375-7.

Balija M, Huis M, Nikolic, V, Stulhofer M. 1999. Laparoscopic visualization of the cystic artery anatomy. *World J Surg*., 23, 703-707.

Bektas H, Schrem H, Winny M, Klempnauer J. 2007. Surgical treatment and outcome of iatrogenic bile duct lesions after cholecystectomy and the impact of different clinical classification systems. *Br J Surg*., 94:1119–1127. (PubMed)

Bismuth H, 1984. Postoperative stricutures of the bile duct. In Blumgaart LH (ed) : the biliary tract : clinical surgery international. Edinghburgh, Chruchill Livingstone, pp. 209-218.

Bjorn Tornquvist. 2013. Iatreogenic bile duct injury during cholecystectomy.

Braasch JW. 1958. Congenital anomalies of the gallbaldder and bile ducts. *Surg Clin North Am*., 38-627.

Brooks DC, *et al*, 1993. Management of bile leaks following laparoscopic cholecystectomy. (Thesis) Paris, 1980, No. 25, p. 50.

Carroll BJ, *et al.* 1996. Routine cholangiography reduces sequelae of common bile duct injuries. Surg endoscopic 10: 1194-1197.

Chapman WC, *et al*. 1995. Postcholecystectomy bile duct stricutres. *Arch Surg*., 130 : 57-604.11

Chow S, Bosco JJ, Heiss FW, Shea JA, Qaseem T, Howell D. 1997. Successful treatrment of post-cholecysectomy bile leaks using nasobiliary tube drainate and sphicterotomy. Oct, 92(10) : 1839-43.1.

Courtney M. Townsend Jr., *et al*. 2012. Sabiston Textbook of Surgery, 19 th edition, Saudners.

Cuschieri A, Dubois, F, Mouiel J, Mouret P, Becker H, Buess G, Trede M. Troidl H. 1991. The European experience with laparoscopic cholecystectomy. Mar; 161(3) : 385-7.

Davidoff AM, *et al*, 1992. Mechanisms of major biliary injury during laparoscopic cholecystectomy : *Ann Surg*., 215 : 196-208.

Deziel DJ, *et al*. 1994. 2014. Complications of laparoscopic cholecystectomy : A national survey of 4,292 hospitals and an analysis of 77,604 cases. J Am Coll Surg. 165:91-14.

Farquharson's Text Book of Operative Surgery, 8th edition, CRC Press.

Flum DR, Cheadle A, Prela C, *et al*. 2003. Bile duct injury during cholecystectomy and survivial in Medicare beneficiaries. *JAMA*, 290(16) : 2158-73.

Gigot J, *et al* 1997. The dramatic reality of biliary tract injury during laparoscopic cholecystectomy : An anonymous multicentre Belgian survey of 65 patients. Surg Endosc 11 : 1171-1178.

Healey JE Jr, Schroy PC. 1954. Anatomy of the biliary ducts within the human liver : analysis of the prevailing pattern of branching and the major variations of the biliary ducts. *Arch Surg*., 66 : 599.

Hemant Sharma, George Bird. Endoscopic Management of Postcholecystectomy Biiary Leaks. Discolosures 2011.

Hermann RE. Manual of Surgery of the Gallbladder, Bile Duct and Endocrine Pancreas. New York; Springer - Verlag, 1979.21

Kasper DL, *et al*. 2004. Harrison's Principles of Internal Medicine, 16th edition, MacGraw Hill.

Kum CK *et al*, 1996. Laparoscopic cholecystectomy for acute cholecystitis : is it really safe ? *World J Surg*., 20 : 43-49.

Lamah M, Karanjia ND, Dickson GH. 2001. Anatomical variations of the extrahepatic biliary tree: review of the world literature. *Clin Anat*., 14:167–172. (PubMed)

Lillemoe KD, *et al*, 1997. Major bile duct injuries during laparoscopic cholecystectomy : follow up after combined surgical and radiological management. *Ann Surg*., 225 : 459-471.

MacFadyen, JB, *et al*, 1998. Bile duct injury after laparoscopic cholecystectomy : the United States experience. *Surg Endosc*., 12:315-321.

Mattox KL, Feliciano DV, Moore EE. Trauma. 3rd ed. Stamford, CT: Applenton & Lange; 1996. pp. 515–519.

Mc Mohan AJ. *et al*, 1995. Bile duct injury and bile leakage in laparoscopic cholecystectomy. *Br. J. Surg.,* 82 : 307-313.

Michels NA. 1955. Blod Supply and Anatomy of the Upper Abdominal Organs. Philadelphia : Lippioncott.

Moosman DA. 1975. Where and how to find the cystic artery during cholecystectomy. *Surg Gynecol Obstet*., 141 : 769.

Moosman DA. and Coller FA. 1951. Prevention of trauamatic injury to the bile ducts : a study of the structures of the cystohepatic angle encountered in cholecystectomy and supraduodenal choldeohchostomy. *Am J Surg*., 32 : 132.

Morgenstern L, Wong L Berci G. 1992. Twelve hundred open cholecystectomies before the laparoscopic era. A standard for comparison. Apr, 127(4) : 400-3.32

Neidich R, Soper N, Edmundowicz S Chokshi H, Aliperti G. 1996. Endoscopic management of bile duct leaks after attempted laparoscopic cholecystectomy, Oct., 6(5) : 348-55.

Newman HF. and Horthrup JD. 1963. Extrahepatic biliary trat anatomy. *Wst J. Surg Obstet Gyuanecol*., 71-59.31

Nikolic V. 1967. Artere cystique recurrente. *Bull Assoc Anat*., 136, 739.

Northover JMA. and Terblanche J. 1979. A new look at the arterial blood supply of the bile duct in man and its surgical implications. *Br J Surg*., 66 : 379-384.

Olsen D, 1997. Bile duct injury during laparoscopic cholecystectomy. *Sureg Endosc*., 11 : 133-138.

Ooi LL, Goh YC, Chew SP *et al*. 1999. Bile duct injuries durng laparoscopic cholecystectomy : A collective experience of four teaching hospitals and results of repair. *Aust N Z J Surg*., 69(12) : 844-6.

Parke WW, Michles NA, Ghosh GM. 1963. Blood supply of the common bile duct. *Surg Guynecol Obstet*., 117-47.

Pitt HA, *et al*, 1989. Benign postoperative biliary strictures : operate or dilate *Ann Surg*., 210 : 417-425.

Ray CE Jr, Hibbeln JF Wilbur AC. 1993. Complications after laparoscopic cholecystectomy : imaging fingings. May, 160(5) : 1029-32.

Richardson MC, *et al*. 1996. Incidence and nature of bile duct injuries following laparoscopic cholecystctomy : an audit of 5913 cases. West of Scotland Laproscopic Cholecystectomy Audit Group. *Br. J Surg*., 83 : 1356-1360.

Roslyn JJ, *et al* 1993. Open cholecstectomy : a contemporary analysis of 42,474 patients. *Ann Surg*., 218 : 129-137.

Rossi RL, Tsaaso JI, 1994. Surg Cl N Am 74 : 825-841.44

Russell JC, *et al.* 1996. Bile duct injuries, 1989-1993. A statwide experience. Connecticut laparscopic cholecystectomy registry. *Arch Surg*., 131 : 382-388.

Russell RCG, *et al*. 2000. Bailey and love, Short Practice of Surgery, 23nd edition, CRC Press.

Savader SJ, *et al*. 1997. Laparsocopic cholescystectomy - related bile duct injuries : a health and financial disaster. *Ann Surg*., 225: 268-273.

Schwartz Text Book Surgery, 10th edition, MacGraw Hill, 2004

Shea JA, Healey MJ, Berlin JA, Clarke JR, Malet PF, Staroscik RN, Schewartz JS, Wiliams, SV. 1996. Mortality and complications associated with laparoscopic cholecystectomy. A meta-analysis, Nov. 224(5) : 609-20.57

Sheng R., Sammon JK, Zajko AB, Campbell WL. 1994. Bile leak after hepatic transplanation : cholnagiographic features, prevalence, and clincal outcome, Aug. 192(2) : 413-6.

Sicklikc JK Camp MS, Lillemoe KD, *et al*. 2005. Surgical management of bile duct injuries sustained during laparoscopic cholecystyectomy : perioperative resulrts in 2000 p (atients. *Ann Surg*., 241 (5) : 796-792.

Stewart L. and Way LW, 1995. Bile duct injuries during laproscopic cholecystectomy : factors that influence the result of treatment. *Arch Surg*., 130 : 1123-1129.

Strasberg SM, *et al.* 1995. An analysis of thje problem of biliary injury during laparoscopic cholecystectomy. *J Am Coll Surg.,* 180 : 101-125.

Stremple JF. 1986. The need for careful operative dissection in Moosman's area during cholecystectomy. *Surg Gynecol Obstet*., 163 : 169.

Suzuk T, Nakyasu A, Kausabe K, Takdea H, Honjo I. 1971. Surgical significance of anatomic variations of the hepatic artery. *Am J. Surg*., 122 : 505.

The Southern Surgeons Club, 1991. A prospective analysis of 1,518 laparoscopic cholecystectomies performed by southern US surgeons. *N Eng. J. Med*., 324 : 1073-1078.

Tocchi A, *et al*. 1996. The long term outcome of hepaticojejuncostomy in the treatment of benging bile duct strictures. *An Surg*., 224 : 162-167.52.

Tzovaras, G., P Peyser, and J Toouli. 2001. Minimally invasive management of bile leak after laparoscopic cholecystectomy.

Van Damme JKP. 1993. Behavioral anatomy of the abdominal arteries. *Surg Clin North Am*., 73(4) : 699-725.

Van Damme JP, Bonte J. 1985. The branches of the celiac trunck. *Acta Anat*., 122 : 110.

Vitellas KM, El-Dieb A, Vaswani K, Bennett WF, Fromkes J, Steinberg S Bova JG. 2001. Detection of bile duct leaks using MR cholangiography with mangfdipir trisodium (Tesalascan). Jan-Feb, 25(1) : 102-5.

Waage A. and Nilsson M. 2006. Iatrogenic bile duct injury : a population based study of 152 776 cholecystectomies in the Sweidsh Inpatient Registry. *Arch Surg*., 141(12) : 1207-13.

Waage A. and Nilsson M. 2006. Iatrogenic bile duct injury : a population based studfy of 1562 776 cholecystectomies in the Swedish Inpatient Registry. *Arch Surg*., 141 (12) : 1207-13.

Walsh RM, *et al.* 1998. Trends in bile duct injuries from laparoscopic cholecystectomy. *J Gastrointest Surg*., 2:458-462.

Way LW, Stewart L, Gantert W, *et al*. 2003. Causes and prevention of laparoscopic bile duct injuries. *Ann Surg*., 237:462.

Wherry DC, *et al*. 1996. An external audit of laparoscopic cholecystectomy in the steady state performed in medical treatment facilities of the department of defence. *Ann Surg.,* 224 : 145-154.

## MASTER CHART

| Serial No. | Name | Age (years) | Sex | Religion | Indication of Surgery | Postoperative | | Cause of biliary leak | | | | Type of treatment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Uneventful (Y/N) | Complication | CBD Injury | Cystic Duct Stump | Liver Bed | Undiagnosed | Roux-en-y | Choledoco-dudenostomy | Primary repairing | Conservative |
| 1 | S D | 36 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 2 | KD | 23 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 3 | I R | 55 | M | H | Others | Yes | - | - | - | - | - | - | - | - | - |
| 4 | KD | 42 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 5 | M P | 40 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 6 | S K | 50 | F | Mu | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 7 | S D | 35 | F | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 8 | S D | 55 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 9 | G M | 47 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 10 | S D | 19 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 11 | S D | 45 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 12 | N D | 28 | F | H | Others | Yes | - | - | - | - | - | - | - | - | - |
| 13 | PD | 55 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 14 | A K | 36 | F | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 15 | M D | 47 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 16 | S P | 45 | F | Mu | Acute | No | Bile leak | √ | - | - | - | - | √ | - | - |
| 17 | B M | 45 | M | H | Acute | No | Bile leak | - | - | √ | - | - | - | - | √ |
| 18 | R S | 62 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 19 | M K | 45 | M | Mu | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 20 | S K | 30 | F | Mu | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 21 | M T | 80 | F | CH | Others | Yes | - | - | - | - | - | - | - | - | - |
| 22 | A Y | 42 | M | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 23 | S D | 32 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 24 | S H | 59 | F | S | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 25 | P D | 42 | F | H | Acute | Yes | - | - | - | - | - | - | - | - | - |

## MASTER CHART

| Serial No. | Name | Age (years) | Sex | Religion | Indication of Surgery | Postoperative | | Cause of bie leak | | | | Type of treatment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Uneventful | Complication | CBD Injury | Cystic Duct Stump | Liver Bed | Undiagnosed | Roux-en-y | Choledoco-dudenostomy | Primary repairing | Conservative |
| 26 | A D | 42 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 27 | S D | 25 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 28 | GD | 55 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 29 | P D | 32 | F | H | Others | Yes | - | - | - | - | - | - | - | - | - |
| 30 | R D | 37 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 31 | A H | 52 | F | H | Acute | No | Bile leak | - | - | √ | - | - | - | - | √ |
| 32 | G D | 43 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 33 | A S | 42 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 34 | P D | 60 | F | H | Others | Yes | - | - | - | - | - | - | - | - | - |
| 35 | V D | 60 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 36 | LD | 30 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 37 | J D | 40 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 38 | B P | 35 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 39 | S S | 65 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 40 | S | 35 | F | Mu | Acute | No | Bile leak | √ | - | - | - | √ | - | - | - |
| 41 | A S | 42 | M | H | Acute | No | Bile leak | - | √ | - | - | - | - | √ | - |
| 42 | R D | 32 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 43 | B D | 28 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 44 | P D | 36 | F | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 45 | R Y | 52 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 46 | K D | 40 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 47 | S K | 40 | F | Mu | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 48 | K S | 64 | M | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 49 | N D | 33 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 50 | M | 35 | F | C | Others | Yes | - | - | - | - | - | - | - | - | - |

## MASTER CHART

| Serial No. | Name | Age (years) | Sex | Religion | Indication of Surgery | Postoperative | | Cause of bile leak | | | | Type of treatment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Uneventful | Complication | CBD Injury | Cystic Duct Stump | Liver Bed | Undiagnosed | Roux-en-y | Choledoco-dudenostomy | Primary repairing | Conservative |
| 51 | M D | 26 | F | H | Others | Yes | - | - | - | - | - | - | - | - | - |
| 52 | B K | 28 | F | Mu | chronic | Yes | - | - | - | - | - | - | - | - | - |
| 53 | G D | 55 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 54 | M D | 56 | F | H | chronic | Yes | - | - | - | - | - | - | - | - | - |
| 55 | M G | 67 | F | H | chronic | Yes | - | - | - | - | - | - | - | - | - |
| 56 | G D | 27 | F | H | chronic | Yes | - | - | - | - | - | - | - | - | - |
| 57 | U D | 40 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 58 | N D | 40 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 59 | A D | 32 | F | H | Acute | No | Bile leak | - | - | √ | - | - | - | - | √ |
| 60 | S B | 25 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 61 | M D | 60 | F | C | Others | Yes | - | - | - | - | - | - | - | - | - |
| 62 | R P | 40 | F | H | Acute | No | Bile leak | - | - | √ | - | - | - | - | √ |
| 63 | B D | 37 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 64 | G M | 38 | M | H | Acute | No | Bile leak | √ | - | - | - | √ | - | - | - |
| 65 | M D | 56 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 66 | S D | 35 | F | S | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 67 | G D | 50 | F | H | Others | Yes | - | - | - | - | - | - | - | - | - |
| 68 | S D | 40 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 69 | J D | 65 | F | H | Acute | No | Bile leak | - | √ | - | - | - | - | - | √ |
| 70 | A D | 40 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 71 | A R | 35 | M | Mu | Acute | No | Bile leak | - | - | - | √ | - | - | - | √ |
| 72 | N S | 48 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 73 | K D | 40 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 74 | S T | 31 | F | S | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 75 | D M | 55 | M | H | Others | Yes | - | - | - | - | - | - | - | - | - |

## MASTER CHART

| Serial No. | Name | Age (years) | Sex | Religion | Indication of Surgery | Postoperative | | Cause of bile leak | | | | Type of treatment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Uneventful | Complication | CBD Injury | Cystic Duct Stump | Liver Bed | Undiagnosed | Roux-en-y | Choledoco-dudenostomy | Primary repairing | Conservative |
| 76 | A S | 40 | M | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 77 | A M | 55 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 78 | M D | 30 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 79 | S D | 50 | F | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 80 | K K | 40 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 81 | G D | 25 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 82 | KD | 50 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 83 | B D | 45 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 84 | S D | 50 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 85 | S D | 50 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 86 | N D | 35 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 87 | L | 51 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 88 | S D | 29 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 89 | M T | 55 | M | C | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 90 | S | 32 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |
| 91 | S R | 62 | M | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 92 | K R | 41 | M | H | Acute | Yes | - | - | - | - | - | - | - | - | - |
| 93 | P D | 50 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 94 | SK | 29 | F | Mu | Acute | No | Bile leak | - | - | √ | - | - | - | - | √ |
| 95 | T B | 60 | F | Mu | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 96 | K R | 32 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 97 | G D | 30 | F | H | Acute | No | Bile leak | - | - | - | √ | - | - | - | √ |
| 98 | S D | 35 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 99 | M D | 50 | F | H | Chronic | Yes | - | - | - | - | - | - | - | - | - |
| 100 | R D | 21 | F | H | Acute | No | Haemo. | - | - | - | - | - | - | - | √ |

**Abbreviations:**
M = Male F = Female H = Hindu C = Christian M = Muslim S = Sarna Haemo.= Haemorrhage

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