MIRIZZI SYNDROME: HISTORY, CURRENT KNOWLEDGE AND PROPOSAL OF A SIMPLIFIED CLASSIFICATION

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ABSTRACT

The article describes modern methods of diagnosis and treatment of Mirizzi Syndrome. Despite a wide range of surgical methods for treating this syndrome, the results of treatment to date remain not entirely satisfactory. The presence of Mirizzi Syndrome in a patient during surgery increases the risk of intra- and postoperative complications. Difficulties in diagnosing Mirizzi syndrome, the risk of damage to the bile duct, several observations, as well as a fairly wide range of surgical treatment methods determine the relevance of studying this problem. The introduction of modern methods for diagnosing MS and the development of rational surgical tactics, depending on the type of syndrome, will make it possible to improve the treatment of patients with this complication of gallstone disease.

KEY WORDS: Mirizzi syndrome, bile ducts, diagnostics, computed tomography, retrograde cholangiopancreatography.

INTRODUCTION

Mirizzi syndrome (MS) is one of the least understood concepts in bile duct surgery. This is due to the rarity of this pathology. This disease occurs according to the literature, from 0.5 to 5% among all patients operated on for gallstone disease [6, 12, 13, 17]. In connection with the progress of biliary tract surgery, an increase in the incidence of cholelithiasis, interest in this problem has increased in recent years. However, there is still no consensus on the diagnosis and tactics of surgical treatment [1, 2, 7, 15]. MS is often diagnosed only during surgery, which increases the percentage of access conversion and the risk of trauma to the common bile duct [9, 18].

Who was pablo luis Mirizzi?

Pablo Luis Mirizzi was a surgeon from Argentina, born in the city of Cordoba on January 25, 1893 and deceased in the same city on August 28, 1964. Mirizzi, graduated from the Medical Sciences School at the National University of Cordoba in 1915; and in 1916 at 23 years of age defended his “Tesis Doctoral” entitled “Anemia Esplenica Cirrogena”. Mirizzi was a brilliant young doctor studying under the most prominent Argentinean surgeons of their time. At the age of 25 years; in 1918, he was appointed Assistant Professor of Surgery at the same university where he had studied. During the next few years, Mirizzi traveled abroad and visited the most important and renowned surgical centers of his time in the United States of America and Europe. After he returned to Argentina, he developed his professional, scientific and academic career and in 1926 he became Full Professor of Surgery [9, 10]. On June 18, 1931 Mirizzi performed the first operative cholangiography which is considered his main contribution to modern biliary surgery [9-11]. The

first description made by Mirizzi compatible with the syndrome that bears his name, was published in 1940 in an article dealing with a "physiologic sphincter of the hepatic duct" [12]; The most known and cited description of his syndrome was published in 1948 postulating the functional spasm of the "common hepatic duct sphincter", which he believed existed within the common hepatic duct, as the cause of the obstructive jaundice in patients with chronic or acute gallstone disease [13]. The syndrome that Mirizzi described, consisted of an uncommon and benign cause of obstructive jaundice, caused by a gallstone impacted at the Hartmann's pouch, gallbladder infundibulum or the cystic duct and its associated inflammatory process, thereby causing obstruction of the common hepatic duct [9,10,12,13]. Mirizzi, believed that the obstruction of the common hepatic duct was rather functional, and that the mechanical obstruction of the gallbladder infundibulum and consequent inflammatory process predisposed to the contraction of a "muscular sphincter" located in the common hepatic duct [9,10,12-14]. However, current knowledge has dismissed the presence of any sphincter, or even smooth muscle, in the common hepatic duct [10,14,15]. Pablo Luis Mirizzi was recognized during his lifetime as a great surgeon, a great teacher, and a great humanitarian physician. In 1955 he was named Honorary Professor of the National University of Cordoba, and in 1956, the "Sociedad Argentina de Cirugia" honored him the title "Cirujano Maestro". Afterwards, numerous surgical academies and societies around the world awarded him honorary memberships as well as many other honors. In 1957, the Assembly of the International Society of Surgery named Professor Mirizzi as President of the International Surgical Congress that was to be celebrated in Munich in 1959; this was the first time that a Latin-American surgeon had received such a high honor. Pablo Luis Mirizzi died in his city, Cordoba, on August 28, 1964. Besides his great contributions to surgery, he left his art collection to the "Museo Provincial de Bellas Artes Emilio Caraffa", donated his medical library to the Medical Sciences School of the National University of Cordoba, and established a biennial traveling surgical scholarship in biliary surgery to be awarded to distinguished young surgeons from Cordoba, Argentina [9,10].

Early and latest descriptions of the "Mirizzi syndrome".

The most common complications of chronic gallstone disease are acute cholecystitis, acute pancreatitis and acute cholangitis [1]. Other benign complications are unusual and include Mirizzi syndrome and gallstone ileus among others [1, 8]. The bizarre complications of gallstone disease described in the surgical literature of the late XIX century and early XX century are seldom found today due to the widespread use and availability of ultrasonography, which have led to early diagnosis and early treatment for patients with gallstone disease, consequently avoiding the development of those late complications [4, 8]. Professor Mirizzi, however, was not the first to describe the The cystic duct has become obliterated due to a chronic inflammatory process and the gallstones have eroded the gallbladder wall and formed a cholecystobiliary fistula corresponding to Mirizzi syndrome type Π according to the Csendes classification (original drawing from Annals of Surgery 1950; 132, page 300) M characteristics of benign obstruction of the bile duct with resultant jaundice. Partial duct obstruction secondary to an impacted gallstone and its associated inflammatory process was first described by Kehr [16] in 1905 and by Ruge [17] in 1908. Mirizzi [12] reported his syndrome for the first time in 1940, and in 1941 Levrat et al reported other cases. Finally the famous article that established the eponym of Mirizzi [13] for this condition was published in 1948. At the same time, other authors began to report other forms of complications related to long-standing gallstone disease, and in 1942, Puestow [19] reported the first fistula between the gallbladder and the choledochus in a series of 16 patients with "spontaneous internal

biliary fistulas", he described fistulas between the gallbladder and other abdominal and thoracic organs such as stomach, duodenum, colon and bronchus.

Pathophysiology.

The current concept of Mirizzi syndrome, includes the external compression of the bile duct and the later development of cholecystobiliary and cholecystoenteric fistulas as different stages of the same disease process [4,7,8]. Mirizzi syndrome can be caused by an acute or chronic inflammatory condition secondary to a single large gallstone or multiple small gallstones impacted in the Hartmann's pouch or in the gallbladder infundibulum and cystic duct [1,4,7,8,14,25]. A long cystic duct; parallel to the bile duct, and a low insertion of the cystic duct into the bile duct, have been regarded as predisposing factors for the development of Mirizzi syndrome. Recurrent impaction of gallstones will lead to repeated episodes of acute cholecystitis and will render the gallbladder initially distended with thick inflamed walls. Eventually the gallbladder will become contracted and atrophic, having thicker fibrotic walls if contracted. When the gallbladder becomes atrophic, it will degenerate into thick or thin atrophic walls; and in some cases the walls would be intimately adherent to the contained gallstones [1,2,25,27]. The close proximity of the acutely or chronically inflamed gallbladder to the bile duct could eventually lead to the fusion of their walls by edematous inflammatory tissue that in time will become fibrotic contributing to the external compression of the bile duct and leading to the characteristic obstructive jaundice seen with this condition.

Symptomatology and other clinical manifestations.

Patients with Mirizzi syndrome present with a mean age varying from 53 to 70 years, and are female with a frequency of around 70% of all cases. However, it may occur at any age and in any patient with gallstones [4,27,32]. Long-standing gallstone disease, with a median of 29.6 years of disease, has been reported for patients with Mirizzi syndrome [4, 33].

The main clinical manifestations of MS are pain in the right hypochondrium, jaundice and fever as a result of associated cholangitis [4, 8, 12]. It is practically difficult to isolate the clinical symptoms that distinguish this syndrome from others that occur with obstructive jaundice. Differential diagnosis is carried out with such diseases and conditions as choledocholithiasis, common bile duct cancer, gallbladder cancer, pancreatic cancer, pseudotumorous pancreatitis, compression of the common bile duct with metastatic lymph nodes, sclerosing cholangitis, etc. [3, 18]. Diagnosis of MS is developing in parallel with the progress of technical equipment in medicine. If at the origins of the description of the syndrome is only intraoperative cholangiography, now all new technologies are coming to the aid of the surgeon. Ultrasound examination (ultrasound) of the abdominal cavity is a routine method for detecting pathology of the pancreato-duodenal zone. This method is also a screening method for MS. But, according to different authors, the sensitivity of this method is quite low and varies from 4 to 46% [7, 8, 20, 21, 25]. Such characteristics according to the results of ultrasound, such as a shrunken gallbladder in the presence of dilated intrahepatic ducts with a normal size of the distal common bile duct, allow one to suspect SM at the initial stage of the examination [16, 20].

Methods of direct contrast enhancement of bile ducts have been the standard in preoperative diagnosis of MS for several decades. Among them, the most commonly used endoscopic retrograde cholangiopancreatography (ERCP) [1, 5, 7]. Hakim H. A. N. et al. (2020) indicate 100% sensitivity of this method in the diagnosis of Hassan R. et al. (2019) believe that the differential diagnosis between compression of the proximal part of the common bile duct and its stricture is of great importance for the choice of the scope of the operation. To exclude the tumor nature of the disease,

the authors propose to use a set of techniques, consisting of endoscopic papillotomy performed for diagnostic purposes, instrumental revision of the biliary tract and selective cholangiography of the deformed part of the duct. At the same time, the authors emphasize that the use of additional diagnostic techniques in general increases the invasiveness of the study, and therefore the indications for their implementation must be limited. Other methods of direct contrasting of the bile ducts, such as percutaneous transhepatic cholangiography (PTSC), cholecysto-cholangiography, are less relevant in the diagnosis of MS due to their higher invasiveness. In addition, when performing PTCG, difficulties arise in visualizing the distal common bile duct due to an obstacle located above [13, 14].

Despite the fact that ERCP plays a leading role in the preoperative diagnosis of SM, it should not be forgotten that approximately 6–22% of patients fail to cannulate the large duodenal papilla or achieve visualization of the entire common bile duct [1, 7]. Also, after ERCP and endoscopic retrograde papillosphincterotomy (EPST), there is a risk of severe complications such as pancreatitis, cholangitis, bleeding, and sepsis [7, 9, 30]. And although the likelihood of them is quite low, nevertheless, the risk of performing ERCP can be life-threatening. All this forces researcher to look for new, effective and safer methods. In recent years, non-invasive methods of preoperative diagnosis of MS, such as spiral computed tomography, magnetic resonance cholangiopancreatography, have been developing [9, 12]. Nagakawa T. et al. (1997) note that computed tomography (CT) does not provide any additional information in comparison with abdominal ultrasound or ERCP [21]. Only 79% of stones that are detected in the gallbladder by ultrasound can be visualized with CT [21]. However, this research method plays a significant role in the differential diagnosis with cholangiocarcinoma, gallbladder cancer, compression of the common bile duct by metastases in the hepatic hilus [9, 20]. There is another point of view on this research method. Nagakawa T. et al. (1997) in their work noted the high sensitivity, specificity and accuracy, 93%, 98% and 94%, respectively, of spiral computed tomography after performing infusion cholangiography.

Magnetic resonance cholangiopancreatography is a new and still poorly studied method for diagnosing MS. A number of authors consider this research method as the most promising for the verification of this syndrome [9, 21]. E.C.H. Budzinskiy S. A. et al. (2019) in their work talk about the advantages of laparoscopic ultrasound of the pancreatoduodenal region [9]. During surgery, if MS is suspected, this diagnostic method allows real-time construction of a multi-plane image of the bile ducts at different angles, but at present it remains inaccessible and insufficiently studied. In general, despite the variety of diagnostic methods, it is often not possible to diagnose MS before surgery. Such a situation during the operation can disorient the surgeon and create the danger of injury to the common bile duct, mistakenly considered to be the gallbladder or a wide cystic duct. Thus, the lack of universal preoperative methods for examining MS calls for the development of optimal diagnostic tactics. There are two main directions in the treatment of MS in modern surgery: X-ray endoscopic methods, surgical interventions. X-ray endoscopic techniques can be used as the first stage of a surgical procedure as a preoperative preparation or as an independent method of treating patients with MS in the case of a high anesthetic risk [2, 11]. Among the disadvantages of REV, the authors distinguish the following: radiation exposure to patients and staff; high cost of endoscopic and X-ray equipment; the impossibility of eliminating the narrowing of the lumen of the proximal common bile duct [2, 24].

According to the literature, the methods of operative access and options for operations in Mirizzi syndrome vary greatly: for example, some authors attribute this syndrome to absolute

contraindications to laparoscopic cholecystectomy [1, 2, 13]. Lledó J. B. et al. (2014) in a review of the literature on the use of the laparoscopic technique in MS indicates 40% conversion of access, 20% of complications, and 6% of reoperations [19]. However, there are a number of publications, the authors of which indicate the possibility of using the laparoscopic technique under certain conditions. So, Lai E. C. H., Lau W. Y. (2006) indicate the possibility of using the laparoscopic approach by an experienced surgeon only in the first type of MS [17].

The most common operation for the first type of MS is cholecystectomy, supplemented by drainage of the common bile duct [2, 17, 18]. In the presence of a biliary fistula, it is necessary to separate it with the subsequent restoration of the integrity of the common bile duct. As one of the options for closing the common bile duct defect, used by most surgeons, is the elimination of the common bile duct wall defect with a specially left part of the gallbladder [2, 10, 15] However, Waisberg J. et al. (2005) suggest that it is theoretically logical that the retained gallbladder tissue may increase the risk of developing residual choledocholithiasis [27].

Pugaev A. V. et al. (2019) in the presence of a cholecystobiliary fistula, it is recommended to perform plasty of the common bile duct with temporary stents. The authors explain the need for temporary stenting by the presence of long-term inflammatory changes in the area of the hepatoduodenal ligament, due to which MS can be considered as a "model of damage to the bile ducts." With significant damage to the wall of the common bile duct involved in the fistula, a number of surgeons indicate the need to form a biliodigestive anastomosis: choledocho-duodenoanastomosis, choledocho-jejunonastomosis, cholecysto-choledochojejunoanastomosis [22, 23].

During operations for MS, there remains a high risk of developing intra- and postoperative complications [1, 2, 6]. The most common complication after surgery for MS is stricture of the common bile duct. According to Zhang J., Perera P., Beard R. (2020) of 46 patients operated on with MS, stricture of the common hepatic duct developed in 6.5%. The results of operations on the so-called lost drainage, performed in four patients with the first form of MS ("stenosing" form), Vorobey A. V. et al. (2018) is rated as positive [27]. However, the reasons for the removal of drains from the ducts are immediately given, such as the development of jaundice, obstruction of the drains caused by the formation of small stones, the deposition of salts on the walls of the drainages and the accumulation of putty detritus, which leads to repeated attacks of cholangitis. The greatest difficulty for surgical treatment is presented by patients with significant destruction of the common bile duct wall. It is noted that the higher the degree of destruction of the common bile duct wall (III – IV type MS according to C.K. McSherry et al., 1982), the higher the level of postoperative mortality [2, 6, 26]. In type III – IV MS, most surgeons adhere to the position of the need to apply choledochojejunostomy.

Classification.

Before recognition of external compression of the bile duct and cholecystobiliary fistula as different evolving stages of the same disease process during the decade of 1980; in 1975, Corlette et a/231 classified the cholecystocholedochal fistulas in two types. Type I was defined when the fistula involved the Hartmann's pouch and the bile duct. Type II was defined when the gallstone dilated and eroded the cystic duct into the bile duct. McSherry et al in 1982, classified the Mirizzi syndrome into two types based on ERCP findings. Type I involves the external compression of the bile duct by a large stone or stones impacted in the cystic duct or in the Hartmann’s pouch. Type II consists of a proper cholecystobiliary fistula, caused by a gallstone or gallstones that have eroded into the bile duct. In 1989 Csendes et a'tn‘, modified the classification of McSherry by dividing

Mirizzi syndrome into four types. Csendes classification further categorized the cholecystobiliary fistula according to the extent of bile duct destruction. Csendes type I corresponds to McSherry type I, the external compression of the bile duct by an impacted gallstone in the gallbladder infundibulum or cystic duct. Mirizzi syndrome type II consists of a cholecystobiliary fistula resulting from erosion of the bile duct wall by a gallstone, the fistula must involve less than one-third of the circumference of the bile duct. Mirizzi syndrome type III consists of a cholecystobiliary fistula involving up to two-thirds of the bile duct circumference. Mirizzi syndrome type N is a cholecystobiliary fistula with complete destruction of the bile duct wall with the gallbladder completely fused to the bile duct forming a single structure with no recognizable dissection planes between both biliary tree structures. In 2007, Csendes added one more type to his classification that was later validated by Beltran and Csendes in 2008 [4]; the Mirizzi type V, which includes the presence of a cholecystoenteric fistula together with any other type of Mirizzi. Furthermore, Mirizzi type V a includes a cholecystoenteric fistula without gallstone ileus and Mirizzi type V b refers to a cholecystoenteric fistula complicated by gallstone ileus [4]. Other lesser known classification systems have been described over the last 25 years; such as acute vs chronic variant, anatomic variant of cystic duct vs no anatomic variant of cystic duct, and obstruction due to gallstones vs obstruction due to inflammation [14,30]. The incidence of the different types of Mirizzi syndrome according to Beltran and Csendes [4] is detailed in Table 3. Mirizzi type I is fairly common (10.5% to 51%) and Mirizzi N is rather uncommon (1% to 4%). Mirizzi V, however, could be present in up to 29% patients with any other type of Mirizzi. Recently, some authors have used the new addition to the former Csendes classification to describe their patients with complex cholecystobiliary fistulas and associated cholecystoenteric fistulas [27].

CONCLUSION

Thus, today MS is one of the complications of gallstone disease, in the diagnosis and surgical tactics of which there are a number of unresolved issues. Despite a wide range of surgical techniques for this syndrome, the results of treatment to date are not entirely satisfactory. The presence of MS in a patient during surgery increases the risk of intra- and postoperative complications. Difficulties in diagnosing Mirizzi's syndrome, the danger of damage to the bile duct, few observations, as well as a fairly wide range of surgical treatment methods determine the relevance of studying this problem. The introduction of modern methods for diagnosing MS and the development of rational surgical tactics, depending on the type of syndrome, will make it possible to improve the treatment of patients with this complication of cholelithiasis.

Conflict of interest.
The authors declare no conflicts of interest or special funding for the current study.

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