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REVIEW ARTICLE

Role of Robotic Surgery in the Treatment of Mirizzi Syndrome

George Chilaka Obonna, RK Mishra

ABSTRACT

Mirizzi syndrome (MS) is a rare complication of cholelithiasis. It presents as a spectrum of disease that varies from extrinsic compression of the common hepatic duct to the presence of a cholecystobiliary fistula. This dangerous alteration to anatomy if not recognized preoperatively has the potential to lead to significant morbidity and billiary injury particularly in the laparoscopic era.

Aim: To study the role of robotic surgery in the treatment of MS having in mind the various types of the syndrome.

Methods: Literature review from HighWire press, PubMed, Medline, goggle, SpringerLink, Wikipedia relevant documents, templates, forms, E-books and Cochrane database was conducted. Analysis of other publications and journals from robotic surgical institute was done, including live robotic surgery and robotic clinical videos.

Results: When a preoperative diagnosis is made through endoscopic stent insertion via endoscopic retrograde cholangiopancreatography (ERCP) with computed tomographic (CT) scan or intraoperative exploration and assessment with ultrasonography establishes Mirizzi types 1 or 2, the current robotic surgical system offers an effective treatment of the syndrome. With the ultra high magnification of the surgical field and the endowristed 7 degrees of refined movement together with an enhanced clinical capability and integration of electrosurgical device, detailed and careful cholecystectomy and even primary closure of common hepatic duct fistula can be perfected.

Conclusion: Combined endoscopic and robotic surgery is effective and safe in the treatment of MS types 1 and 2. Definitely robotics has a role to play in the treatment of MS. During cholecystectomy, partial resection is possible in order to extract the stones,visualize the bile duct and define the type and location of the fistula. T-tube could be placed distal to the fistula in the absence of a preoperative stent. However, complete removal of the gallbladder is now advocated because of the increased risk of malignancy in stone disease.

Keywords: Mirizzi syndrome, Robotic cholecystectomy, da Vinci, Endoscopic retrograde cholangiopancreatography.

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INTRODUCTION

It was in 1948, Argentinean surgeon Pablo Luis Mirizzi, Professor of surgery in Cordoba first described a syndrome of common hepatic duct obstruction in the setting of longstanding cholelithiasis and cholecystitis,[1] erroneously postulating that the extrinsic pressure and inflammation induced spasm of the common bile duct. The classic description of the disease includes four components: (1) A close parallel course of the cystic duct and the common hepatic duct, (2) an impacted stone in the cystic duct or the neck of the gallbladder (GB), (3) common hepatic duct obstruction secondary to external compression by cystic duct stone (and the surrounding inflammation), (4) jaundice with or without cholangitis.

Mirizzi syndrome (MS) is a rare complication of cholelithiasis with an estimated incidence of 0.05 to 2.7% and approximately 0.35% of cholecystectomies.[2-4] The main classifications of MS are by Csendes, Nagakawa and Sherry.

In the Csendes[5] classification:

Type 1: Those with external compression of the common hepatic duct by stone impacted in the cystic duct.

Type 2: Cholecystocholedochal fistula is present with erosion of less than one-third of the circumference of the common hepatic duct.

Type 3: Fistula involves up to two-thirds of the duct circumference.

Type 4: there is complete destruction of the common hepatic duct.

Types 3 and 4 by Nagokawa defined type 3 as hepatic duct stenosis due to a stone at the confluence of the hepatic cystic ducts and type 4 as hepatic duct stenosis as a complication of cholecystitis in the absence of calculi impacted in the cystic duct or GB neck.[6]

McSherry only talked about extrinsic compression of the common hepatic duct (type 1) and presence of cholecystobiliary fistula (type 2).[7]

Precise diagnosis may be difficult initially because the condition may be confused with choledocholithiasis and cholangitis. The classical ultrasound findings are of a contracted GB, dilated intrahepatic ducts and a normal common bile duct.

Although a rare condition, a combination of endoscopic retrograde cholangiopancreatography (ERCP) and robotic surgery will ensure proper treatment of the patient. The role of the current da Vinci surgical system is hereby highlighted from its operational intuition.

METHODOLOGY

This author was present in a live da Vinci Si robotic cholecystectomy performed by Professor RK Mishra at the

Third world association of laparoscopic surgeons conference in World Laparoscopy Hospital, DLF Cyber City, Gurgaon, Haryana, India (Figs 1 and 2). We also have previously studied the mechanism and operational ergonomics of the da Vinci surgical robot. References were also made from available clinical videos.

RESULTS

ERCP and or magnetic resonance cholangiopancreatography (MRCP) are usually used to define billiary images anatomically. Results of axial T2-weighted magnetic resonance imaging (MRI) in a patient having MS and fistula formation usually show pneumobilia and a suspicion of fistula. However, the result of the corona T1-weighted image with intravenous gadolinium in same patient usually confirms the presence of such fistulous tract. On the size of the defect with respect to the common hepatic duct diameter, results show that in the group of MS where a fistula is present; in type 2 the defect is smaller than 33% of the common hepatic duct diameter, type 3—the defect is 33 to 66% of the diameter of the common hepatic duct and type 4 the defect is 66% of the common hepatic duct diameter.

Results also show that nondiagnosis or diagnostic delay is usually common, especially in cases where there are no clinical suspicion and where there are no advanced imaging facilities. It is generally accepted that there is an increased risk of GB carcinoma in patients with stone disease. From the foregoing, particular attention must be focused on the histology of the cholecystectomy specimen retrieved during robotic cholecystectomy. Apart from open cholecystectomy and laparoscopic-assisted cholecystectomy, purely laparoscopic cholecystectomy had been done with limited value in complicated cases of stone disease. Robot-assisted cholecystectomy has now given way to robotic cholecystectomy. In most complicated GB diseases where multiple peritoneal adhersions and distorted anatomy are the rule, robotic retrograde cholecystectomy is an option. Preoperative ERCP and stenting of the bile duct is usually advised. The steps in the surgical procedure in a case of certain diagnosis includes; docking, inserting robotic bipolar forceps and hook, dissection of peritoneal adhersions, aiming at the right subcostal space, visualization of the fundus of the GB and GB exposure with careful dissection of the tissues around the GB, dissection and ligation of the cystic artery, retrograde cholecystectomy leading the way to the cystic duct, ligature of the cystic duct with stone retrieval and closure of fistula.

Port Positions of Robotic Cholecystectomy

Four ports are used like in conventional laparoscopic cholecystectomy with the telescope centered in the umbilical port (12 mm), one port in the epigastrum (8 mm), two other 8 mm ports, one midclavicula line below right costal margin and the second a little inferiolateral to it. For the robotic cholecystectomy because of the size of the robot the working angle is up to 90º and the distance to the target is up to 10 cm (Fig. 3) .

DISCUSSION

Treatment of MS depends on the type. In type 1 cholecystectomy with choledochostomy to remove the impacted stone is effective. While in type 2 closure of the fistula with absorbable material or choledochoplasty with the remnant of the GB can be performed. In type 3, choledochoplasty is recommended while type 4 will need a bilioenteric anastomosis. Robotic surgery is of value in the treatment of stage 1 and 2 in combination with preoperative ERCP and intraoperative robotic ultrasound useful in locating the impacted stone and to partially replicate the touch of the surgeons hand which will soon be embedded as sensors in the newer generation of robots.

Fig.1: Surgeon in robotic console

Fig. 2: Docking of robotic system

First, let us look at the capability of the current robot da Vinci. It has a dual console capability which enables two surgeons to work simultaneously in the surgical field. 3D HD vision with up to 10× magnification offering high level of visual acuity and good perception of depth of the hepatobilliary complex and carlot's triangle with no obscurity by the liver. The digital zoom and high definition of the operation field can detect pinpoint fistula better than the human eye. This offers an immense view of the Calot's triangle superior to laparoscopic and open surgery. It thus provides unsurpassed visual clarity for precise visualization of target anatomy or anomaly. Its endowrist instrumentation-a multiuse facility with natural dexterity available in 8 and 5 mm diameter ensures refined movement. The intuitive motion it provides is best for operation at the Calot's triangle where avoidance of billiary injury is paramount. It maintains a corresponding eye hand instrument tip alignment allowing for intuitive instrument control. Surgeons hand movements are scaled, filtered and seamlessly translated to the robotic arms and instrument (Fig. 4). In this type of complex surgery, with robotics there is perfect alignment between visual and motor axis thus preventing injury to the billiary system.

The ergonomic settings are well-customized with a surgeons touch pad offering comprehensive control of video, audio and system settings, unique user profile providing automatic recall for future cases (Fig. 5). A wide touch screen with telestration capability facilitates team communication with improved visualization of anatomy and instruments entering from the periphery. The integration with electrosurgical devices enables a bloodless surgery. The cross-quadrant access means that there are extended reach instruments offering improved arm range of movements. The implication is that in the same sitting the surgeon can conveniently cover all quadrants of the abdomen unlike in conventional laparoscopic setting. Thus, the current Si model updated da Vinci with all its enhancement like fluorescence imaging, lightweight intelligent camera head, boom compatible vision system, skills stimulator, multifunction energy control, remains unbeatable in task performance especially for complex surgery of MS type 1 and 2.

Operative cholangiography is advocated to improve the safety of cholecystectomy, but an accurate transcystic cholangiogram will not be possible in MS. A standard technique in open surgery for the difficult laparoscopic cholecystectomy was the fundus first approach. This can be replicated in laparoscopic surgery by the use of a liver retractor and means that exposure does not rely on traction on the fundus of the GB.[8] In MS, the GB is often fibrosed and contracted so that fundic traction gives relatively poor exposure of the hepatobiliary triangle. Also once the GB is freed from the liver, the obliterated Calot's triangle can be more easily evaluated. The highly magnified view combined with its modern technology makes robotic surgery superior in most cases.

Fig. 4: da Vinci surgical robot

Fig. 3: Portposition in robotic cholecystectomy

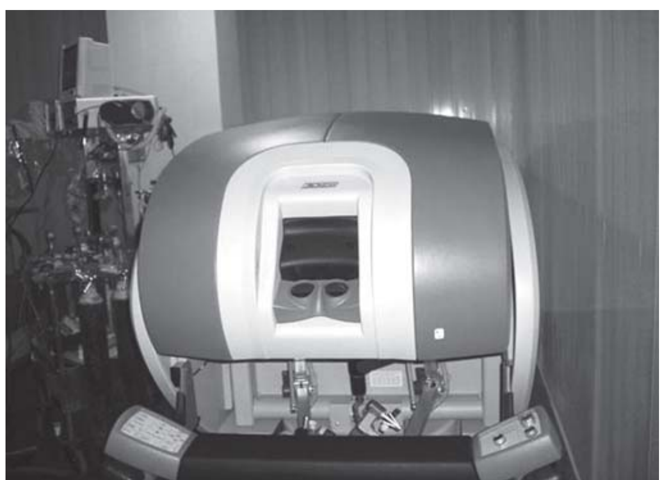

Fig. 5: Robotic console

Conversion or an open operation allows the use of proprioception or the touch of the surgeon's hand and is generally accepted as a way to improve the safety of any operation, especially one in which severe inflammation is present. To replicate this, hand-assisted laparoscopic surgery for MS has been advocated.[9] However, MS open surgery is associated with significant short- and long-term morbidity, and a difficult operation is not necessarily easier or safer when performed open.[10,11] With the recent advanced preoperative imaging, ERCP, current intraoperative robotic fluorescence imaging-compatible and sensors; robotics are now very relevant and useful in stone disease.

ERCP is used to make the diagnosis and insert a stent to alleviate the jaundice and allow planning of an elective operation. Stenting usually overcomes the resistance of the choledochal sphincter and this simplify and improves the safety of the operation. If ERCP is to be used as definitive treatment, sophisticated techniques may be needed for these cases, including the use of a 'mother and baby scope' and electrohydraulic or laser lithotripsy.[12] Any of these sophisticated ERCP techniques would require an endoscopic sphincterotomy. Since, the GB is to be removed anyway, it is preferable to leave the choledochal sphincter intact to avoid long-term risk of choledocholithiasis from a colonized biliary tract and papillary stenosis.[13] When it is not possible to stent the obstruction from below, a percutaneous transhepatic approach could be used. This would be relatively straightforward as the hepatic ducts may be dilated and would be a good strategy in patients unfit for surgery.[14]

There is an estimated five-fold risk of GB malignancy in MS compared with that in uncomplicated gallstone disease.[15] Prasad et al[15] found 5.3% of patients with MS had GB cancer compared with 1% in non-MS cases, and most were diagnosed on histology after cholecystectomy. If the patient is fit for surgery, the optimal management of MS must be complete removal of the GB with a wedge resection of the liver.[16] This is most possible in robotic surgery with ultrasound dissector because it possesses enhanced 3D HD vision with scaled filtered and refined pinpoint dissection strategy.

CONCLUSION

The da Vinci surgical robot has simplified what could have been a complex surgery because of its model technology. In combination with endoscopic stenting, robotics are useful in the operation of patients with MS types 1 and 2. Stenting overcomes the resistance of the choledochal sphincter and even if accurate closure of the opening in a friable and inflamed duct is not possible it should avoid the development of a significant biliary fistula. When there is danger of injury to biliary structures the more than human eye magnification of the operation field and the highly skilled, refined and controlled movement of the surgical robot is actually what is required to make the difference. The drawback of robotic cholecystectomy is the extra time taken to prepare the patient and docking, however, surgery once started does not take much time.

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REFERENCES

1. Mirrizi PL. Syndrome del conducto. J Int de Chir 1948;8: 731-33.
2. Waisberg J, Corona A, Luppinacci RA. Benign obstruction of the common hepatic duct: Diagnosis and operative management. Arq Gastroenterol 2005;42:13-18.
3. Yeh, et al. Laparoscopic treatment for Mirrizi syndrome. Surg Endosc 2003;17:1573-78.
4. Chan CY, Liau KH, Ho CK. Mirrizi syndrom: A diagnostic and operative challenge. Surgeon 2003;1:273-78.
5. Csendes A, Diaz JC, Burdiles P, Maluenda F, Nava O. Mirrizi syndrom and cholecystobilliary fistula: A unifying classification. Br J Surg 2005;76(11):1139-43.
6. Nagokowa T, Ohta. A new classification of Mirrizi syndrome from a diagnostic and therapeutic viewpoint. Hepatogastro-enterology 1997;44:63-67.

7. Mcsherry CK, Ferstenberg H, Virshup M. The Mirrizi syndrome. Suggested classification and therapy. Surg Gastroent 1982;1: 219-25.
8. Martin IG, Dexter SPL, Marton J, Asker J, Firulio A, McMahon J. Fundus first laparoscopic cholecystectomy. Surg Endosc 1995;203-06.
9. Wei Q, Shen LG, Zheng HM. Hand-assisted laparoscopic surgery for complex gallstone disease. World J Gastroenterol 2005;11:3311-14.
10. Hugh TB. New strategies to prevent laparoscopic bile duct injury-surgeons can learn from pilots. Surgery 2002;132:826-35.
11. Martin IG, Dexter SPL, Marton J, Gibson J, Asker J, Firulo A, McMahon MJ. Fundus–first laparoscopic cholecystectomy. Surg Endosc 1995;9:202-06.
12. Seitz U, Bapaye A, Bohnacker S, Navarrete C, Maydeo A, Soehendra N. Advances in therapeutic endoscopic treatment of common bile duct stones. World J Surg 1998;22:1133-44.
13. Jacobs R, Hartman D, Kudis V, et al. Risk factors for symptomatic stone recurrence after transpapillary laser lithotripsy for difficult bile stone using a laser with a stone recognition system. Eur J Gastroenterol Hepatol 2006;18:469-73.
14. Kelly MD. Acute Mirrizi syndrome. J Soc Laparoend Surg 2009;13(1):104-09.
15. Prasad TL, Kuma A, Sikora SS, Sexena R, Kapoor VK. Mirrizi syndrome and gallbladder cancer. J Hepatobiliary Pancreat Surg 2006;13:323-26.
16. Obonna GC, Njoku T, Okoro E, Osime U. Gallbladder carcinoma unassociated with cholelithiasis. Niger J Surg Sci 2007;7(2):113-15.

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