PAST PRESENT AND FUTURE LAPAROSCOPIC CHOLECYSTECTOMY

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HISTORY:

The earliest reference to laparoscopy dates back to biblical history. At that time classical Galenic medical tradition was based on the concept of maintaining homeostasis by balanced production and excretion of bodily wastes. Imbalance led to disease states. Classical restoration to normal balance was by means of purgatives and cathartics. Alternatively, surgically draining the abdomen of "bad humours" by means of trocar insertion was in vogue as described by Ezekiel and Celsus (25 BC - AD 50) [1].

Mouret from France performed the first human laparoscopic cholecystectomy in Lyon. On that day in March 1987 as he was completing a gynaecologic laparoscopy on a woman also suffering from symptomatic gallstones, he shifted his laparoscope to the sub hepatic area Upon finding a comparatively free and supple gall bladder he decided to remove it laparoscopically instead of opening up [1].

Now Laparoscopic cholecystectomy is one of the most commonly undertaken procedures in General Surgery with more than 500,000 performed annually. Overall, the complication rate is less than 1.5%, and the mortality rate is less than 0.1%. As such, laparoscopic cholecystectomy (Laparoscopic Cholecystectomy) was considered by most to be at its zenith since its inception in the early 1990 s [6]. Laparoscopic Laparoscopic cholecystectomy was the preferred surgical procedure since 1991 because of less morbidity , mortality and early return to work [7].

Laparoscopic Cholecystectomy is acceptable surgical alternative for high risk patient requiring cholecystectomy [8]. As the benefits of Laparoscopic Cholecystectomy there is reduction in emergency operation, morbidity and Intraoperative Cholangiography, fewer exploration of common bile duct, short stay in hospital and decrease of all costs [9].

PRESENT STATUS OF LAPAROSCOPIC CHOLECYSTECTOMY:

Now the laparoscopic cholecystectomy is the procedure of choice in all gall bladder diseases and there is increase in the skills of surgeons with newer equipments [12] . Laparoscopic Cholecystectomy now done by 3 ports [11]. 2 ports Laparoscopic Cholecystectomy done by introducing a suture needle to fix the gall bladder to abdominal wall in the right hypochondrial region with 2 ports moreover these 3&2 Laparoscopic Cholecystectomy are low expensive and less scar formation than 4 ports Laparoscopic Cholecystectomy. . Although initially Laparoscopic Cholecystectomy in pregnancy was absolutely contraindicated but now during 2nd trimester Laparoscopic Cholecystectomy was performed with same low complications incidence of other patients but the disadvantages are poor ergonomic situations and limited intra-abdominal working space [23]. The conventional surgery with reduction in number of emergency operations and morbidity, fewer CBD exploration, shortened hospital stay, reduced all costs in expert hands and for cosmetic purposes [12],[13].

THE PROCEDURE OF LAPAROSCOPIC CHOLECYSTECTOMY

a) After induction of general anesthesia an oral-gastric tube is placed to decompress the stomach and a Foley catheter is used to drain the bladder of urine.

b) A small incision is made near the umbilicus and a needle (Veress) is inserted blindly into the peritoneal cavity.

c) Carbon dioxide is introduced in the peritoneal cavity through the Veress needle which is now insufflated to 15mm mercury pressure.

d) A trocar/port is placed into the now insufflated peritoneum and a laparoscope is introduced into the peritoneum which allows the inside of the peritoneum to be projected onto video screens on either side of the operating table.

e) Three additional trocar ports are now placed in the right upper quadrant under direct vision, two are 5mm in diameter and one is 10mm in diameter. It is through these ports that laparoscopic instruments, i.e., graspers, dissectors, scissors, etc. are introduced to separate the gallbladder from the liver bed and the biliary free. This is accomplished in the following fashion:

1) The end of the gallbladder is grasped and pushed up toward the diaphragm. This places the cystic dust and cystic artery on stretch and permits the necessary separation of these structures prior to ligating them. Unfortunately when the end of the gall bladder is placed on stretch it can tent up the common bile duct to which it is attached. To avoid this tenting up of the common bile duct and to gain better exposure of the cystic duct, common duct, cystic artery area (Triangle of Calot), a second grasping instrument is now used to grasp the proximal portion of the gall bladder (Hartmann's pouch) and retract it inferior laterally.

This now opens up the cystic duct-common duct junction and allows for safe identification and dissection of this area.

2) Once the cystic duct, common bile duct and cystic artery have been clearly identified and dissected free of each other and other fibrous and fatty tissue, it is now safe to ligate and divide the cystic duct and the cystic artery. This is done by inserting a clipping instrument through the 10mm port and placing two clips proximally and distally then cutting between the clips. With this accomplished the gall bladder is then separated from the liver by dividing the peritoneum between the liver and the gall bladder using electrocautery. The electrocautery can be attached to any number of dissecting instruments designed for this purpose.

Sharp dissection with electrocautery or laser light is very effective in both separating the gall bladder from the liver bed and stopping any bleeding which may be encountered during this part of the operation.

3) Once the gall bladder has been safely separated from the cystic duct, cystic artery and liver bed it is grasped and pulled out through one of the larger 10mm ports.[7]

2 PORTS, LAPAROSCOPIC CHOLECYSTECTOMY PROCEDURE :

Two-port laparoscopic cholecystectomy has been reported to be safe and feasible. However, whether it offers any additional advantages remains controversial. This study reports a randomized trial that compared the clinical outcomes of two-port laparoscopic cholecystectomy versus conventional four-port laparoscopic cholecystectomy. One hundred and twenty consecutive patients who underwent elective laparoscopic cholecystectomy were randomized to receive either the two-port or the four-port technique. All patients were blinded to the type of operation they underwent. Four surgical tapes were applied to standard four-port sites in both groups at the end of the operation. All dressings were kept intact until the first follow-up 1 week after surgery. Postoperative pain at the four sites was assessed on the first day after surgery using a 10-cm unscaled visual analog scale (VAS). Other outcome measures included analgesia requirements, length and difficulty of the operation, postoperative stay, and patient satisfaction score on surgery and scars. *Results:* Demographic data were comparable for both groups. Patients in the two-port group had shorter mean operative time and less pain at individual sub costal port sites , at the midsubcostal port site and at the lateral sub costal port site]. Overall pain score, analgesia requirements, hospital stay, and patient satisfaction score on surgery and scars were similar between the two groups , Two-port laparoscopic cholecystectomy resulted in less individual port-site pain and similar clinical outcomes but fewer surgical scars compared to four-port laparoscopic cholecystectomy. Thus, it can be recommended as a routine procedure in elective laparoscopic cholecystectomy.[14] ,[22]

FUTURE LAPAROSCOPIC CHOLECYSTECTOMY:

Robotic assisted Laparoscopic Cholecystectomy in specialized hospitals now performed successfully in the experimental animals and the volunteers. [13],[14],[15],[16] . and has a good and progressive future including the Robotic assisted Laparoscopy which is more save with less complications but very expensive than conventional Laparoscopic Cholecystectomy [17],[18],[20] ,there are also Endoluminal and Tansluminal surgery including extraction of gall bladder transanally, transvaginally ,transcolonic and transgastric with flexible endoscopic instruments these are till now experimentally performed . [19].

Transgastric Laparoscopic Cholecystectomy : This procedure performed on animals experimentally (pigs) by creating a pneumoperitoneum was created with a standard Veress needle and a 10-mm laparoscopic port was inserted into the abdomen for a 10-mm laparoscope (Karl Storz Endoscopy, Culver City, CA).

NOTES

Natural Orifice Translumenal Endoscopic Surgery™ (NOTES™) is a new type of surgical procedure currently being studied at research hospitals and facilities around the world. The idea of NOTES was developed several years ago in response to the concepts that patients would:

(1) realize the benefits of less invasive surgery by reducing the recovery time

(2) experience less physical discomfort associated with traditional procedures and,

(3) have virtually no visible scarring following this type of surgery. All of these advantages have spurred research and investigation forward, encouraging physicians and researchers to develop new equipment and techniques to use during NOTES procedures.

As an example, in natural orifice surgery the gallbladder might be removed through the mouth. The doctor would insert a tube down the esophagus, make a small incision in the stomach or digestive tract to gain access to the abdominal cavity and take the organ out by the same route. A range of procedures might be performed this way, such as gastric bypass, fallopian tubal ligation, removal of the ovaries and diagnostic work. Some operations might be done via the rectum, vagina, urethra or bladder as well.

Because NOTES is so new, research generally has been confined to animals, mainly pigs. Recently, however, human studies have emerged that report the procedures to be highly successful. Further studies involving a variety of procedures, under close supervision by medical experts and review boards, are being performed.

While this new series of procedures may seem a bit unorthodox, the safety and care of the patient is in the forefront as this technology develops. Constant oversight is in place to ensure the outcomes are monitored thoroughly and the new procedures are genuinely better than those currently used. Over time, NOTES procedures will be evaluated by physicians and patients; future use will be determined by the facts and results of the studies being conducted now.

The NOTES initiative is a joint effort of the American Society for Gastrointestinal Endoscopy (ASGE) and the Society for American Gastrointestinal Endoscopic Surgeons (SAGES). Together, these societies have formed the Natural Orifice Surgery Consortium for Assessment and Research™ (NOSCAR™), a group that provides guidance and oversight and evaluation of NOTES techniques and the related research required.

TRANS GASTRIC

An overtube was placed into the pig's mouth and advanced to the esophagus and stomach with a forward-viewing double-channel endoscope inside the overtube. An anterior gastric wall was punctured under direct laparoscopic observation using an endoscopic needle knife with a combination of 20 W coagulation and 30 W cut current. This opening was enlarged to 20-mm with a pull-type sphincterotome, and the endoscope was advanced into the peritoneal cavity, rotated, retroflexed, and advanced toward the gallbladder. The laparoscope was used to observe the position of the flexible endoscope and to facilitate its orientation inside the peritoneal cavity. Once the gallbladder was identified, a 10-mm laparoscopic port was inserted in the right upper quadrant of the abdominal wall under direct observation through the flexible endoscope, and a laparoscopic grasper was introduced into the peritoneal cavity to provide traction and facilitate exposure of the gallbladder .The cystic duct and artery were identified, and ligated with endoclips using a prototype endoscopic multiple clip applicator designed for use through the biopsy channel of the flexible endoscope The cystic duct and artery were transected between the clips using the needle knife or an isolated tip (IT) knife through the biopsy channel of the flexible endoscope The gallbladder was dissected from the liver with the isolated tip (IT) knife and the needle knife through the biopsy channel of the flexible endoscope and retrieved by withdrawing the flexible endoscope into the stomach and through the mouth. The gastrotomy was closed from inside the gastric lumen with endoclips by approximating the incision edges together under visualization through the laparoscope from inside the peritoneal cavity. [21]

Five pigs underwent hybrid minimally invasive cholecystectomies. There were no problems or complications related to insertion of the Veress needle and the laparoscopic ports, or with creation of pneumoperitoneum. Gastric puncture and gastric wall incision were easily performed under direct laparoscopic observation without any injury to adjacent organs. Direct laparoscopic observation facilitated manipulations and orientation of the flexible endoscope inside the peritoneal cavity. The gallbladder was identified in all cases without any difficulty, although gallbladder traction with laparoscopic forceps significantly improved visualization and access to the cystic duct and artery. Use of a double-channel flexible endoscope facilitated ligation of the cystic duct and artery by using two instruments at the same time: a clip applicator through one channel and grasping forceps through another channel. The endoscopic multiple clip applicator was easy to use and provided good hemostasis and reliably closed the cystic duct.

The double-channel endoscope also facilitated dissection of the gallbladder by allowing use of the grasping forceps through one channel and the needle knife through the second instrumental channel. The laparoscopic camera port was used only for observation. There was no need to use this port for additional instruments because it was possible to manipulate two different instruments simultaneously through the flexible endoscope.

All cholecystectomies were performed without complications. Gastric wall incision was successfully closed with 3–4 endoscopic clips under visualization through the laparoscope from inside the peritoneal cavity. Postmortem examination did not reveal any intraperitoneal complications. The cystic duct stump and artery were securely closed with the endoclips without any bleeding or bile leakage. The gastrotomy site was closed completely with endoclips without injury to the surrounding tissues. So this procedure is future endoluminal transluminal surgery for laparoscopic chlecystectomy. [19],[21]

Transgastric endoscopic surgery is a new and evolving approach that will require the cooperation of endoscopists and surgeons . Examples include transgastric gastrojejunostomy,appendectomy, or cholecystectomy, aswell as gastroplasty and bypass surgery for obesity ,this procedure also performed on humen .[25]

TRANS VAGINAL

The New York patient, 66, had her gallbladder removed on March 21 and is recovering well, said her surgeon, Dr. Marc Bessler, the director of laparoscopic surgery at Columbia University Medical Center. Dr. Bessler said he thought it was the first time the operation had been performed in the United States, and he plans to show a video of the operation at a gastroenterology meeting in Las Vegas on Sunday.

"Going through a natural orifice, the mouth or rectum or vagina, to get into the abdomen and do an operation, is being excitedly worked on by a whole lot of people," Dr. Bessler said, adding that companies were beginning to make special surgical tools for the operations and that doctors had formed an organization called Noscar (www.Noscar.org), which stands for Natural Orifice Surgery Consortium for Assessment and Research.

ROBOTIC LAPAROSCOPIC CHOLECYSTECTOMY ;

Robotic surgery is a new technology which may expand the variety of operations a surgeon can perform with minimally invasive techniques. We present a retrospective review of our first 100 consecutive robotic cases in children.

A three-arm robot was used with one camera arm and two instrument arms. Additional accessory ports were utilized as necessary. Two different attending surgeons performed the procedures.

Twenty-four different types of procedures were completed using the robot. The majority of the procedures (89%) were abdominal procedures with 11% thoracic. No urology or cardiac procedures were performed. Age ranged from 1 day to 23 years with an average age of 8.4 years. Weight ranged from 2.2 to 103 kg with a median weight of 27.9 kg. Twenty-two patients were less than 10.0 kg. Examples of cases included gastrointestinal (GI) surgery, hepatobiliary, surgical oncology, and congenital anomalies. The overall majority of cases had never been performed minimally invasively by the authors. The overall intraoperative conversion rate to open surgery was 13%. One case (1%) was converted to thoracoscopic because of lack of domain for the articulating instruments. No conversions or complications occurred as a result of injuries from the robotic instruments. Interestingly, four abdominal cases were converted to open surgery due to equipment failures or injuries from standard laparoscopic instruments used through non-robotic accessory ports.

Robotic surgery is safe and effective in children. An enormous variety of cases can be safely performed including complex cases in neonates and small children. Simple operations such as cholecystectomies have minimal advantages by using robotic technology but can serve as excellent teaching tools for residents and newcomers to this form of minimally invasive surgery (MIS). The technology is ideal for complex hepatobiliary cases and thoracic surgery, particularly solid chest masses.[17],[18],[24]

There is also micro-robot of the present invention provides a mobile robotic system to be used inside the body in minimally invasive surgery, particularly laparoscopy. The micro-robot according to the present invention may comprise various sensors including but not limited to, in various embodiments, sensors to measure temperature, blood or other fluids in tissue, humidity, pressure and/or pH. In addition, the micro-robot comprises one or more transceivers and imaging capability. In addition, in some embodiments, the micro-robot of the present invention may include one or more manipulators. Certain embodiments of the invention are adapted to fit through standard laparoscopic tools for use in the abdomen during laparoscopic surgery. The invention provides both teleoperated and non-teleoperated embodiments. [24]

DISCUSSION :

Laparoscopic Cholecystectomy now replace the conventional open surgery and progressing with new equipments and high facility and new procedures are used now.

Laparoscopic Cholecystectomy according to the our study is the preferred procedure now due to these advantages:

1. less morbidity and mortality . [7]

2. early return to work . [7]

3. better cosmotic results. [7], [13]

4. Laparoscopic Cholecystectomy is acceptable surgical alternative for high risk patient requiring cholecystectomy. [8]

5. Reduction in emergency operation, morbidity and Intraoperative Cholangiography, fewer exploration of common bile duct, short stay in hospital and decrease of all costs . [9]

But also we have disadvantages of Laparoscopic Cholecystectomy:

1.Poor ergonomic situations and limited movements. [13]

2.The conversion rate was 5.1%.

3.The overall morbidity was 7.1%.

4. The biliary morbidity was 0.45%:

5. Seven severe bile duct injuries were recognized at laparoscopy (0.28%) and four lesions were postoperatively diagnosed (0.16%). Bile leak unrelated to bile duct lesion occurred in 14 patients (0.7%), leading to five reoperations.

6.The mortality was 0.12% and was unrelated to the laparoscopic approach in two cases.[17]

In spite of these disadvantages and risk factors the struggles of progressing the procedures and manufacturing of new and advanced equipments for Laparoscopic Cholecystectomy including 3 or 2 ports Laparoscopic Cholecystectomy and increased skill of surgeons now to decrease the complications

The future Laparoscopic Cholecystectomy promising the patients for more advanced methods like ; Robotic assisted Laparoscopic Cholecystectomy using a robot and remote control with computerized system [17] ,[18] , [20]. There is a disadvantage in using Robot that there is a delay in setup of system and it is more expensive.

Endoluminal and Transluminal Endoscopic surgery is an experimental future procedure by transvaginal, transanal ,transgastric and transcolonic Laparoscopic Cholecystectomy which has more better cosmetic results.[19]

Laparoscopic Cholecystectomy is in continuous progress for better out come and less complications even in risky patients.

CONCLUSIONS :

Laparoscopic Cholecystectomy started in 1985 in Germany when 1st time performed till now show more advances and progressions in procedures and techniques with more advanced equipments. The current

procedures like 4 , 3 ports or 2 ports Laparoscopic Cholecystectomy are more safe , with less surgical complications, reduction in pain, better cosmoses and less conversion to open surgery, short stay in hospital and low cost than before and more acceptable by the patients. But the future Laparoscopic Cholecystectomy considering these advantages followed by the development of Robotic Laparoscopic Cholecystectomy and Transluminal Laparoscopic Cholecystectomy. This include transgastric, transvaginal, transcolonic and transanal. Incisionless Laparoscopic cholecystectomy are new procedures which are experimental and performed on animals and volunteers promising us with new methods of highly advanced techniques with very low complaints and incisionless operations.

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