CIRUGÍA ESPAÑOLA

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Original Article

Laparoscopic Biliopancreatic Diversion: a Surgical Technique in our Learning Curve

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ARTICLE INFORMATION

Article history:
Received January 5, 2011
Accepted February 14, 2011

Keywords:
Bariatric surgery
Laparoscopic surgery
Biliopancreatic diversion
Morbid super-obesity

A B S T R A C T

Background: We present our initial experience with the laparoscopic BPD technique for super-obese patients. Recommended tips on the technique are summarized.
Methods: A total of 35 super-obese patients were submitted to BPD by laparoscopy in November 2009 and June 2010 for the treatment of morbid obesity.
Results: All operations were performed by laparoscopy with no need to convert to laparotomy. No mayor complications and mortality related to surgery were observed.
Conclusion: The Scopinaro technique can be safely performed in super-obese patients by surgeons with special dedication for bariatric surgery and advanced skills in intracorporeal suturing and knot-tying.

Derivación biliopancreática laparoscópica: técnica quirúrgica en nuestra curva de aprendizaje

Palabras clave:
Cirugía bariátrica
Cirugía laparoscópica
Derivación biliopancreática
Superobesidad mórbida

R E S U M E N

Objetivo: Presentamos nuestra experiencia inicial con la técnica de Scopinaro mediante abordaje laparoscópico para el tratamiento de la superobesidad mórbida. Se repasan aspectos técnicos que hemos aprendido en nuestra curva de aprendizaje.
Métodos: Treinta y cinco pacientes con criterios de superobesidad mórbida fueron intervenidos de forma consecutiva en un centro concertado de segundo nivel en el periodo comprendido entre noviembre de 2009 y junio de 2010.
Resultados: Todas las operaciones se realizaron por laparoscopia sin necesidad de conversión. No hubo complicaciones mayores ni mortalidad.
Conclusión: La técnica de Scopinaro por laparoscopia se puede realizar en pacientes superobesos con seguridad en centros que incorporen cirujanos experimentados en el manejo de anastomosis y sutura laparoscópica intracorpórea.

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0009-739X/$ - see front matter

Introduction

Super morbid obesity is a disease defined by an excess in body fat with a BMI>50 kg/m^2, and is an indication for elective bariatric surgery in patients who do not present a contraindication for it.

Laparoscopic surgery reduces complications attributed to open bariatric surgery due to the surgical wound (eventrations, infections, seromas) and reduces the incidence of other complications such as pneumonia and atelectasis by promoting faster recovery. We therefore propose the widespread use of laparoscopic surgery for the management of super obesity, once we have achieved a satisfactory learning curve using simpler techniques, such as tubular gastrectomy, in patients with a BMI under 50.

Scopinaro et al[1,2] in 1979 published their excellent results from operations using a mixed technique in contrast to the restrictive techniques of the time. This began a fierce competition aimed at demonstrating which of the available techniques yielded the best long-term results. Based on the excellent results by Nicola Scopinaro on super obesity, we protocolised the use of this technique in patients with BMI>50 who did not present contraindications for laparoscopic surgery.

Our laparoscopic technique is similar to the Scopinaro technique as we perform a long Roux-en-Y loop with 300 cm alimentary limb and 60 cm common limb, which includes subtotal gastric resection (a gastric preservation variant described by Domene). However, gastrectomy was completed in 20% of patients for presenting antrum-body ailments with premalignant potential or intense antral gastritis.

Methods

Between November 2009 and June 2010, we performed 35 Scopinaro-type laparoscopic biliopancreatic diversions at a secondary care hospital that provide services for patients referred from the Spanish National Health System. None of the patients required a transfer to our tertiary university hospital for major complications, although there was one readmission for digestive haemorrhage associated with pancreatitis. There was no age limit but two patients were rejected by the anaesthetist at the centre in which the patients underwent surgery. One patient was rejected for severe restrictive respiratory disease and the other for heart disease with low ejection fraction. The age of the patients varied between 16 years and 60 years (mean 36 years). BMI varied between 50 and 66 (mean 55). Gender distribution was 86% (n=30) female and 14% (n=5) male.

Patient Positioning

All patients are monitored under general anaesthesia, and a vesical probe and two peripheral catheters are put in place. Compression bandages are applied to the lower extremities, and LMWH (Clexane® 40 sc/12 h; starting the first dose 12 hours after surgery) is administered to prevent deep vein thrombosis. At hospital discharge, all patients are administered Clexane® 40 sc/24 h for one month. During the first half of the surgery procedure, the patient is placed in leg holders at 0 degrees with the legs slightly bent. The surgeon and assistant stand on the patient's left, facing the monitor, which is placed on the patient's right flank.

During the second half of the operation, the monitor needs to be repositioned to the patient's right shoulder. The surgeon stands between the legs while the assistant normally stays on the patient's right, although sometimes he or she may be more comfortable on the left. Generally, the operation is completed with one surgeon and the help of a resident who assists with the camera. A second assistant is not necessary with this technique.

Trocar Placement

The pneumoperitoneum is set at 15 mm Hg and is performed with optical trocar (Endopath® XCEL™ Bladeless Trocar, Ethicon Endo-Surgery, Cincinnati, OH) in the left hypochondrium, thus avoiding the midline and any possible complications related to the large vessels.

For our technique, we use four trocars (Endopath® XCEL™ Bladeless Trocar, Ethicon Endo-Surgery, Cincinnati, OH). The first 12 mm optical trocar is inserted into the left hypochondrium, some 10 cm from the costal margin (relatively low). We then place another 12 mm trocar supraumbilically (trocar 2) and another 12 mm trocar in the right hypochondrium (trocar 3), all of which are placed at the same height. The last 12 mm trocar (trocar 4) is placed in the left iliac fossa, positioned strategically with trocars 1 and 2 to allow proper triangulation for the first half of the procedure (Figure 1).

During the first stage of intervention, the camera is placed in trocar 1 and work proceeds on trocars 2 and 4 (at this time, we may also dispense with trocar 3). We have only occasionally needed to insert a subxiphoid trocar to separate the liver.

Figure 1 – The entry ports are shown along with the placement of the patient with the left arm close to the body.

Surgical Technique

During the first half of the procedure, the patient is placed in leg holders at 0 degrees with the legs slightly bent. At this time, the surgeon and assistant are positioned to the left of the patient. The first 60 cm from the ileocaecal valve are then measured (with trocars 2 and 4), in 10 cm steps with the help of two *Endo Clinch*® graspers. A reference point is placed using long unknotted silk to facilitate later location. Once we have measured the first 60 cm from the valve, we continue measuring in the same direction (towards the Treitz) until we reach 250 cm-300 cm. We then section the intestine, usually with one single 35 mm blue load (Endopath® ETS linear cutter, Ethicon Endo-Surgery, Cincinnati, OH). We then section the mesentery with a Ligasure ATLAS® (Valleylab, Covidien, Boulder, CO) up to the mesenteric root, taking great care not to injure the superior mesenteric artery (Figure 2).

The biliopancreatic limb is now proximal and at this point we perform the first jejunoileal anastomosis in the antiperistaltic side-to-side direction. To do this, we locate the reference point placed earlier at 60 cm and bring both limbs together with a 2-0 silk suture. We then open two small orifices with the help of endoscissors to insert the 35 mm blue endostapler (Figure 3).

Once this anastomosis has been completed, we close the entry orifice of the endostapler with continuous suture (2-0 silk) in two layers back and forth. We then close the mesenteric orifice with the same continuous suture up to the root of the mesentery which is sectioned to prevent the possibility of future internal herniation (Figure 4).

Once mesenteric closure is complete, the first half of the operation is finished. To start the second half, the monitor needs to be repositioned to the patient's right shoulder. The surgeon will then stand between the legs. The camera is introduced through the supraumbilical trocar. First, we prepare the gastric section. We have performed gastrectomy in seven patients, extracting the stomach through a trocar, which is performed without difficulty at the end of the operation. The gastric section is prepared by opening the gastrocolic ligament to about 2 cm below the short vessels and opening a buttonhole in the lesser curvature with the help of the 1 0mm Ligasure ATLAS® (Figure 5).

Once gastrolysis has been completed, we locate the previously sectioned alimentary limb and bring it to the stomach to perform an antecolic and antegastric anastomosis some 5 cm from the lesser curvature (Figure 6), which is where it tends to stay most aligned. This gastrointestinal anastomosis will have a calibre of about 2 cm, which we will perform with a 35 mm endostapler (blue load) in the same

Figure 2 – A) Resection approximately 300 cm-350 cm from the ileocaecal valve. B) The arrow indicates the biliopancreatic limb being pull by the surgeon's left hand with an Endo Clinch® to facilitate vertical sectioning of the mesentery without being deflected. C) Resection of the intestinal mesentery until traction is obstructed. This indicates that we are near the major mesenteric vessels. D) We reach the root of the superior mesenteric artery so as to take the alimentary limb up antecolically.

Figure 3 – A) A suture joins the biliopancreatic limb 60 cm from the ileocaecal valve. B) We open an orifice with monopolar energy using the endoshears. C) We introduce the 35 mm blue GIA to perform the anastomosis. D) Closure of the orifice through which the endoGIA was inserted in two planes.

Figure 3 – A) We initiate mesenteric closure with 2-0 silk. B) The suture is continuous, using little mesentery. C-D) Once we reach the closest point to the division of the cranial mesentery, we continue in the opposite direction (continuous back and forth suture).

Figure 5 – A) We start the resection of the gastrocolic ligament some 12 cm from the pylorus upwards until we measure 10 cm-12 cm from the His to the greater curvature. B) The buttonhole in the lesser curvature is performed from the posterior gastric wall, coagulating the left gastric artery branches. C) We section the stomach (in this case with Echelon 60 mm/3.8 mm). D) The alimentary limb is joined to the stomach with a suture. There tends to be tension, and for this reason we use the Endo Clinch®, which tractions from trocar 4 downwards.

manner as the jejunoileal one. To do this, it is important to make a 2-0 silk suture to bring the limb to the stomach so that the anastomotic staple line loses tension. We have always performed this anastomosis using double layer (silk - staples - silk) and checked with air injection through a nasogastric probe with prior flooding of the field with serum.

Results

Compression bandages were applied to the legs and DVT prophylaxis was administered to all patients. All patients without exception received prophylaxis with antibiotics for the first 24 hours (2 g Augmentine®) to prevent infection of the surgical wound. Surgical time ranged from 60 minutes to 160 minutes (average time of 92 minutes). There were no conversions although two patients presented challenges during surgery due to adherence syndrome and the need to perform laparoscopic adhesiolysis (one patient had previously undergone laparotomy for gynaecological peritonitis and another patient had been operated on for umbilical herniation). Although previous surgery may contraindicate this technique, it is important to note that entry with optical trocar and patience (in one patient, adhesiolysis was prolonged by 60 minutes) are the best allies when completing surgery. These two cases were performed after accumulating a certain amount of experience with the technique and we therefore felt no need to stage the surgery.

All patients were treated at a second tier hospital in a special bariatric surgery programme so as to accelerate the waiting lists. All patients without exception spent the first night in the Intensive Care Unit. All had nasogastric probes (NGP) until the start of the transfer. Feeding began on the second day and patients were discharged on the third or fourth day (up to 50% of patients were discharged on the third day, ranging from 3 days to 10 days). Two patients had postoperative complications. The first had an infection at trocar 1 from which an alimentary limb segment of some 5 cm was extracted due to poor perfusion when sectioning the mesentery. The second patient had gastrointestinal bleeding and radiologically suspected mild pancreatitis, which was resolved without incidents. This last patient had to be readmitted for five days for blood transfusions with two red blood cell concentrates and pancreatitis control.

Prophylaxis of anastomotic mouth ulcer with Omeprazol® lasted six months in the absence of symptoms (only one patient prolonged its use despite normal endoscopy.) Smoking cessation was recommended for all smokers.

In terms of short-term follow-up (9 to 12 months), we had 15 patients with 0% incidence of marginal ulcers, 0% incidence of gastrojejunostomy stenosis, 3% readmission rate (one

Figure 6 – A) We prepare the first layer with continuous 2-0 silk sutures. We thus avoid most of the tension. B) Anastomosis calibrated at 2 cm as indicated by the dashed line. C) We close the open buttonhole with a 2-0 silk suture. D) Strengthening of the front stapled layer with a new suture line. The anastomosis is perfectly aligned.

patient) and 3% incidence of gastrointestinal haemorrhage (one patient). Patients had favourable bowel habits with an average of four stools/day.

Mortality was 0% and morbidity 8% (one case of fever with UTI, one case of gastrointestinal haemorrhage with melaena and another case of trocar infection that only required antibiotics for one week).

Discussion

There are several alternatives for surgical treatment of morbid obesity. However, the mixed techniques for the treatment of super obesity such as the Scopinaro and the duodenal switch are real challenges for surgeons. During the period from September 2009 to June 2010, we operated on 120 consecutive morbid obesity patients (35 of the operations for super obesity used Scopinaro laparoscopy) following the 1991 criteria of the National Institutes of Health.[3] In our programme, we used restrictive techniques up to a BMI of 50 (proximal gastric bypass and laparoscopic vertical gastrectomy), and mixed techniques when BMI exceeded 50. Mixed techniques have been shown to be superior in this subgroup of patients over time.[4,5] Recently, a meta-analysis[6] concluded that mixed techniques are the most effective in the medium to long term, with biliopancreatic diversions showing an average 74% weight loss at 10 years, which are enviable results.

Our intention is to present the surgical technique and discuss various issues of interest to surgeons dedicated to this condition. We believe that mixed techniques must be performed by interested surgeons not only because of the complexity of the training throughout the learning curve but also because of the special dedication needed for the follow-up, which must be individualised and lifelong. It is important that training takes place in centres of excellence with experience performing intracorporeal anastomosis safely (previous experience with the porcine model would be ideal). One of our team's surgeon performed a five-month hospital stay in centres of excellence for this purpose (Fresno Heart Hospital, California, and Hospital Weill-Cornell, New York, in 2007). At these centres, the surgeon learned the multidisciplinary handling and techniques of duodenal switch, proximal/distal gastric bypass, vertical gastrectomy and revision surgery. That is why our learning curve regarding surgery times and morbidity and mortality is very good compared to others published in the literature. We can therefore say that rotations in these centres reduce learning curves and undoubtedly improve patients' safety.

Technical Considerations

The technique we perform is a blend of what we have learned and our experience in open surgery using the Scopinaro

technique (more than 300 patients). We have simplified this technique, having previously reviewed the experience published in other series.

One of the most discussed steps in the literature concerns the method for taking the alimentary limb up to the stomach, both in gastric bypass and in biliopancreatic diversion (BPD).

Starting with the first case in our series, we have taken the alimentary limb up to the stomach above the transverse colon (antecolic). During surgery and when noting the shortening and/or thickening of the mesenteries, the surgeon may be concerned about the limb not securely reaching the stomach. Nevertheless, we have never had to resort to the retrocolic due to this problem. It is true that we have always noted a certain tension in gastrointestinal anastomosis, but this is not a problem and indicates that the horizontal gastric section was high and that the stomach will have the proper capacity for the technique (200 cc-250 cc). Another interesting fact is that it has not been necessary to divide the greater omentum (a technique proposed by Gagner[7] in antecolic gastric bypass) to take the limb up without problems. Generally, the limb is taken up without difficulty and the only problem is that this tension impedes the creation of the anastomosis. For this, the surgeon stands between the patient's legs during the second half and performs the anastomosis using trocars 1 and 3. It is sometimes necessary to pull the stomach with an Endo Clinch® grasper from port 4 to pull it downwards and facilitate this step.

Another issue that a surgeon may face is the mesenteric closure of Petersen's space. We have closed this space in fewer than 10% of our patients. We believe that by taking the antecolic limb up without dividing the greater omentum we create a large Petersen's space in which the limbs will not be subject to incarceration and much less to necrosis. A recent review[8] showed this possibility in the reconstruction techniques with Roux-en-Y, with a non-negligible rate. For this, we create a large Petersen's space and, as we measure the limbs, we place the proximal limbs to the left of the patient to minimise this possibility. Since intestinal division is performed in this technique some 350 cm from the ileocaecal valve, the intestinal tract is divided in half making it very difficult for the first jejunal loops to pass below the alimentary limb.

In the reviewed Scopinaro laparoscopy series, they also did not proceed to the closure of this space. In those cases where we closed this space (three patients), we applied the same technique described by Gagner[9] and we made sure to move the omentum upwards to see where to put the sutures in the transverse mesocolon.

Today most surgeons use white loads in the endostaplers when performing enteric anastomosis in order to prevent possible gastrointestinal bleeding. This is a fact worth noting since we could have avoided bleeding in the patient who required hospital re-admission and transfusion if we had used them. It is our objective to introduce them in the future, taking into account that we have certain limitations in material when operating in a private centre that provides services for patients referred from the Spanish National Health System.

We believe that tension in gastroileal anastomosis may predispose patients to leakage and/or postoperative stenosis, as has been previously reported in the literature. However, in our experience we have not seen a single case in point. To avoid tension in all cases, we performed the first posterior layer with silk, which allows us, among other things, to align it and avoid kinking. Additionally, we usually suture the lesser curvature to the sero-serous ileal loop to avoid kinking of the anastomosis, similar to the antiobstruction stitch described by Brolin.[10]

Moreover, gastroileal anastomosis is linear (endostapler) and is performed on the front side of the stomach using a 35 mm load and calibrated with a 2 cm diameter. With this we achieve two objectives: firstly, since this is the front side, the stomach empties more slowly and we achieve greater satiety with lower intake, and we also theoretically avoid the dumping syndrome, which we have not yet observed in our patients' follow-up. In terms of calibration, it is obvious that we achieve the same objective (early satiety due to the effort required for the stomach to empty itself). For this reason, when patients are discharged they are informed of the dietary restriction that they will soon notice. As a consequence, at the first visit one week after surgery, they are provided with a plan for a quality diet very rich in proteins. It is obvious that this type of diet should continue into the future since there is a risk of malnutrition if the patient is not fed properly. So far, we have not seen any negative aspects of front face gastric anastomosis such as the possibility of mouth ulcers and gastric dilation. We can confirm that vomiting and early dumping has not been a problem with our patients.

As support for our technique, we can certify that we operate on patients with morbid obesity using tubular gastrectomy and gastric bypass (40 to 50 BMI), but we have significant respect with the challenge of operating on patients with BMI>50 using laparoscopy. However, despite appearances, this technique is performed with "certain" safety since it involves performing anastomosis just like gastric bypass but avoiding high dissection in the stomach (approaching the angle of His), which sometimes tends to be difficult. The variant we perform with gastric resection and preservation described by Domene[11] further simplifies the technique and avoids the duodenal stump fistula. On this point, we believe that Scopinaro laparoscopy is not more difficult than proximal gastric bypass in a patient with a BMI<50.

Lastly, our results are similar to those published by other European series,[12-14] and our patients have presented few complications. Therefore, we believe that Scopinaro laparoscopy[15] is a relatively safe technique if we compare the possible complications with those of gastric bypass and/or certical gastrectomy. In our personal experience, we have more reasons to worry about high fistulas in the angle of His in vertical gastrectomy than a gastroenteric anastomosis dehiscence in a patient with BMI of 56 operated on with Scopinaro laparoscopy. This is because in the latter a complication of this type is theoretically easier to treat.

Conflict of Interest

The authors affirm that they have no conflict of interest.

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