SCIENTIFIC PAPER

Laparoscopy in Transplantation

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ABSTRACT

Background: Solid-organ transplantation has become the treatment of choice for patients with end-stage renal disease, end-stage liver failure, and some patients with type 1 diabetes mellitus. Similarly, surgical expertise and mechanical improvements have led to significant advances in laparoscopic surgery. Laparoscopic interventions are sometimes not pursued in transplant recipients due to the lack of strong supporting evidence for the use of laparoscopic techniques in these patients.

Methods: Using an extensive literature search, we review herein the available data on the utility of laparoscopic interventions in transplant recipients, with particular attention to the risks and benefits, indications, and contraindications for this complex patient population.

Results: Although randomized trials are few, multiple case reports indicate that many transplant recipients have benefited from laparoscopic interventions.

Conclusion: The well-known benefits of laparoscopy could be extended to transplant recipients.

Key Words: Transplantation.

INTRODUCTION

Laparoscopy has revolutionized the field of surgery. Many procedures previously performed with the open technique are now being performed with the laparoscopic approach. Decreased pain, shorter hospital length of stay, and a lower incidence of wound infections are some of the benefits associated with laparoscopy. Similarly, organ transplantation has revolutionized the care for many patients with end-organ failure. As scientific advancements progress, a select group of solid-organ recipients can be candidates and receive the well-known benefits of laparoscopic procedures. We review the current role of diagnostic and therapeutic laparoscopy in solid-organ transplant recipients.

POSTKIDNEY TRANSPLANTATION

Posttransplant Lymphoceles

Posttransplant lymphoceles occur in approximately half of kidney transplant recipients. About 1% to 10% of these lymphoceles become symptomatic requiring intervention. Treatment ranges from simple percutaneous aspiration to open surgical fenestration/marsupialization. Surgical fenestration can be done via the laparoscopic approach with short- and long-term results equal to results with the open technique and decreased hospital stay, decreased recurrence, and earlier return to work.[1–10]

Elements of the procedure include identification of the lymphocele, laparoscopic needle aspiration of the cyst for confirmation, precise incision of the cavity, lysis of all septa and loculations, and maintaining patency of the marsupialization. The critical step is proper identification of the lymphocele and surrounding vital structures (iliacs, ureter, bladder).[2] Various techniques have been used to aid in accurate localization of the lymphocele such as intraoperative ultrasound,[8] percutaneous intracavitary instillation of methylene blue,[9] and opacification of the lymphocele wall via placement of an intracavitary fiberoptic endoscope.[10]

Native Kidney Nephrectomy

Clayman and associates[4] first described laparoscopic nephrectomy in 1991. Indications for the procedure are the

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same as those for open nephrectomy.[11,12] These include obstructive uropathy with hydronephrosis, renal cell cancer, uncontrolled renal hypertension,[13] and also autosomal dominant polycystic kidney disease,[14] which may require bilateral nephrectomy. These entities also exist in the posttransplant patient, for which laparoscopic nephrectomy has been utilized.[15]

In a study by Fornara and colleagues,[15] laparoscopic bilateral nephrectomy was retrospectively compared with open bilateral nephrectomy. The laparoscopic approach had longer operative times but shorter hospital stay, less analgesia requirements, earlier resumption of oral intake, and earlier return to work.

Laparoscopic Donor Nephrectomy and Robotic-Assisted Donor Nephrectomy

Live-donor kidney transplantation is associated with improved patient and graft survivals compared with deceased-donor kidney transplantation. Laparoscopic donor nephrectomy has been accepted as an alternative to the open surgical approach and is considered by many to be the gold standard for live-donor kidney donation.[16] The public acceptance of the laparoscopic approach has increased the availability of organs from the living donor population. The United Network for Organ Sharing (UNOS) data reveals that approximately 50% of kidney donors are living donors. The first laparoscopic living donor nephrectomy was performed at Johns Hopkins Bayview Medical Center in 1995.[17] In a 5-year follow-up on this technique, Ratner et al[18] found that the statistically significant advantages of the laparoscopic approach were decreased postoperative pain, decreased length of stay, a faster return to work and day-to-day activities, and better cosmesis with no adverse effects on kidney function.

The robotic-assisted approach has been used in several centers to procure the living donor kidneys with good results.[19] This technique offers the advantage of replicating the movements of the surgeon's hands with the robotic instruments, which allows the use and application of well-known open surgical techniques to the laparoscopic approach. Horgan et al[20] also found that the superior dexterity of the robotic-assisted approach helped in obtaining an increased length of the dissected vessels allowing the procurement of a better organ for transplantation. The main disadvantage of this technique is the cost of the robot and the increased operative time.

Laparoscopic Liver Biopsy, Liver Resection, and Radiofrequency Ablation

Hepatitis B and C infections are significant causes of morbidity and mortality in patients with end-stage renal failure and are associated with decreased patient and graft survival after kidney transplantation.[21] With the use of immunosuppressant drugs, kidney transplant recipients are at an increased risk of developing subsequent malignancies, including hepatocellular carcinoma.[22] Colon cancer is also a concern in the kidney transplant population. Most of the patients with a history of kidney transplant and subsequent colon cancer are found to harbor metastatic liver lesions at presentation.

Cheng et al[22] performed liver resections in 18 patients with hepatocellular carcinoma and previous renal transplant and found no difference in overall survival when compared with a group of patients with liver cancer and no renal transplantation. Two of the patients lost their graft 3 years and 8 years after liver resection.

Laparoscopic techniques are currently used to treat, diagnose, and stage patients with liver malignancy. The group at the University of Cincinnati[23] has performed over 100 laparoscopic liver resections for malignant liver disease in cirrhotic and noncirrhotic patients with acceptable morbidity and mortality rates. Radiofrequency ablation for nonresectable liver malignancies has been performed with the laparoscopic and hand-assisted approach with acceptable results.[24–26]

Laparoscopic liver biopsy, resection, and radio frequency ablation are procedures offered by many institutions for patients with previous kidney transplantation and the new onset of primary or metastatic liver lesions.

Management of Peritoneal Dialysis Catheters

Laparoscopic management of malfunctioning peritoneal dialysis catheters is another application of laparoscopy in posttransplant patients who still require peritoneal dialysis after a failed kidney transplant.

Kurihara[27] and Brandt[28] in separate papers describe laparoscopic and laparoscopic-assisted lysis of adhesions and peritoneal catheter management with a success rate of 96% described as a functioning catheter 30 days after surgery.

Renal Allograft Biopsy

Percutaneous biopsy of the transplanted kidney under ultrasound guidance is currently the standard of care for obtaining a kidney biopsy in patients with allograft dys-

function. In patients with clotting disorders, increased bleeding may be a risk. In such patients, performing the biopsy under direct vision with a laparoscope allows immediate intervention via percutaneously applied fibrin glue. Such an approach was reported by Fornara[29] in 6 patients with no complications noted.

Kidneys placed intraabdominally are sometimes difficult and unsafe to biopsy percutaneously. In these instances, laparoscopy may be utilized to safely obtain tissue for diagnosis.

Laparoscopic Cholecystectomy

Mouret performed the first laparoscopic cholecystectomy in a human in 1987.[30] At present, laparoscopy has practically replaced open cholecystectomy as the procedure of choice in gallbladder surgery. Hudson[31] published a case report in 1992 regarding its application in a postkidney transplant recipient, a contraindication to the laparoscopic approach at that time. A history of kidney transplantation is now no longer considered a contraindication to laparoscopic cholecystectomy.

Laparoscopic Appendectomy

Salomon[32] reported 2 cases of laparoscopic appendectomy in postrenal transplant patients, the diagnosis of which was made more complicated given the fact that in both cases, the transplanted kidney was placed in the right iliac fossa. Diagnosis and management was carried out expeditiously due to the availability of laparoscopy.

Laparoscopic Incisional Hernia Repair

Incisional hernias account for 80% or more of the ventral hernias repaired by surgeons, with a prevalence of 2% to 11% after laparotomy.[33] Laparoscopic ventral hernia repair offers advantages over the conventional open mesh repair and may decrease the hernia recurrence rate to 10% to 15%.

Birolini[34] reported the use of polypropylene mesh as an onlay mesh in reinforcing the primary repair of incisional hernias in kidney transplant recipients. No recurrences and no mesh-related complications were seen over a follow-up period of 1 to 3 years. A similar experience was reported by Mazzuchi[35] who found this technique to be safe and effective with no hernia recurrences observed over an average follow-up period of 18 months.

Summary of Laparoscopy in Postkidney Transplant Recipients

With the increasing longevity of kidney transplant recipients, the potential to present with other surgical problems seen in the general adult population will increase. Laparoscopy gives the transplant recipient another option with less morbidity and mortality.

As pointed out in previous studies,[7,16] transient and self-limiting oliguria has been noted in nontransplant patients with normal kidney function, which has been attributed to pneumoperitoneum-induced renal vein compression. Fornara[29] reported that there was no significant effect on postoperative urine output and serum creatinine in post-transplant patients who required a native kidney nephrectomy for various reasons. However, appropriate use of diuretics, steroids, and pre-, intra-, and postoperative monitoring of hydration are important considerations.[36]

POSTPANCREAS TRANSPLANTATION

Pancreas Allograft Biopsy

At present, the utilization of laparoscopy in postpancreas transplant patients appears to be limited to its use in evaluating allograft dysfunction via biopsy under the direct vision of the laparoscope. Most biopsies are currently done percutaneously under ultrasound or computed-tomographic guidance, or via cystoscopy. Transient hyperamylasemia, hematuria, and in 3% to 8% of patients major hemorrhage are the complications associated with these procedures. Open biopsy is traditionally the next option. Laparoscopy offers a feasible alternative to open pancreas allograft biopsy with less morbidity. Kayler et al[37] from Michigan published their experience with 12 laparoscopic pancreas allograft biopsies done in 11 patients with good technical success and minimal morbidity and mortality. Pancreas transplant recipients could still benefit from standard laparoscopic procedures.

POSTLIVER TRANSPLANTATION

Many reports of the laparoscopic management of the complications from kidney transplantation exist in the literature. Laparoscopy is easily applied in those situations given the fact that the dissection is extraperitoneal.[38] We review in this section the current applications of laparoscopy in the post liver transplant recipient.

Laparoscopic Lymphocele Drainage

Lymphocele is a rare complication of liver transplantation. Merenda[38] reported a series of 3 cases of lymphocele after orthotropic liver transplantation treated laparoscopically. All of the cases presented as a symptomatic right-sided pleural effusion. The diagnosis of a lymphocele was made by computed tomographic scan. In all 3 cases, access to

the abdominal cavity with the blunt trocar was easy due to the small number of adhesions present. Once the cyst was drained, the surrounding structures were easily examined with the laparoscope. All 3 patients had their drain removed after surgery with a complete resolution of the lymphocele and chest effusion.

Laparoscopic Lysis of Adhesions

Postoperative adhesions are common after any abdominal surgery, with an incidence between 12% and 17%.[39] It is a known cause of small bowel obstruction as well as other complications, such as pelvic pain, ureteral obstruction, and female infertility.[40] Laparoscopic adhesiolysis has many advantages over the open procedure including less postoperative pain, quicker recovery of bowel function, shorter hospital stay, and faster return to work. The conversion rate is between 6.7% and 43%.[39] In a report by Merenda,[38] 2 cases of postoperative obstruction after liver transplantation were treated by laparoscopy. One of the cases was converted to an open procedure after injury of the choledochojejunal anastomosis. The second case was successfully treated by lysis of a single band in the right upper quadrant. Access to the abdominal cavity was achieved with the use of the open trocar insertion technique. A limited number of posttransplant adhesions were found in all of the cases.

LAPAROSCOPIC INCISIONAL HERNIA REPAIR

As mentioned above, incisional hernias account for a large percentage of the hernias repaired by surgeons in the present.

Andreoni et al[41] reported the successful completion of 12 of 13 attempted incisional hernia repairs by the laparoscopic technique in liver transplant patients. Gore-Tex mesh was used. At the time of publication, they report no recurrence. They concluded that laparoscopic mesh repair of incisional hernias is practical and safe in patients with a surgical history of abdominal organ transplantation, with a low incidence of infections and no recurrence.

LAPAROSCOPIC ADRENALECTOMY

Laparoscopic adrenalectomy has become the standard of care for benign adrenal lesions.[42] The justification for removal of the adrenal gland is based on the size of the mass noting an increased risk of malignancy once the mass is >5 cm in diameter. The indications for laparoscopic adrenalectomy include nonfunctioning adrenal tumors, enlarging mass in serial examinations, solitary metastatic tumor to the adrenal gland, and functioning tumors like cortisol- and aldosterone-secreting tumors among others. Laparoscopic adrenalectomy is contraindicated in adrenocortical carcinoma.

Gill[43] reported a single case of a right adrenalectomy after liver transplantation. A 63-year-old female underwent orthotopic liver transplantation for primary biliary cirrhosis with portal hypertension. She had a surgical history of a left radical nephrectomy for a renal cell carcinoma 5 years before her transplant. Five years after her liver transplant, she was found to have a 5-cm nonfunctioning right adrenal mass suspicious for metastatic disease. Surgeons were able to complete a laparoscopic right adrenalectomy via the retroperitoneoscopic approach. They chose this method to avoid the peritoneal adhesions secondary to the prior abdominal procedure. The superomedial laparoscopic dissection was facilitated by the previous ligation of the adrenal vein during her liver transplantation. The patient did well and was discharged home on the first postoperative day.

LAPAROSCOPIC SPLENECTOMY

Laparoscopic splenectomy is the current standard of care in patients with a normal-sized spleen.[44] Conversion rates reported in the literature vary from 0% to 33%.[45,46] Indications for laparoscopic splenectomy include autoimmune disorders, hereditary hemolytic anemias, hematologic malignancies and disorders, such as Gaucher's disease, Felty syndrome, cysts, and tumors.[46]

Laparoscopic splenectomy is contraindicated in patients with severe cardiopulmonary disease and cirrhosis with portal hypertension. Previous abdominal surgery is only a relative contraindication. The abdomen should be entered using the Hasson technique.[47]

Splenic artery aneurysm is the most common splanchnic aneurysm, with an incidence of 0.1% to 10%.[47] The cause and physiopathology are not completely understood.[48] Some risk factors for splenic artery aneurysm include multiple pregnancies, portal hypertension, female gender, and fibrodysplasia.[47,48] The incidence of splenic artery aneurysms in liver transplant patients ranges from 7% to 17%. They are generally multiple (87%) and located in the distal third of the splenic artery.[49] The risk of rupture in these patients is 4%, and it increases to up to 9.6% when the aneurysm is >2 cm in size. The mortality rate for a ruptured splenic artery aneurysm varies in different series, being as high as 75% in pregnant patients.

The treatment of splenic artery aneurysm is surgical and varies from vascular reconstruction, ligation or resection

of the aneurysm, to splenectomy, depending on the location of the diseased segment. Deroover[47] reported the case of a 46-year-old female with a history of orthotopic liver transplant for primary sclerosing cholangitis 10 years prior, who complained of left upper quadrant pain. On her workup, an angiogram showed 2 intrasplenic aneurysms and 2 other aneurysms originating 1.5 cm from the splenic artery origin. The patient underwent percutaneous embolization of the aneurysms with a good result, but because the patient complained of persistence of her abdominal pain, a laparoscopic splenectomy was performed with an intraoperative time of 100 minutes and minimal blood loss. The abdomen was entered with the Hasson technique. The patient was discharged on postoperative day 3 free of symptoms.

Laparoscopic Treatment of Biliary Peritonitis

Biliary peritonitis after T tube removal in liver transplant recipients is not uncommon. The treatment is usually by percutaneous or nasobiliary drainage.[50] When this conservative treatment fails, laparotomy with lavage is usually performed.

As reported by Robles,[50] 2 cases of biliary peritonitis after T tube removal failed conservative treatment and subsequently a laparoscopic approach was used. The operative time was approximately 90 minutes in both cases. The abdominal cavity was entered with the open Hasson technique. Lysis of adhesions was carried out in the right upper quadrant. A Penrose drain was laparoscopically placed in both patients and 700 mL and 900 mL of bile were obtained. The drainage diminished in the following days, and both patients were discharged home on postoperative day 4.

CONCLUSION

Laparoscopy after solid organ transplantation is feasible. We described above some of its applications based on our experience and the limited literature currently available on this subject. Future applications of laparoscopy in these patients might include Roux-Y gastric bypass, Nissen fundoplication, colon resection, intracorporeal anastomosis, hysterectomy, jejunostomy, gastrostomy, and others.

Some of the benefits of the laparoscopic approach include reduced pain, shorter hospital stay, earlier mobility and return to work, better cosmesis, preserved pulmonary function, and a lower incidence of wound-related complications. Less tissue injury with the laparoscopic technique diminishes the hypermetabolic stress response of surgery by decreasing the energy expenditure, myocardial oxygen demand and renal workload. Overall, laparoscopic surgery offers chronically ill patients a good option for the treatment of their surgical disease.

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