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Abstract:	Severe aorto-iliac occlusive disease can cause disabling symptoms. The treatment of aorto-iliac occlusive disease has changed dramatically with the introduction of endoluminal techniques. However, according to the Trans-Atlantic Inter-Society Consensus for severe aorto-iliac disease, aorto-bifemoral bypass remains the therapy of choice. A recent addition to the open repair is laparoscopic-assisted aorto-bifemoral bypass, especially in occlusive arterial disease. In this article, we describe a new technique of performing gasless laparoscopic-assisted aorto-bifemoral bypass grafting with a self designed abdominal wall-lifting system. This was a patient with history of coronary artery disease and poor cardiopulmonary functional reserve. He had disabling symptoms of claudication and rest pain on bilateral lower extremities. He was diagnosed with aorto-biliac-femoral occlusive disease and underwent the gasless laparoscopic-assisted aorto-bifemoral bypass. The total procedure time was 260 minutes. The patient was extubated 5 hours postoperatively. The patient was discharged home 5 days after the surgery without complications. This procedure is attractive not only to minimize the length of the wound and the time to extubation, but also to avoid the possible lethal complications associated with the traditional laparascopic pneumoperitonium. This device and technique can also provide a bridge for young or less-experienced surgeons to be familiar with total laparoscopic aortic surgery from traditional open repair.

Title Page

Gasless Laparoscopic Aorto-bifemoral Bypass Grafting Using Self-Designed Abdominal Lifting System

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Abstract

Severe aorto-iliac occlusive disease can cause disabling symptoms. The treatment of aorto-iliac occlusive disease has changed dramatically with the introduction of endoluminal techniques. However, according to the Trans-Atlantic Inter-Society Consensus for severe aorto-iliac disease, aorto-bifemoral bypass remains the therapy of choice. A recent addition to the open repair is laparoscopic-assisted aorto-bifemoral bypass, especially in occlusive arterial disease. In this article, we describe a new technique of performing gasless laparoscopic-assisted aorto-bifemoral bypass grafting with a self designed abdominal wall-lifting system. This was a patient with history of coronary artery disease and poor cardiopulmonary functional reserve. He had disabling symptoms of claudication and rest pain on bilateral lower extremities. He was diagnosed with aorto-biliac-femoral occlusive disease and underwent the gasless laparoscopic-assisted aorto-bifemoral bypass. The total procedure time was 260 minutes. The patient was extubated 5 hours postoperatively. The patient was discharged home 5 days after the surgery without complications. This procedure is attractive not only to minimize the length of the wound and the time to extubation, but also to avoid the possible lethal complications associated with the traditional laparascopic pneumoperitonium. This device and technique can also provide a bridge for young or less-experienced surgeons to be familiar with total laparoscopic aortic

surgery from traditional open repair.

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Introduction

Endovascular repair for Trans-Atlantic Inter-Society Consensus (TASCII) type D aorto-iliac occlusive disease has gained popularity for its minimal invasiveness, but there are still many concerns about the long-term patency of the procedure[1-4]. Traditionally open surgical aorto-bifemoral bypass is still the preferred choice for these lesions. Due to its highly invasive nature, laparoscopy-assisted aorto-bifemoral reconstruction has matured to become one of the minimally invasive options that retain the advantages of open procedures to vascular surgeons, especially in terms of long term patency rates[5-7]. In our center, the open transperitoneal approach with gasless laparoscopy-assisted technique has been routinely used in general surgery since 2004[8-10]. We adopt the technique in abdominal aortic surgery and present herein our first case with gasless laparoscopy-assisted aorto-bifemoral bypass surgery.

Case Report

The patient was a 69-year-old male with history of atrial fibrillation, current smoker, gastric cancer and coronary artery disease status post subtotal gastrectomy and percutaneous coronary angioplasty. He had progressive worsening symptoms of claudication and rest pain after failed exercise training and optimal medical treatment. At this present admission, reconstructive computational tomography angiography

showed total occlusion of bilateral common and external iliac arteries, left external iliac, left superficial femoral artery and aneurysm formation of left internal iliac artery(Figure 1). Concerning about his comorbidities and long-term outcome of the disease nature, gasless laparoscopic aorto-bifemoral bypass using self-designed abdominal lifting systems was planned.

This patient was positioned in the supine position under general anesthesia. The operator stood on the right side of the patient, while the assistant stood on the left side. A 8-cm minilaparotomy was made in the midline of abdomen 3 cm above and 5 cm below the umbilicus. A wound protector was positioned over the minilaparotomy. The abdominal wall was then elevated by specially designed self-retaining retractors (Figure 2A). Three trocard ports were created at the bilateral lower quadrant region and suprapubic area (Figure 2B). The laparoscope was inserted either through the minilaparotomy or through any of the ports for thorough viewing of the distal abdominal aorta. A three-dimensional vision was obtained efficiently by direct viewing through the minilaparotomy and the laparoscopic image simultaneously. The intestine loops, transverse colon and stomach were retracted and packed circumferentially under the abdominal wall with the big gauze pad to facilitate dissecting the aortoiliac bifurcation by using electrocautery directly from minilaparotomy wound. The approach to the abdominal aorta was the same as that

performed through a open xiphopubic incision. After mobilizing the distal abdominal aorta, the patient was heparinized with 7,500 units to keep the activated clotting time above 300 seconds. We used atraumatic aortic clamp to partially clamp the aorta and sewing a bifurcated abdominal aortic graft (16-8-8, Hemasheild, Boston Scientific, Natick, Mass) to the distal abdominal aorta with the end to side fashion. The anastomotic suture was done with 3-0 prolene through either the minilaparotomy wound or trocard ports to facilitate the circumferential stitches under the aid of laparoscopy. Bilateral common femoral arteries were dissected free in the conventional way through two groin incisions. Transperitoneal tunnelings to bilateral groins were performed and the graft limbs were pulled out. The right common femoral artery anastomoses and additional profundoplasty were done with the end-to-end fashion. The left distal femoral artery anastomosis with end-to-side fashion was then performed

We placed two rubber tubes in a dependent area through the bilateral trocard ports and closed the abdominal wall in layers (Figure 2C). The whole procedure time was 260 minutes. The aortic clamp time was 30 minutes and the dissection of aorta took 32 minutes. No transfusion was necessary during the procedure. The patient was transferred to the intensive care unit and subsequently extubated in 5 hours. Peristalsis resumed in 20 hours after the surgery. Total intensive care unit stay was one day.

Antegrade coil embolization of the internal iliac artery aneurysm from the left brachial artery was planned 3 days after the surgery (Figure 3A) and the angiography showed patent aorto-bifemoral graft (Figure 3B).The patient was discharged home 5 days after the surgery with an uncomplicated recovery. In one year follow-up, this patient was symptom free and the vascular duplex showed patent aorto-bifemoral grafts.

Discussion

Surgical treatment is still the preferred treatment of recommendation for TASCII Type D aorto-iliac occlusive disease. Traditionally this is treated with open surgical bypass grafting. Due to the high invasiveness of open repair, the TASC II also notes increasing interest in the laparoscopic approach recently[11].

Gasless laparoscopy-assisted abdominal surgery was introduced in general surgery to cope with the more complex laparoscopic procedures without jeopardizing the benefits of a minimal-access approach in our center since 2004. In the gas-filling total laparoscopic system, the creation of a pneumo-peritoneum increased cardiac afterload and systemic vascular resistance. All of which might adversely affect the heart function in susceptible patients to a clinically significant degree[1, 12]. Moreover, difficulty in control of accidental massive bleeding and a steep learning curve were

still the major concerns in total laparoscopic aortic surgeries. Through the minilaparotomy made at the beginning of our procedure, the surgeon could perform dissection similar to traditional methods through direct vision. Direct control of the bleeding could be made easily, if needed, through the minilaparotomy, and vigorous suction could be accomplished through the ports or the minilaparotomy. The insertion of a hand inside the abdominal cavity restored tactile feedback to the operator and thus enabled the surgeon, by virtue of the restored tactile palpation and evaluation of the quality of the tissues (especially calcification of the arterial walls)[5]. The aortic anastomosis could be easily performed through these three ports circumferentially with traditional instruments. In the transperitoneal approach to the abdominal aorta, the custom-made abdominal wall lift also played a primary role for retraction of the intestinal loops. It permitted a quick exposure of tissues which was otherwise difficult to achieve by laparoscopic autostatic retraction systems.

Endovascular intervention was the treatment of choice for TASC type-A and B lesions but seldom tried in TASC C/TASC D lesions until recently[11]. In a review of these procedures, Karwowski and Zarins[2] concluded that the early results are promising but the endografts need further evaluation before being accepted into routine use. In an uncontrolled study comparing 32 patients who had aortobifemoral bypass against 40 patients who underwent aortoiliac stenting, Hans et al[1] concluded

that both modalities gave satisfactory results. However, aorto-iliac stenting was associated with reduced primary patency at 48 months (69±0.12% for aorto-iliac stenting and 93±0.07% for aorto-bifemoral bypass).

Conclusion

The aim of laparoscopic vascular surgery in the aortoiliac segment is to replicate the excellent outcomes of open aortic surgery while providing the advantages of minimal invasive surgery. In this article, we reported one patient who was successfully treated by gasless laparoscopy-assisted aorto-bifemoral bypass with a newly developed retraction device. We found that few difficulties were encountered. This gasless procedure not only enjoyed the benefits of total laparoscopic surgery, including faster recovery, less postoperative pain, fewer adverse cosmetic effects, but also preserved the advantages of open surgery, like direct vision, tactile sensation, the use of traditional instruments, and prevented potential adverse effects of pneumoperitoneum from gas-filling laparoscopic surgery. Before introducing a total laparoscopic repair for aortoiliac occlusive disease, this gasless laparoscopy-assisted procedure can be a good intermediate candidate before surgeons can familiarize with total laparoscopic approach and should be considered as option for aortic bypass when total laparoscopic repair is considered appropriate but not feasible.

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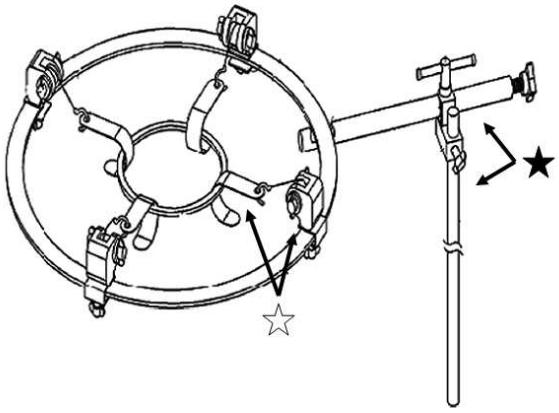

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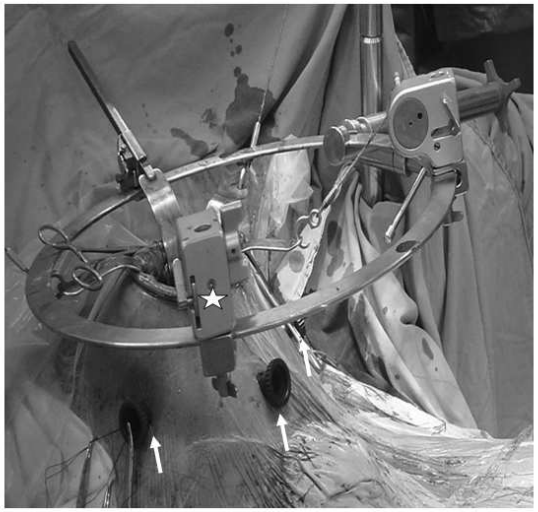

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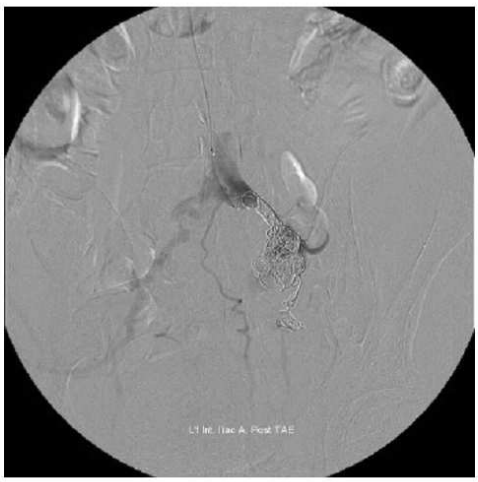

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Figure Legend

Figure 1: (A): Bilateral occluded common iliac arteries and external iliac arteries (Arrow). Left internal iliac artery aneurysm (Asterics). (B): Long segment total occlusion of left superficial femoral artery (Arrow)

Figure 2: (A): Gasless laparoscopic device setting. The specially designed self-retaining retractor (White asterics). Holder of the device locked on the side of operating table (Black asterics)(B): Three torcard ports (Arrow) and the specially designed self-retaining retractors (Asterics). (C):Minilaparoromy (Arrow, 8cm) and three trocard ports (Asterics) with rubber drains placed.

Figure 3: (A): Antergade coil embolization of left internal iliac artery aneurysm from the left brachial artery. (B): Patent aorto-bifemoral artery grafts