Clinics in Surgery

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Minimally Invasive Vascular Surgery

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Abstract

Technological developments in world medicine have given rise to an entire new range of new surgical techniques, particularly in the field of minimally invasive surgery. Laparoscopic, robotic end endovascular techniques represent latest technological procedures in vascular surgery. Minimally invasive vascular interventions are more sparing of the patient, reduce treatment and convalescence times and, finally, also reduce overall treatment costs.

Keywords: Laparoscopic; Robotic; Endovascular

Introduction

In comparison with other surgical fields, laparoscopy was introduced much later for vascular surgical interventions [1]. The primary reasons for the relative lack of interest by laparoscopic vascular surgeons were the difficulties associated with suturing of the vascular anastomosis, the long clamping times and complications in accessing the aorta and pelvic arteries. It would appear that the robotics that began to emerge after 2000 have opened up new perspectives for robot assisted laparoscopic interventions in vascular surgery [2-4]. Endovascular Aortic Repair (EVAR) has gained popularity for its minimal invasiveness and satisfying short-term results, but endoleak is a well-known EVAR-related complication that requires long-term follow-up. Since initial reports by Volodos, and Parodi of EVAR in 1993, there have been continuous technological improvements [5]. EVAR is associated with lower short-term mortality than Open Procedures (OSR). Individuals undergoing EVAR had a higher reintervention rate than those undergoing OSR. EVAR is widely accepted as the treatment of choice for patients with infrarenal AAA. However, the clinical significance of endoleaks is still present but there was a higher incidence of pulmonary complications in the OSR than in the EVAR technique. EVAR is subject to a number of limitations, including device restrictions in patients with anatomical variations as well as increased risk of future complications stemming from device implantation. The elective laparoscopic AAA repair could be favourable safety comparable with EVAR, with low conversion rates as well as similar mortality and morbidity rates. Elective laparoscopic AAA repair may have a role in patients who are unsuitable for EVAR before OSR [6]. Since 1998, laparoscopic surgery has been proposed for AAA treatment. The potential benefits of a minimally invasive aortic procedure have been many times reported. In our experience, laparoscopic surgery, EVAR and robotic surgery have been routinely used for the minimally invasive aortic surgery in our institution.

Discussion and Conclusion

The theoretical advantages of laparoscopic AAA repair are the reduction of the postoperative pain, the decreased small bowel manipulation, the higher peri- and post-operatively core body temperatures, and the quicker recovery. Laparoscopic surgery could be a little problematic due to the long vascular anastomosis resulting in long aortic cross-clamp times. Laparoscopic aneurysm repair is a technically demanding procedure, and only few surgeons experienced in laparoscopic vascular surgery have the required training. On the other hand, robotic technology has been used in cardiovascular medicine since the late 1990s. And vascular surgeons can perform a variety of robotically assisted operations to treat aortic, visceral, and peripheral artery disease. The time of aortic clamping and anastomosis is reduced considerably during the robotic-assisted aorta bypass surgery, and the dissection of aorta is completed successfully in totally robotic approach. The substantial advantage of the robotic aortic surgery is in the phase of arterial isolation, shorter clamping time and faster suturing of vascular anastomosis and no favorable anatomy compared with pure laparoscopic surgery [7]. The question addressed was how elective laparoscopic AAA repair compared to EVAR and robotic technique. Current evidence suggests that EVAR is the preferred surgical approach for AAA repair, due to shorter hospital stay and lower perioperative morbidity and mortality rates, as opposed to an open surgical approach [8] Figure 1. Despite this, EVAR is subject to a number of

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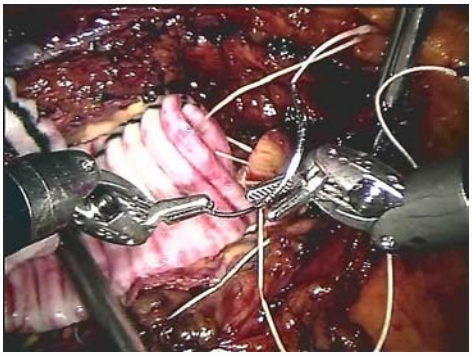

Figure 1: Robotic AAA (central anastomosis).

limitations, including device restrictions in patients with anatomical variations as well as increased risk of future complications. Robotic surgery represents the next step of laparoscopy with widely potential of aortic surgery, especially for no suitable anatomic position appropriate for laparoscopic surgery. Laparoscopy or robotic surgery can help for type II endoleak repair after endovascular aneurysm repair [9]. However, control of lumbar and median sacral arteries is technically difficult for laparoscopic but no for robotic surgery. The evidence suggests that elective laparoscopic AAA repair has a favourable safety profile comparable with that of EVAR, with low conversion rates as well as similar mortality and morbidity rates. Based on his experience of laparoscopic and robotic vascular surgery, the author has reflected on the advantages and disadvantages of robot-assisted reconstruction in aortoiliac surgery. On the basis of the outcomes more than 450 robot operated patients, the greatest advantage of the robot-assisted procedure proved to be the speed of construction of the vascular anastomosis. The robotic system has helped to eliminate the largest disadvantage of laparoscopic vascular reconstruction-lengthy clamping time. Reducing the time needed to construct the anastomosis also shortens the period of temporary ischemia of the lower limbs while the aortal clamps are being placed. This represents a significant reduction in the level of stress placed on the heart and muscular reperfusion and leads to better post-operative results, including morbidity and mortality. These times are now comparable to those of standard vascular surgery, and provide all the advantages of minimally invasive surgical techniques. Patients mainly benefit through shorter hospitalization and an early return to their normal activities and working life, which, in most cases, is not significantly restricted. Another important factor is the excellent cosmetic result. A further advantage of this method is that it can also be used with obese patients, where standard interventions are technically demanding and often involve problems with the healing of wounds after laparoscopy. The main disadvantage is still the high price, not only of the robotic system, but also of the individual instruments, which have a pre-determined life expectancy, and in the case of vascular surgery, the need to combine robotic and standard laparoscopy. Patients suffering from serious forms of obstructive pulmonary disease are not suitable for either laparoscopic or robot-assisted procedures, given the need for capnoperitoneum. A contraindication for capnoperitoneum automatically entails a contraindication for laparoscopic/robotic vascular procedures. Neither may patients be indicated for these interventions after major intra-abdominal operations with numbers peritoneal accretions, but, as has already been mentioned above, obesity is no longer a contraindication. In our institution we offer EVAR technique for patients with numerous co-morbidities and laparoscopic, robotic and OSR procedures for other patients. I conclude from the evidence available that elective laparoscopic AAA repair may have a role in the patients who are unsuitable for EVAR, but robotic surgery with shorter anastomosis and clamping times offer minimally invasive technique for patients unavailable for EVAR and laparoscopic procedures. Robotic systems have apparent advantages and good prospect in minimally invasive vascular surgery. According to the findings of this information's, laparoscopic and robotic surgical procedures are a safe, feasible, and worthwhile alternative for patients with AAAs [10,11]. It is imperative to initiate training programs to develop the required level of expertise with laparoscopic and robotic techniques.

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