

Extended Abstract

Mini-invasive robotic vascular
surgery

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Abstract

The da Vinci system has been used by a variety of disciplines for laparoscopic procedures but the use of robots in vascular surgery is still relatively unknown. The feasibility of laparoscopic aortic surgery with robotic assistance has been sufficiently demonstrated. Our clinical experience with robot-assisted vascular surgery performed using the da Vinci system is herein described. **Methods:** Between November 2005 and September 2015, we performed 342 robot-assisted vascular procedures. 245 patients were prospectively evaluated for occlusive diseases, 70 patients for abdominal aortic aneurysm, four for a common iliac artery aneurysm, five for a splenic artery aneurysm, one for an internal mammary artery aneurysm five for hybrid procedures, three for median arcuate ligament release and nine for end leak II treatment post EVAR. **Results:** 327 cases (95.6%) were successfully completed robotically; one patient's surgery (0.3%) was discontinued during laparoscopy due to heavy aortic calcification. In fourteen patients (4%) conversion was necessary. The thirty-day mortality rate was 0.3% and early non-lethal postoperative complications were observed in six patients (1.75%). **Conclusions:** Our experience with robot-assisted laparoscopic surgery has demonstrated the feasibility of this technique for occlusive diseases, aneurysms, end leak II treatment post EVAR, for median arcuate ligament release and hybrid procedures.

Petr Stadler is the Head of the Department of Vascular Surgery, Na Homolce Hospital in Prague, Czech Republic. He was certified as a console surgeon for the da Vinci surgical system in August, 2005 at the University of California, Irvine. He is a member of the Czech Association of Cardiovascular Surgery, the ESVS, the ISMICS, the SRS and a founding member of the International Endovascular and Laparoscopic Society. He has also received a few prestigious honors from the Czech Association of Cardiovascular Surgery for the best publications in 2004 and 2006, the Letter of Appreciation from Korean Society of Endoscopic and Laparoscopic Surgeons in May 2008, the price of the Czech Society of Angiology for the publication in the year 2007 and the best audio-visual presentation in 2009 in USA (ISMICS) and in 2013 in USA (SCVS). He performed also the robot-assisted vascular operations in South Korea, Russia, Poland and India.

Based on their experience of 150 robot-assisted vascular reconstructions, the authors not only reflect on the current uses of the da Vinci robotic system in vascular surgery, but also discuss

options for the further expansion of this cutting-edge technology in their area of expertise.

To date there has not been the same level of development in laparoscopy in vascular surgery as in general surgery and, despite the numbers of published studies showing interesting results, laparoscopic vascular surgery has never been generally accepted. Robot-assisted surgery represents a new stage of progress in mini-invasive methods. During the period November 2005–September 2009, the authors performed 150 robot-assisted vascular reconstructions in the aortoiliac area. The most significant include aortofemoral reconstructions and surgery on aneurysms of the abdominal aorta, the pelvic arteries and the splenic artery, as well as their first attempts to perform hybrid interventions.

Four cases (2.7%) required conversion to standard surgery and four patients (2.7%) experienced more serious postoperative complications. On one occasion (0.7%) the robotic equipment broke down during the operation and surgery had to be completed laparoscopically. In one case (0.7%) the operation had to be abandoned because the finding on the aorta proved to be inoperable. In the cohort under consideration, the median operating time was 228 min, the median time taken to suture the anastomosis was 27 min and the median clamp time was 39 min.

The aim of this study was to evaluate the clinical experience with 310 robot assisted vascular procedures. The da Vinci system has been used by a variety of disciplines for laparoscopic procedures but the use of robots in vascular surgery is still relatively uncommon.

From November 2005 to May 2014, 310 robot assisted vascular operations were performed. Two hundred and twenty four patients were prospectively evaluated for occlusive disease, 61 patients for abdominal aortic aneurysm, four for a common iliac artery aneurysm, four for a splenic artery aneurysm, one for a internal mammary artery aneurysm, and after the unsuccessful endovascular treatment five for hybrid procedures, two patients for median arcuate ligament release and nine for endoleak II treatment post EVAR. Among these patients, 224 underwent robotic occlusive disease treatment (Group I), 65 robotic aorta-iliac aneurysm surgery (Group II) and 21 other robotic procedures (Group III).

A total of 298 cases (96.1%) were successfully completed robotically. In 10 patients (3.2%) conversion was necessary. The 30 day mortality was 0.3%, and two (0.6%) late prosthetic infections were seen. Targeted Group I and Group II patients were compared. Robotic ilio-femoral bypass, aorto-femoral bypass, or aorto-iliac thrombo-endarterectomy with prosthetic patch (Group I) required an operative time of 194 (range, 127–315) minutes and robotic aorto-iliac aneurysm surgery (Group II), 253 (range, 185–360) minutes. The mean aortic cross clamping time was 37 minutes in Group I and

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93 minutes in Group II. The mean blood loss was more significant in Group II (1,210 mL) than in Group I (320 mL).

From a practical point of view, the greatest advantage of the robot assisted procedure has been the speed and relative simplicity of construction of the vascular anastomosis. This experience with robot assisted laparoscopic surgery has demonstrated the feasibility of this technique in different areas of vascular surgery.

Robotic operating systems improve the precision, control and dexterity of the surgical procedure and offer patients a higher quality of operating interventions.