ARTICULATED ROBOT FOR AORTIC DISEASE A BRIGHT FUTURE

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Disclosure

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I have the following potential conflicts of interest to report:

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Pioneers: transform dream in reality

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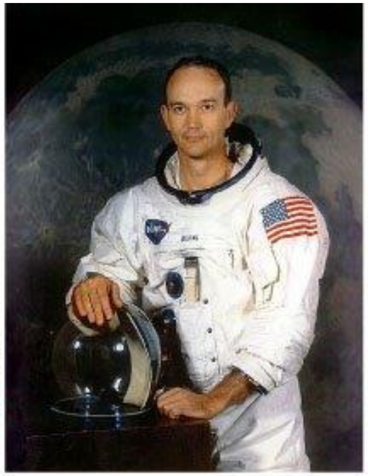

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Pioneers: transform dream in reality

FIRST STEPS IN AORTIC ROBOTIC SURGERY

Robot-assisted laparoscopic aortobifemoral bypass for aortoiliac occlusive disease: A report of two cases

Willem Wisselink, MD,[a] Miguel A. Cuesta, MD,[a] Carlos Gracia, MD,[b] and Jan A. Rauwerda, MD,[a]
Amsterdam, The Netherlands; and Los Angeles, Calif

This article describes the use of robotic technology in laparoscopic aortobifemoral bypass grafting. In two patients with disabling intermittent claudication on the basis of severe aortoiliac occlusive disease, laparoscopic aortobifemoral bypass grafting was performed with a proximal end-to-side anastomosis constructed with robotic arms that had been mounted on the operating table and were controlled from a separate console. No complications occurred. Operating times were 290 and 260 minutes, and aortic anastomosis times were 48 and 37 minutes, respectively. Blood loss was less than 200 mL in both cases. A normal diet was resumed on the second postoperative day, and the patients were discharged home on postoperative days 4 and 6. To our knowledge, this is the first report on robot-assisted laparoscopic aortobifemoral bypass in the world literature. (J Vasc Surg 2002;36:1079-82.)

Laparoscopic aortic surgery to date has not been widely embraced by vascular surgeons probably because of the highly specific technical skills needed especially in performing the aortic anastomosis.[1,2] Robotic technology has been shown to simplify endoscopic surgical manipulation by increasing the degrees of motion and facilitating hand-eye coordination and could therefore potentially stimulate acceptance of laparoscopic aortic grafting into the vascular surgical arena. We report two cases of robot-assisted laparoscopic aortobifemoral bypass grafting for aortoiliac occlusive disease.

PATIENTS AND METHODS

In two male patients, 53 and 56 years old, with disabling claudication and a walking distance of less than 80 m, angiography revealed occlusion of the entire left iliac trajectory and sequential stenoses on the right. Because of the extension of the occlusive disease, we chose to offer the option of primary laparoscopic aortobifemoral bypass grafting. Several years of experience with laparoscopic assisted aortofemoral bypass grafting with laparoscopic aortic dissection[3] followed by a "handsewn" aortic anastomosis via a 10-cm to 15-cm flank incision and a 4-month period of extensive in vitro practice sessions and animal experimentation with a robotic surgical system (Zeus, Computer Motion, Santa Barbara, Calif) preceded approval of our hospital Investigational Review Board and patient informed consent. On February 20 and 21, 2002, the two patients underwent robot-assisted laparoscopic aortobifemoral bypass grafting in the Vrije Universiteit Medical Center.

Surgical technique. With general anaesthesia, the patient was positioned with the left flank slightly tilted on a pillow to provide adequate access to the lateral abdominal wall. Three robotic positioner arms were connected to the operating table rails and prepared into the sterile field, one for a 30-degree endoscope (Aesop Endoscope Positioner, Computer Motion) on the right and two instrument arms on the left side of the patient, in such a fashion that interference with the insufflated abdominal wall was avoided (Fig 1). The arms then were simply rotated away to allow ample room around the table for the aortic dissection with conventional laparoscopic techniques. Via small groin incisions, the common femoral arteries were dissected free bilaterally. Laparoscopic retroperitoneal dissection of the aorta was performed after the creation a of a peritoneal "apron" that was being suspended to the anterior abdominal wall. This technique, with six 10-mm trocars, has been described in detail by one of the authors (CG).[1] Once the infrarenal aorta and its bifurcation were dissected free, lumbar arteries at the proposed site of aortic clamping were ligated with clips and the inferior mesenteric artery was temporarily controlled with a silastic loop to control back bleeding. After systemic heparinization, the aorta was clamped just distal to the renal arteries and just below the inferior mesenteric artery with laparoscopic aortic clamps that were positioned via separate stab incisions. A longitudinal aortotomy was made with laparoscopic scissors after a 14-mm × 7-mm polytetrafluoroethylene prosthesis was introduced into the retroperitoneal cavity via the lower median port. With robotic steered instruments consisting of a needle driver on the right and a grasper on the left and with a voice-controlled robotic positioned endoscope (Micro Joint Heavy Needle Driver, Micro Joint De Bakey

From the Department of Surgery, Vrije Universiteit Medical Center,[a] and the Department of Surgery, University of California at Los Angeles.[b]
Competition of interest: Computer Motion Corp, Santa Barbara, Calif, has provided a Zeus robotic system to the VU Medical Center at no cost to the institution. None of the authors have received financial support from Computer Motion.
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First steps in aortic robotic surgery

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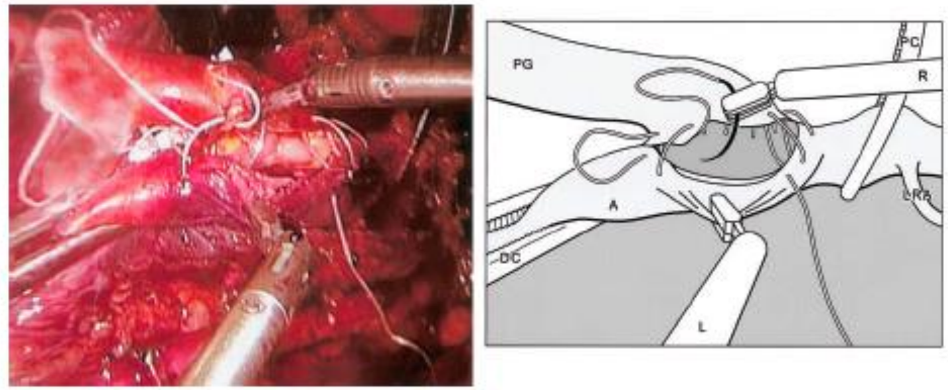

Fig 2. Aortic anastomosis in progress. *L*, Robotic grasper, controlled with left hand; *R*, robotic needle holder, controlled with right hand (note controllable angle between instrument and arm); *A*, aorta; *DC*, *PC*, distal and proximal aortic clamp; *PG*, prosthetic graft; *LRA*, left renal artery.

Fig 3. Surgeon performing aortic anastomosis from separate surgeon control console.

First steps in aortic robotic surgery

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Robotically Assisted Aorto-femoral Bypass Grafting: Lessons Learned from our Initial Experience

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Department of Vascular Surgery, Henri Mondor Hospital, Creteil, France

Objective. *The da Vinci™ Surgical System (Intuitive Surgical Inc., Sunnyvale, CA) is a computer-enhanced telemanipulator that may help to overcome some limitations of traditional laparoscopic instruments. This prospective study was performed to assess the safety and feasibility of robotically assisted aorto-femoral bypass grafting (AF).*
Methods. *Five patients undergoing elective AF were enrolled in this study. In three patients, a laparotomy of 6 cm was first performed, the aorta being exposed using an Omnitract® retractor. In two patients, aortic dissection was performed with laparoscopy, with the patient in a modified right lateral decubitus position. In all patients, the proximal anastomosis was attempted with the da Vinci™ system by a remote surgeon. The role of the assistant at the patient's side was limited to exposure, haemostasis and maintaining traction on the running sutures performed by the robot. Six weeks after the operation, all patients underwent a duplex scan of the graft.*
Results. *Mean operative time was 188 min. Robotically assisted aortic anastomoses were successfully completed in four out of five patients. In these four patients, adequate blood flow was observed within the graft with no need for conversion for haemostasis. In the fifth patient, despite an adequate laparoscopic aortic dissection, the anastomosis was impossible to perform due to external conflicts between the robotic arms. A conversion using conventional suture was successfully performed. No robot-related complications were noted. Six weeks after the operation, the duplex scans demonstrated a graft patency of 100%.*
Conclusion. *Robotically assisted anastomoses are possible by their unique ability to combine conventional laparoscopic surgery with stereoscopic 3D magnification and ultra-precise suturing techniques due to the flexibility of the robotic-wristed instruments using different motion scaling of surgeon hand movements. In addition, prior training in laparoscopic aortic surgery is not necessary for surgeons to obtain the level required for suturing. Further clinical trials are needed to explore the clinical potential and value of robotically assisted AF.*

Key Words: Laparoscopic; Robot; Vascular.

Introduction

Vascular surgical technology has progressively evolved in the direction of minimally invasive procedures for the treatment of aorto-iliac occlusive diseases. According to the TransAtlantic Inter-Society Consensus ($TASC_{[ICP1]}$), endovascular surgery is the treatment of choice for Type A focal lesions and the most currently utilized for type B and C lesions, although evidence of superiority over conventional surgery is still lacking.[1] Aorto-femoral grafting is considered to be the gold standard for treatment of diffuse aorto-iliac lesions (type D).[2] For this procedure, a 5-year patency of 90% in case of claudication, of 87.5% in case of critical ischemia has been described with combined morbidity/mortality greater than 10%.[3] To reduce the surgical trauma, laparoscopic aortic surgery was proposed by Dion in 1993.[4] Since then there have been an increasing number of reports describing different techniques of laparoscopic aortic surgery ranging from laparoscopically assisted procedures with minilaparatomy[5–7] or with hand port[8,9] to totally laparoscopic.[10,11]

However, the surgeon has to face a large number of technique-related challenges when performing an aorto-prosthetic anastomosis, which is exceedingly difficult to accomplish with the currently available endoscopic instruments and requires a huge amount of training.

The da Vinci™ Surgical System (Intuitive Surgical Inc., Sunnyvale, CA) is a computer-enhanced telemanipulator that may help to overcome some of the limitations of traditional laparoscopic instruments.

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First steps in aortic robotic surgery

In conclusion, this preliminary experiment demonstrates that robotically assisted anastomoses are possible and can minimize some of the difficulties and limitations associated with laparoscopic aorto-bifemoral by-pass. Precision of surgical technique is a significant advantage. Several problems became evident, such as cumbersome devices, interferences between the robotic arms and poor tactile feedback. Reducing these drawbacks should expand the use of robotic surgery in vascular surgery. However, minimally invasive surgery has now entered a new era by the introduction of the robotic surgery systems, which will offer all the benefits of endoscopic surgery to the patient, while surgeons regain the dexterity they experience in open surgery.

Is this the end of the road?

Why did you not continue this surgical adventure?

Mini-invasive surgery has good result

A comparison of total laparoscopic and open repair of abdominal aortic aneurysms

Frédéric Cochennec, MD, Isabelle Javerliat, MD, Isabelle Di Centa, MD, Olivier Goëau-Brissonnière, MD, and Marc Coggia, MD, *Boulogne-Billancourt, Hauts-De-Seine, France*

Objective: The feasibility of total laparoscopic abdominal aortic aneurysm (AAA) repair has been well established. In a previous case-control study, we showed that the postoperative courses of total laparoscopic and open AAA repairs were similar. The purpose of this study was to compare the long-term results of these techniques in the same cohort of patients.
Methods: Thirty patients with AAAs treated by total laparoscopic repair between July 2003 and December 2004 (group I) were matched in a case-control fashion by morphology and American Society of Anesthesiologists class with 30 patients who underwent open AAA repair between April 1997 and May 2004 (group II). Patients who survived the intervention were followed up during 5 years. Follow-up consisted of physical examination and duplex ultrasonography at 1 month and yearly thereafter. Group I patients had an additional control computed tomography scan within the first 3 months postoperatively.
Results: Five-year cumulative survival rates were similar (group I: 83% ± 7% vs group II: 79% ± 7%; log-rank test, $P = .69$). No late aneurysm-related death occurred during the follow-up period. Incisional hernias were more likely to occur in group II patients (group I: 0% vs group II: 15.4%; $P = .047$). Incidence of postoperative sexual dysfunction was similar in both groups (group I: 22.2% vs group II: 25.0%; P = not significant [NS]). No late reintervention was recorded in group I, whereas 2 patients in group II had incisional hernia repair. At 5 years, no graft sepsis or anastomotic pseudoaneurysm was reported.
Conclusions: This study suggests that total laparoscopic AAA repair provides good long-term results, comparable to those of open repair in terms of aneurysm-related mortality and morbidity. It may reduce the incidence of laparotomy-related complications. (J Vasc Surg 2012;55:1549-53.)

Total laparoscopic abdominal aortic aneurysm (AAA) repair has been proven to be feasible and safe once the initial learning curve is overcome.[1,2] In a previous case-control study, we showed that total laparoscopic and open AAA repairs were associated with similar in-hospital mortality and complication rates.[3] Laparoscopy reduced laparotomy-related adverse events, especially pain and ileus. After these encouraging results, we wanted to compare long-term results of laparoscopic and open AAA repairs. Multicenter prospective randomized studies are not yet available because few surgical teams have the required level of expertise in laparoscopic aortic surgery to start such studies.

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Author conflict of interest: none.
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Our purpose was to update the follow-up of patients included in our initial case-control study and to compare the 5-year results of total laparoscopic vs open AAA repair.

METHODS

Patient selection has been described previously.[3] Briefly, between February 2002 and December 2004, 52 patients underwent a total laparoscopic AAA repair. In order to reduce the impact of the learning curve, we only reviewed the last 30 patients of this series who were consecutively operated on between July 2003 and December 2004. This laparoscopic group (group I) was matched in a case-control fashion by AAA morphology and American Society of Anesthesiologists (ASA) class with 30 patients who underwent conventional AAA repair between April 1997 and May 2004 (group II). Vascular sutures and aneurysmorrhaphy in the laparoscopic group were performed by a senior surgeon (M.C.)

Clinical exclusion criteria for total laparoscopic and open aortic repair were ASA V patients, patients with recent myocardial infarction, unstable angina, coronary artery disease with severe coronary lesions unsuitable for intervention, tight aortic valve stenosis, uncontrolled congestive heart failure with left ventricular ejection fraction <40% and severe arrhythmias, patients with renal insufficiency

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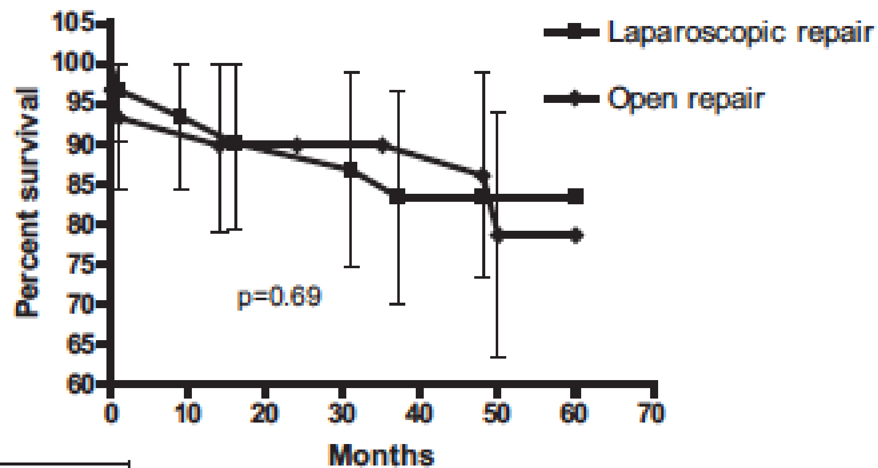

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Fig. Survival curves after total laparoscopic (group I) and open (group II) abdominal aortic aneurysm (AAA) repair.

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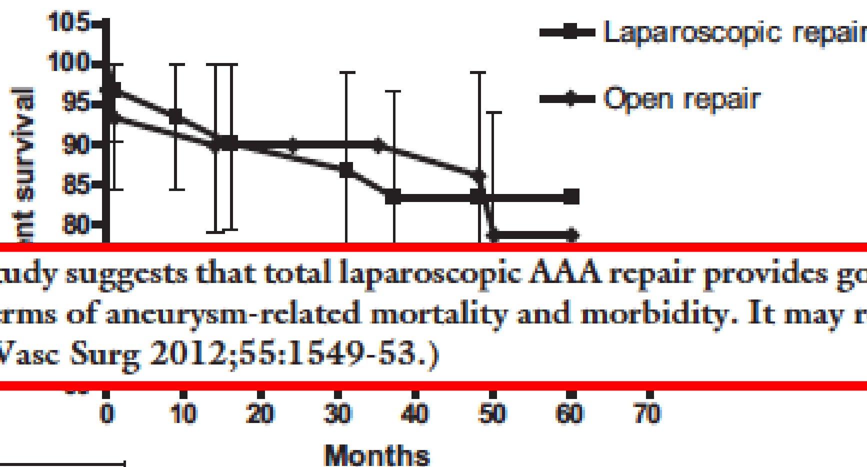

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Mini-invasive surgery is safe for our patients

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Laparoscopic versus Open Approach for Aortobifemoral Bypass for Severe Aorto-iliac Occlusive Disease – A Multicentre Randomised Controlled Trial

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ABSTRACT

Objectives: To investigate differences between open and laparoscopic aortobifemoral bypass surgery for aorto-iliac occlusive disease on postoperative morbidity and mortality.
Design: A multicentre randomised controlled trial.
Methods: Between January 2007 and November 2009, 28 patients with severe aorto-iliac occlusive disease (TASC II C or D) were randomised between laparoscopic and open approach at one community hospital and one university hospital (TASC = Trans-Atlantic Inter-Society Consensus on the Management of Peripheral Arterial Disease).
Results: The operation time was longer for the laparoscopic approach (mean 4 h 19 min (2 h 00 min to 6 h 20 min) vs. 3 h 30 min (1 h 42 min to 5 h 11 min); $p = 0.101$)). Nevertheless, postoperative recovery and in-hospital stay were significantly shorter after laparoscopic surgery. Also oral intake could be restarted earlier (mean 20 h 34 min (6 h 00 min to 26 h 55 min) vs. 43 h 43 min (19 h 40 min to 77 h 30 min); $p = 0.00014$)) as well as postoperative mobilisation (walking) (mean 46 h 15 min (16 h 07 min to 112 h 40 min) vs. mean 94 h 14 min (66 h 10 min to 127 h 23 min); $p = 0.00016$)). Length of hospitalisation was shorter (mean 5.5 days (2.5–15) vs. mean 13.0 days (7–45); $p = 0.0095$)). Visual pain scores and visual discomfort scores were both lower after laparoscopic surgery. Also return to normal daily activities was achieved earlier. There were no major complications in both groups.
Conclusion: Laparoscopic aortobifemoral bypass surgery for aorto-iliac occlusive disease is a safe procedure with a significant decrease in postoperative morbidity and in-hospital stay and earlier recovery.

According to the TASC II recommendations aortobifemoral bypass remains the best treatment for severe aorto-iliac occlusive disease TASC II C and D,[1] although this remains a discussion for some surgeons and interventionalists that will not be discussed in this study. The scope of this study is to evaluate the possible differences in morbidity and mortality between the conventional open and laparoscopic approaches if there is an actual indication for aortobifemoral bypass surgery.

Totally laparoscopic aortic surgery for occlusive disease started with YM Dion in 1995.[2] Since then the technique has matured. Instrumentation has improved and some modifications to the technique have been introduced. The technique as described by Coggia is by far the most used at the moment.[3]

Totally laparoscopic aortic surgery was introduced to reduce morbidity in analogy with the promising results of laparoscopic abdominal surgery.

Several publications of small or larger series have proven feasibility with acceptable short-term results, especially for occlusive disease.[4–7] However, till now there is no strong evidence that laparoscopic aortic surgery is less invasive than and as effective as conventional surgery. Therefore, after having completed the learning curve, we started a multicentre randomised controlled trial.[8]

Patients and Methods

Between January 2007 and November 2009 all consecutive patients necessitating an aortobifemoral bypass for severe aorto-iliac occlusive disease TASC II C or D at Hôpital St. Joseph, Charleroi, Belgium or at University Hospitals Leuven, Leuven, Belgium, were

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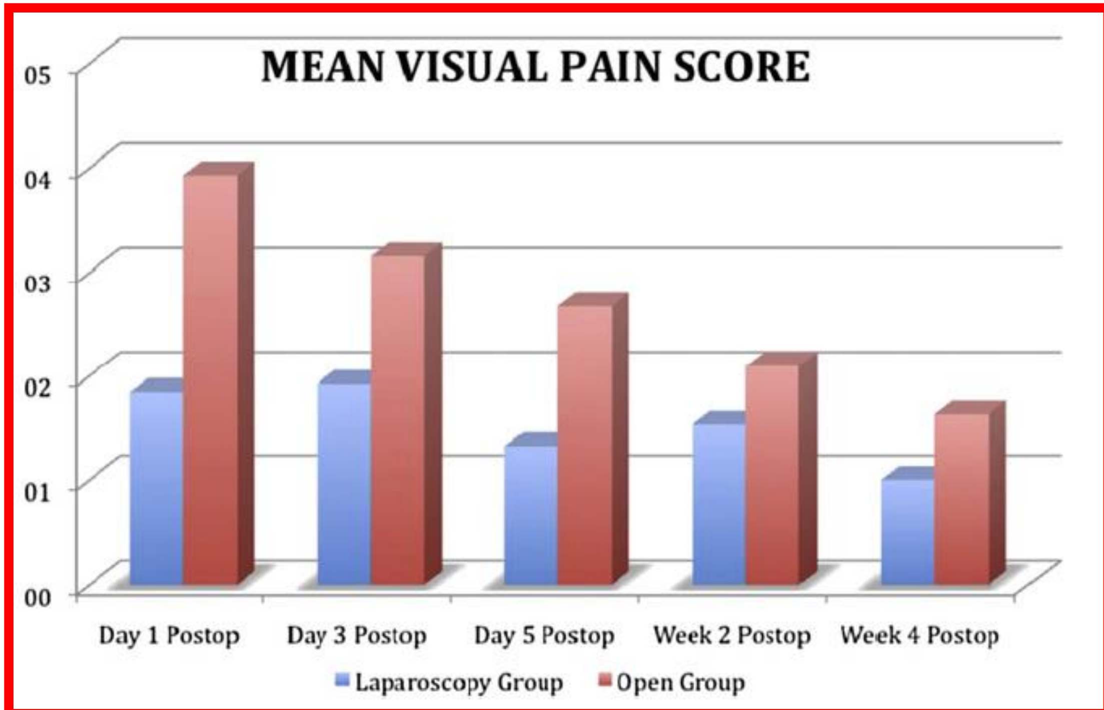

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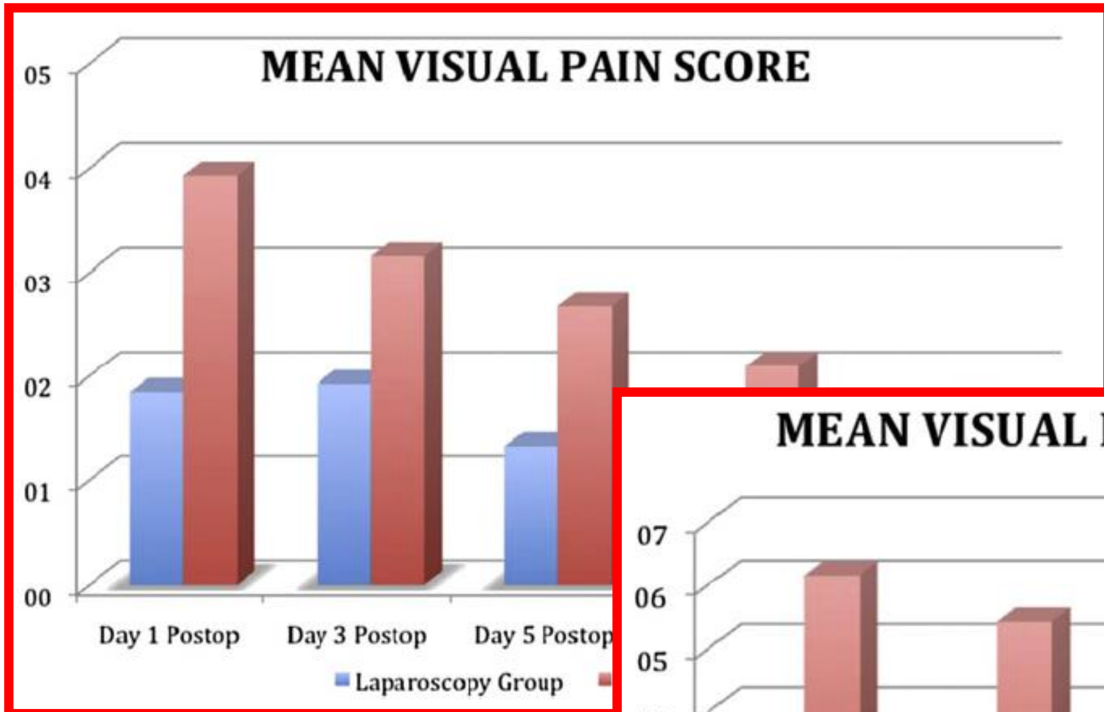
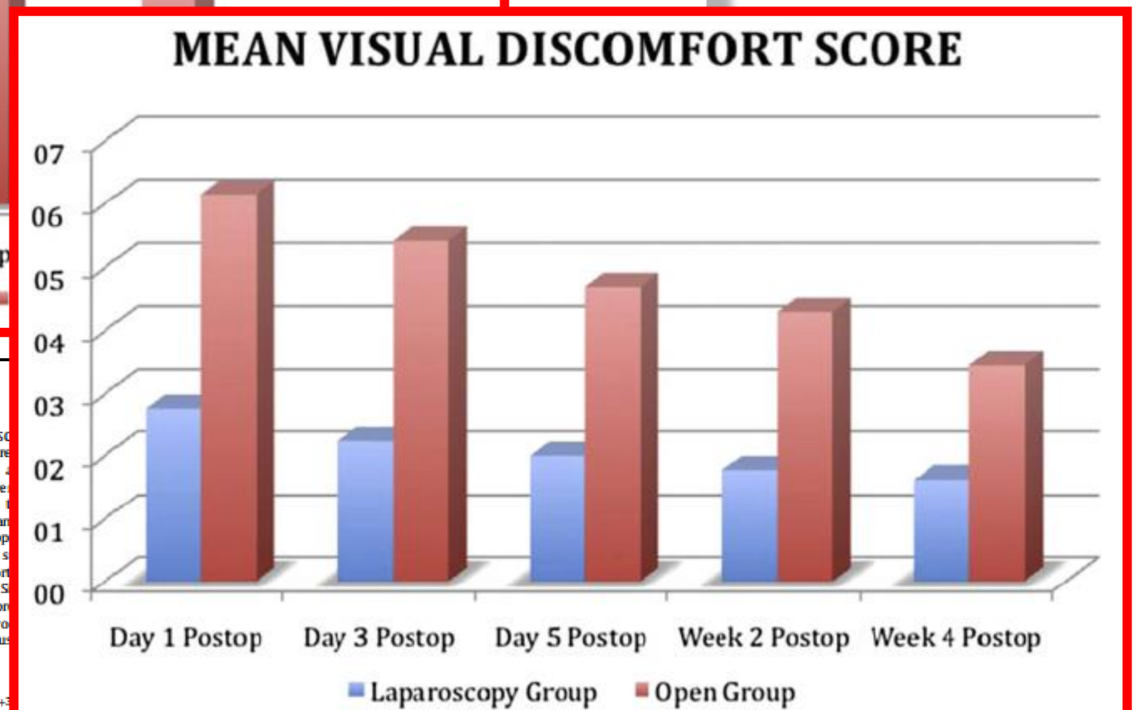
doi:10.1016/j.ejvs.2012.02.003

MINI-INVASIVE SURGERY IS SAFE FOR OUR PATIENTS





urgery

esvs Journal

for Severe
rolled Trial

According to the TASC
bypass remains the best tre
disease TASC II C and D,[1] a
some surgeons and interve
this study. The scope of t
differences in morbidity ar
open and laparoscopic app
for aortobifemoral bypass s
Totally laparoscopic aort
with YM Dion in 1995.[2] S
Instrumentation has impr
technique have been intro
Coggia is by far the most us

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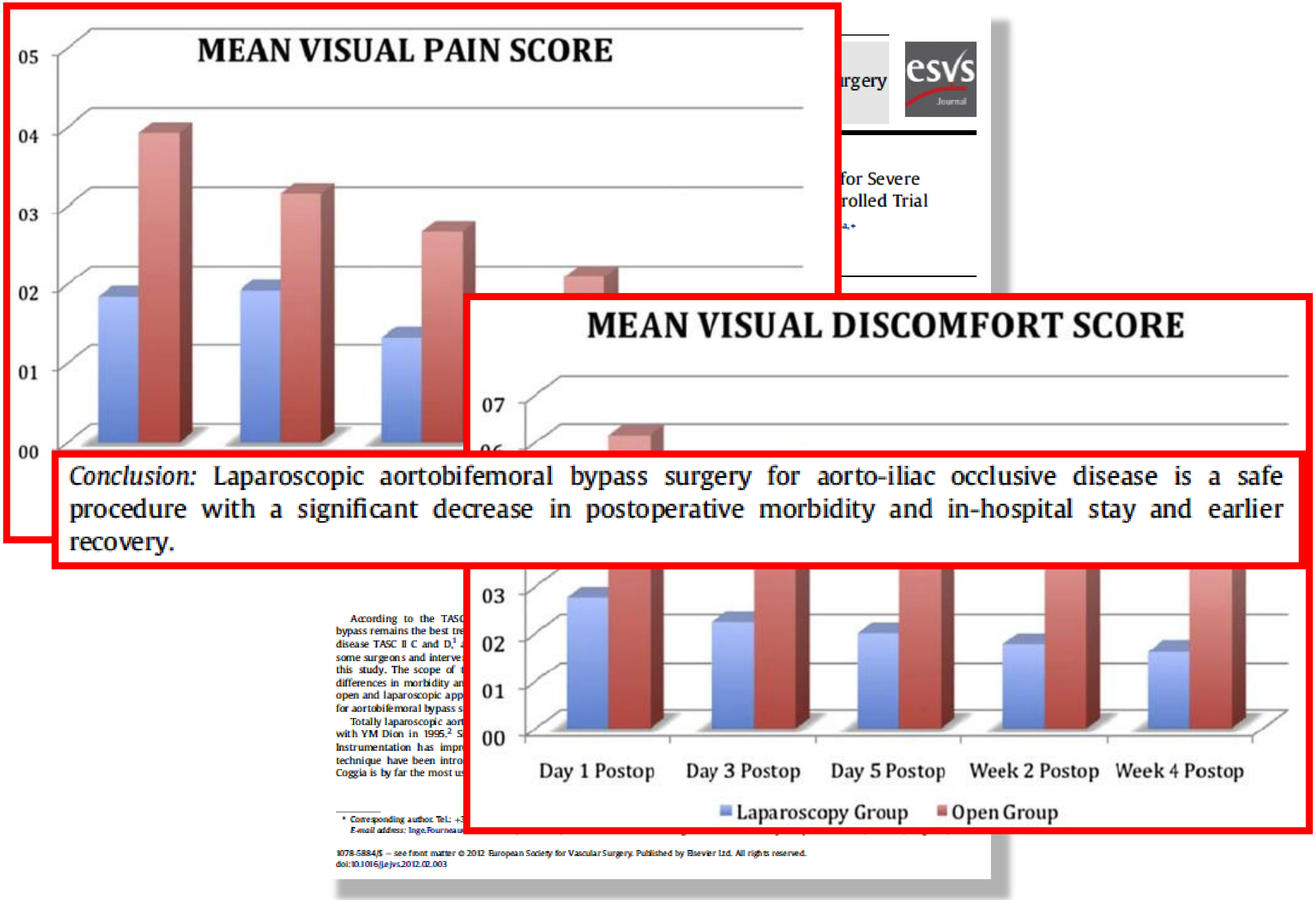
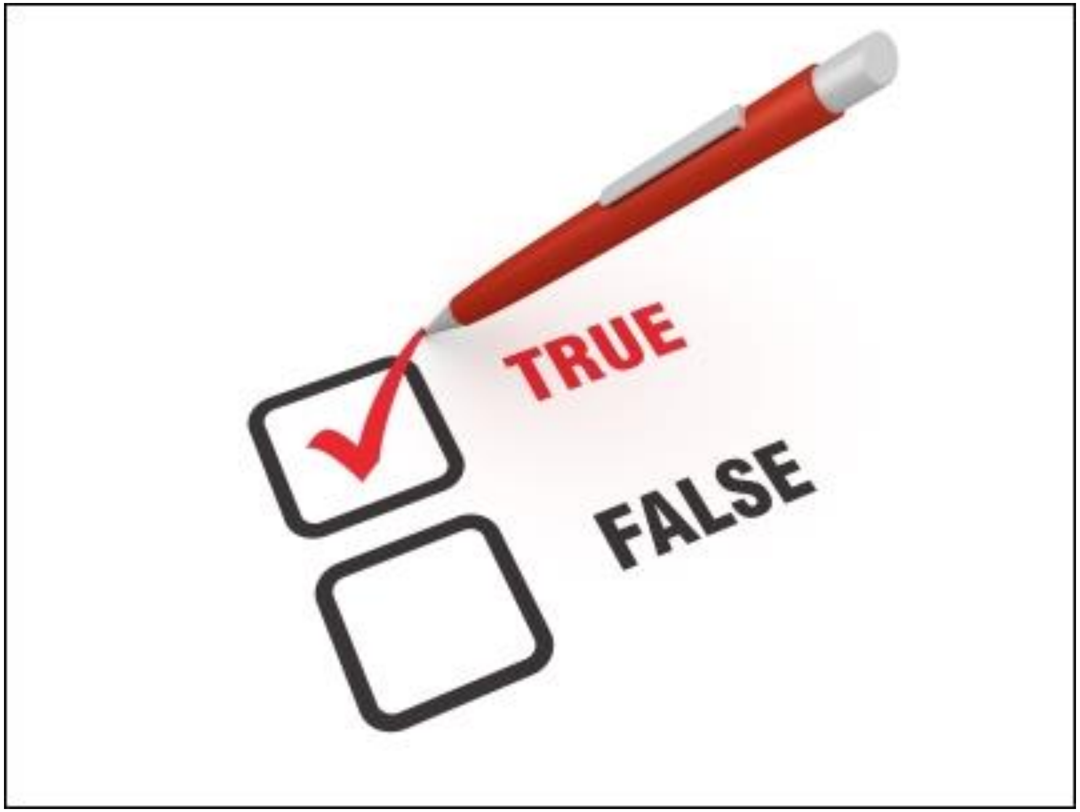


Conclusion: Laparoscopic aortobifemoral bypass surgery for aorto-iliac occlusive disease is a safe procedure with a significant decrease in postoperative morbidity and in-hospital stay and earlier recovery.

Laparoscopic aortic surgery is hard



Which place for the laparoscopy in aortic surgery?

Even for a better postoperative recovery and clinical benefits, these techniques are not widely used, despite for a few centers…

Why?

Why laparoscopic aortic surgery is hard to do?

Technical learning curve…

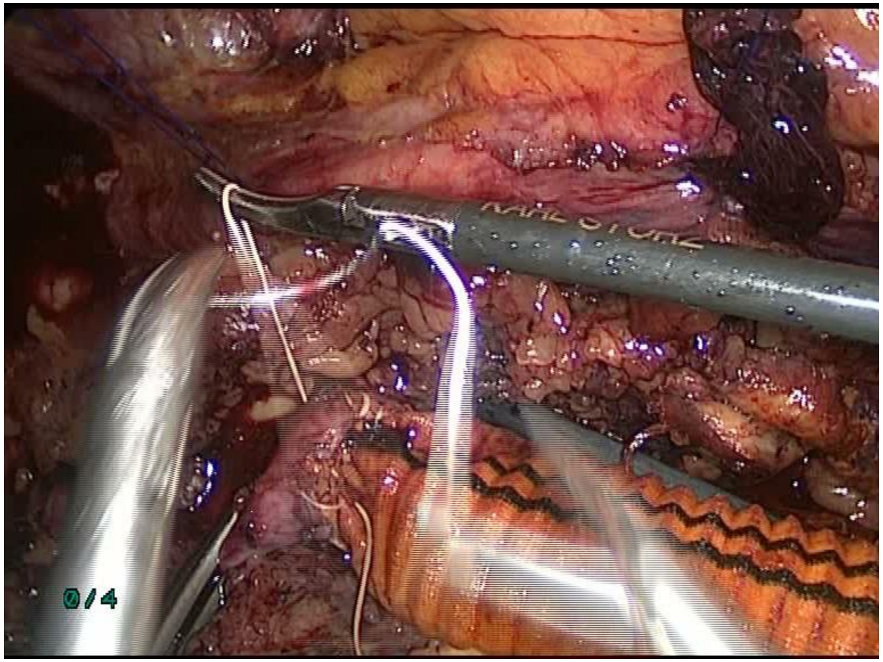
Technical learning curve is exhausting

Surgical time

Exhausted surgeon

Making of aortic anastomosis

Clamping time management



Current time: competition with endovascular

Competition with endovascular wrong debat!

ACE study results

JP. Becquemin et al. JVS 2011

group, in the ACE trial, vascular reinterventions occurred in 16% of the EVAR group vs 2.7% in the OSR group. In

CONCLUSIONS

In a selected group of patients with low to intermediate risk factors, OSR and EVAR offer no difference in survival or in major and minor complications. The choice between OSR and EVAR should rely on the balance of different risks: more postoperative transfusions, a longer hospital stay, and incisional complications with OSR vs the need of follow-up with repeat CT scans, a higher rate of vascular reinterventions, and a small but persistent risk of rupture with EVAR.

A randomized controlled trial of endovascular aneurysm repair versus open surgery for abdominal aortic aneurysms in low- to moderate-risk patients

Jean-Pierre Becquemin, MD, Jean-Chistophe Pillet, MD, François Lescalie, MD, Marc Sapoval, MD, Yann Goueffic, MD, Patrick Lermusiaux, MD, Eric Steinmetz, MD, and Jean Marzelle, MD, for the ACE

(RCTs), have shown that endovascular repair
than open surgical repair (OSR) but a similar
ons. Thus, the role of EVAR, most notably in

oprothese) trial compared mortality and major
e for EVAR and at low-risk or intermediate-risk
ed in institutions with proven expertise for both
SR and 150 to EVAR. Patients were monitored

, there was no difference in the cumulative survival free of death
vs 93.2% ± 2.1% at 1 year and 85.1% ± 4.5% vs 82.4% ± 3.7%
% vs 1.3%; $P = 1.0$), survival, and the percentage of minor
up, however, the crude percentage of reintervention was higher
ysm-related mortality (0.7% vs 4%; $P = .12$).
, open repair of AAA is as safe as EVAR and remains a more

dii's report raised hopes that endovascular repair of AAA (EVAR) might improve outcomes.[1] Meta-analysis of retrospective studies as well as three prospective randomized controlled studies (RCT) tended to confirm this hypothesis, at least in the early stage.[2-4]

After health care provider authorizations and stent graft reimbursements, the number of patients undergoing OSR has rapidly declined while the number undergoing EVAR has expanded.[5,6] However, rupture may still happen after EVAR, and reinterventions are not infrequent.[3,4,7] As a consequence, the long-term efficacy of EVAR is still debated.

The ACE (Anevrysme de l'aorte abdominale: Chirurgie versus Endoprothese) trial (http://ClinicalTrials.gov, #NTC00224718) was conceived in 1998. This multicenter, prospective randomized trial assessed the results of OSR vs EVAR in patients presenting with an asymptomatic AAA, deemed at low to moderate risk for surgery. We report the final results of this trial, with a median follow-up of 3 years.

METHODS

Participants. Inclusion criteria combined anatomic and clinical assessment:

CONCURRENCE DE L'ENDOVASCULAIRE: FAUX DÉBAT!

ACE study results

JP. Becquemin et al. JVS 2011

CLINICAL RESEARCH STUDIES

A randomized controlled trial of endovascular aneurysm repair versus open surgery for abdominal aortic aneurysms in low- to moderate-risk patients

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Concurrence de l'endovasculaire: faux débat!

ACE study results

JP. Becquemin et al. JVS 2011

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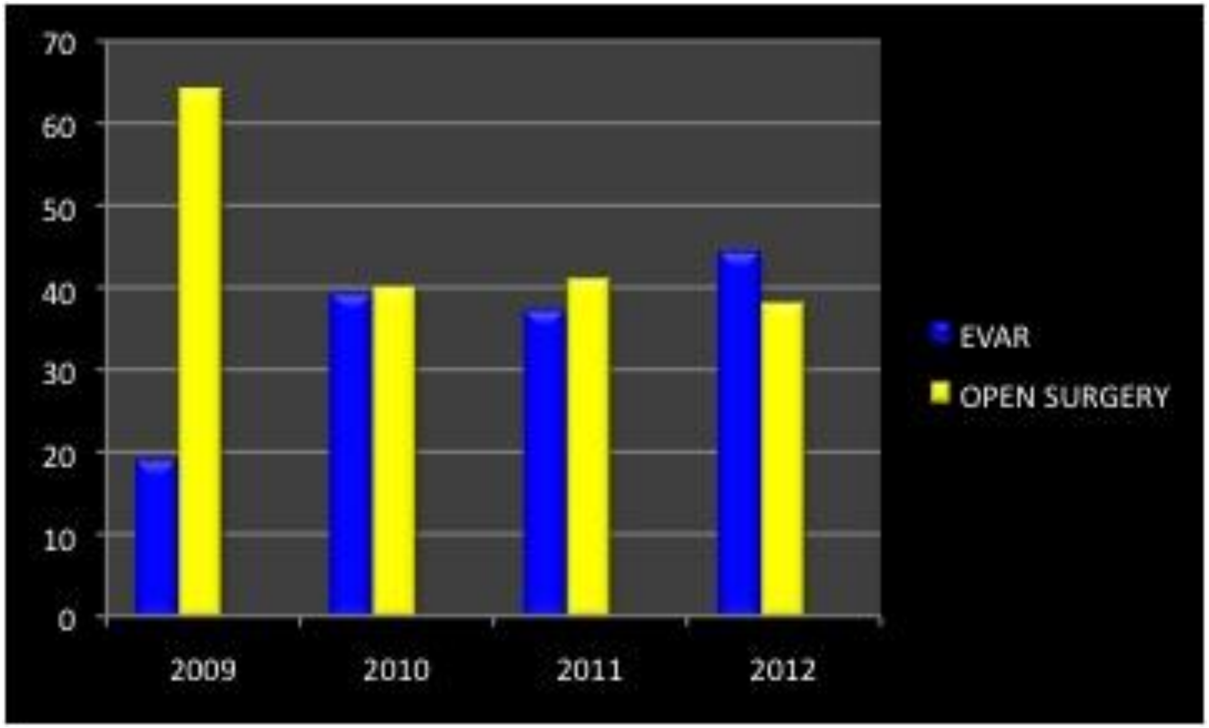
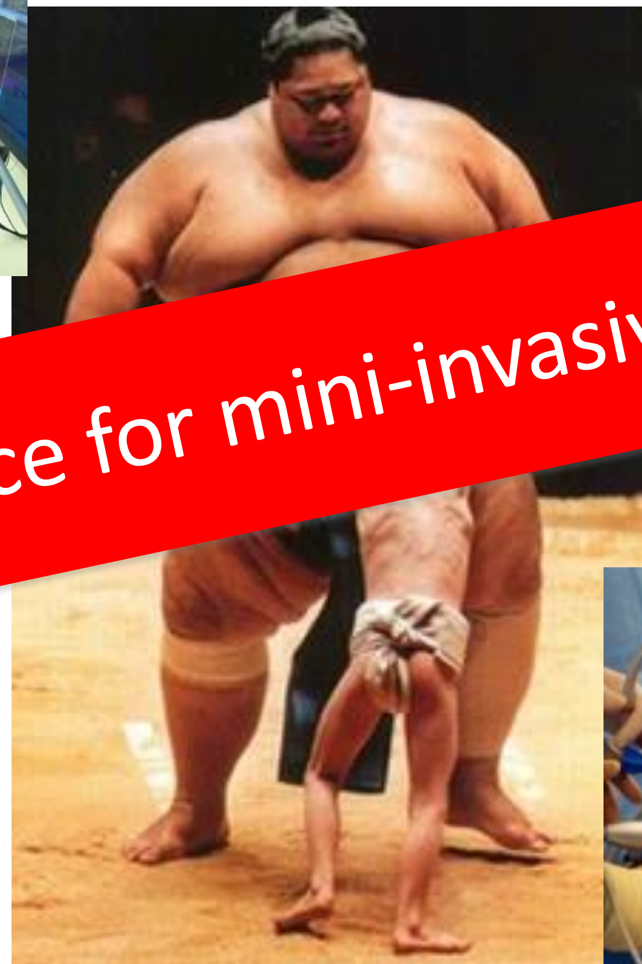
AAA: OUR STRATEGY



Aortic cases with indication for conventional repair



Aortic cases with indication for conventional repair



still a place for mini-invasive surgery

How to fix the problem of the laparoscopic learning curve?

How to fix the problem of the laparoscopic learning curve?

Robot = natural evolution from the open surgery through the laparoscopy?

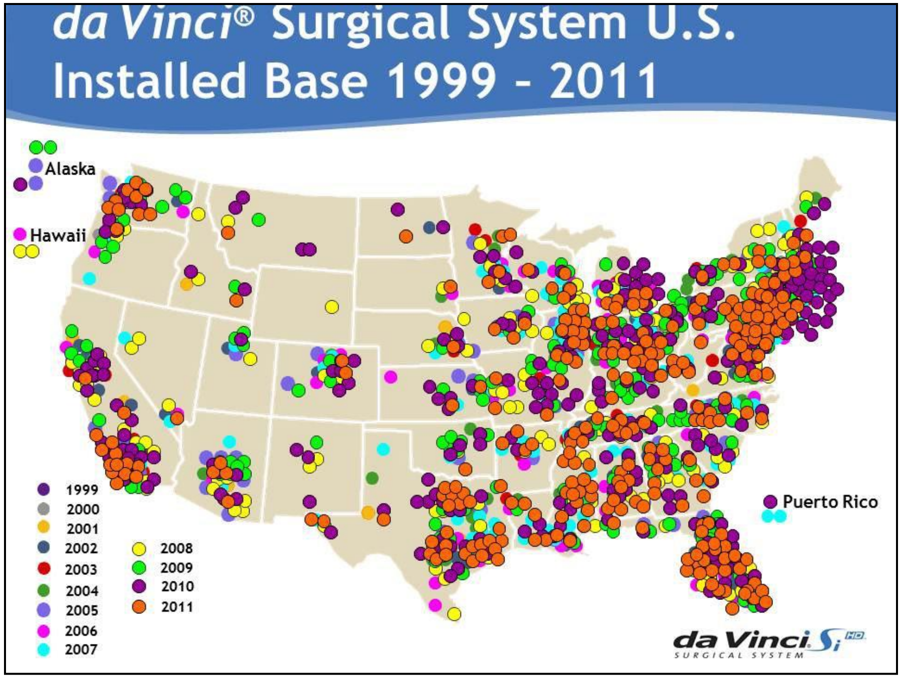
Setting up robots in the world

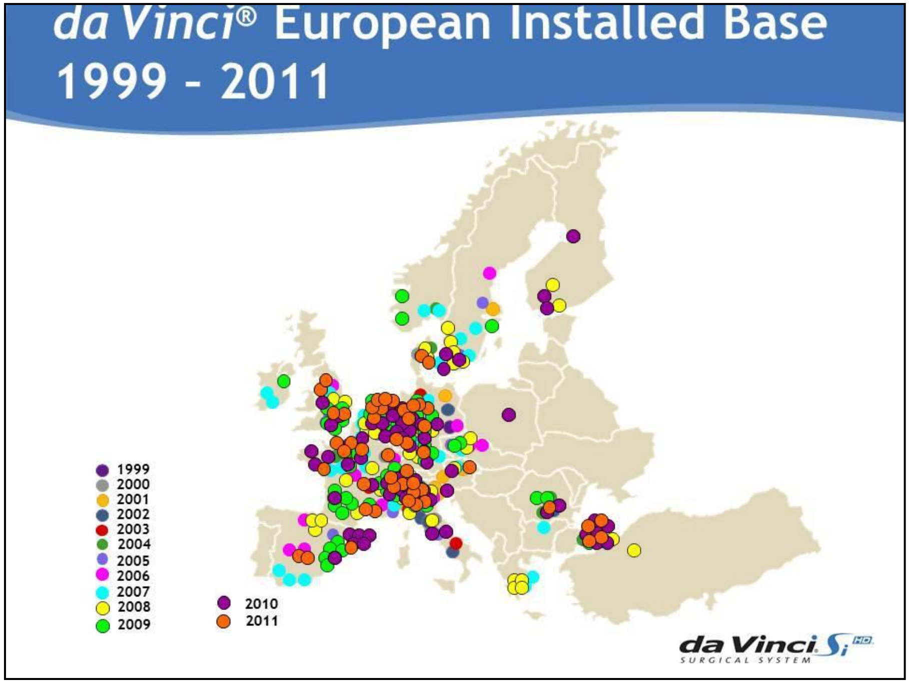
Oct. 2013: **3000** robots around the world

80 robots in France

Since 2011 in France: **17500** surgical procedures

175 interventions / centre / year (70 - 700)





Robotic aortic surgery is feasible

Eur J Vasc Endovasc Surg (2008) 36, 401–404

ELSEVIER

Is Robotic Surgery Appropriate for Vascular Procedures? Report of 100 Aortoiliac Cases

P. Štádler*, L. Dvořáček, P. Vitásek, P. Matouš

Department of Vascular Surgery, Na Homolce Hospital, Roentgenova 2, Prague 5, 15030, Czech Republic

Submitted 12 April 2008; accepted 21 June 2008
Available online 21 August 2008

KEYWORDS
da Vinci System;
Robot-assisted aortoiliac reconstruction;
Arterial occlusive disease;
Common iliac artery aneurysm

Abstract *Aim:* The aim of our study was to evaluate our clinical experience of the da Vinci™ system for robot-assisted aortoiliac reconstructions to treat occlusive disease and aneurysm.
Material and methods: Between November 2005 and January 2008 100 consecutive patients were scheduled to undergo robot-assisted laparoscopic aortoiliac procedures. Patients with serious medical problems and those who had previously undergone major abdominal surgery were excluded from the clinical study. Ninety patients were prospectively evaluated for arterial occlusive disease (AOD), seven patients for abdominal aortic aneurysms (AAA), two for common iliac artery aneurysms (CIAA) and one for a combination of CIAA and AOD.
Results: Ninety-seven of 100 procedures (97%) were successfully completed robotically, while conversions were necessary in three patients (3%). The median operating time was 235 minutes (range 150 to 360 minutes), with a median clamp-time of 42 minutes (range 25 to 120 minutes). The median anastomosis time was 29 minutes (range 12 to 60 minutes) and median blood loss was 430 mL (range 50 to 1500 mL). The median intensive care unit stay was 1.7 days and the median hospital stay was 5.1 days. A regular oral diet was resumed after a mean of 2.4 days. Thirty-day survival was 100% and non-lethal postoperative complications were observed in three patients (3%).
Conclusions: Robotic aortoiliac surgery appears to be safe, with a high technical success rate, with operative times and success rates comparable to conventional open surgery. The creation of the aortoiliac anastomosis appears to be quicker, and more accurate than regular laparoscopic techniques.

Introduction

Major developments in laparoscopic surgery in the 1990s have had a delayed impact on vascular surgery. Minimally invasive approaches used in general surgery have gradually been introduced as novel techniques that can be employed in vascular surgery.[1] The main reasons for this initial lack of interest in laparoscopic vascular surgery were the difficulties associated with the suturing of the vascular anastomosis and the long clamping time. These same reasons have also prevented the further expansion of vascular laparoscopy. Robotics, which was first introduced in 2000, is

* Corresponding author. Petr Štádler, MD, Ph.D. Tel.: +420 2 57272540; fax: +420 2 57272969.
E-mail address: petr.stadler@homolka.cz (P. Štádler).

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doi:10.1016/j.ejvs.2008.06.028

ROBOTIC AORTIC SURGERY IS FEASIBLE

The greatest advantage of the robot-assisted procedure has proved to be the speed of construction of the vascular anastomosis.[7] The median reported clamping and anastomotic times of laparoscopic aortic surgery without robots were 89.5 and 37 minutes, respectively.[8,9] Reducing the time needed to construct the anastomosis also shortens the period of temporary ischemia of the lower limbs. This represents a significant reduction in the level of reperfusion

Table 1 Robot-assisted vascular procedures

IFB (iliofemoral bypass)	17
AUFB (aortounifemoral bypass)	38
ABFB (aortobifemoral bypass) one case of them: ABFB with incisional hernia mesh repair	32
AIE (aortoiliac thromboendarterectomy)	4
CIAA (common iliac artery aneurysm)	2
AAA (abdominal aortic aneurysm)	7

Robotic aortic surgery is feasible

Eur J Vasc Endovasc Surg (2008) 36, 401—404

ELSEVIER

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Arterial occlusive disease;
Common iliac artery aneurysm

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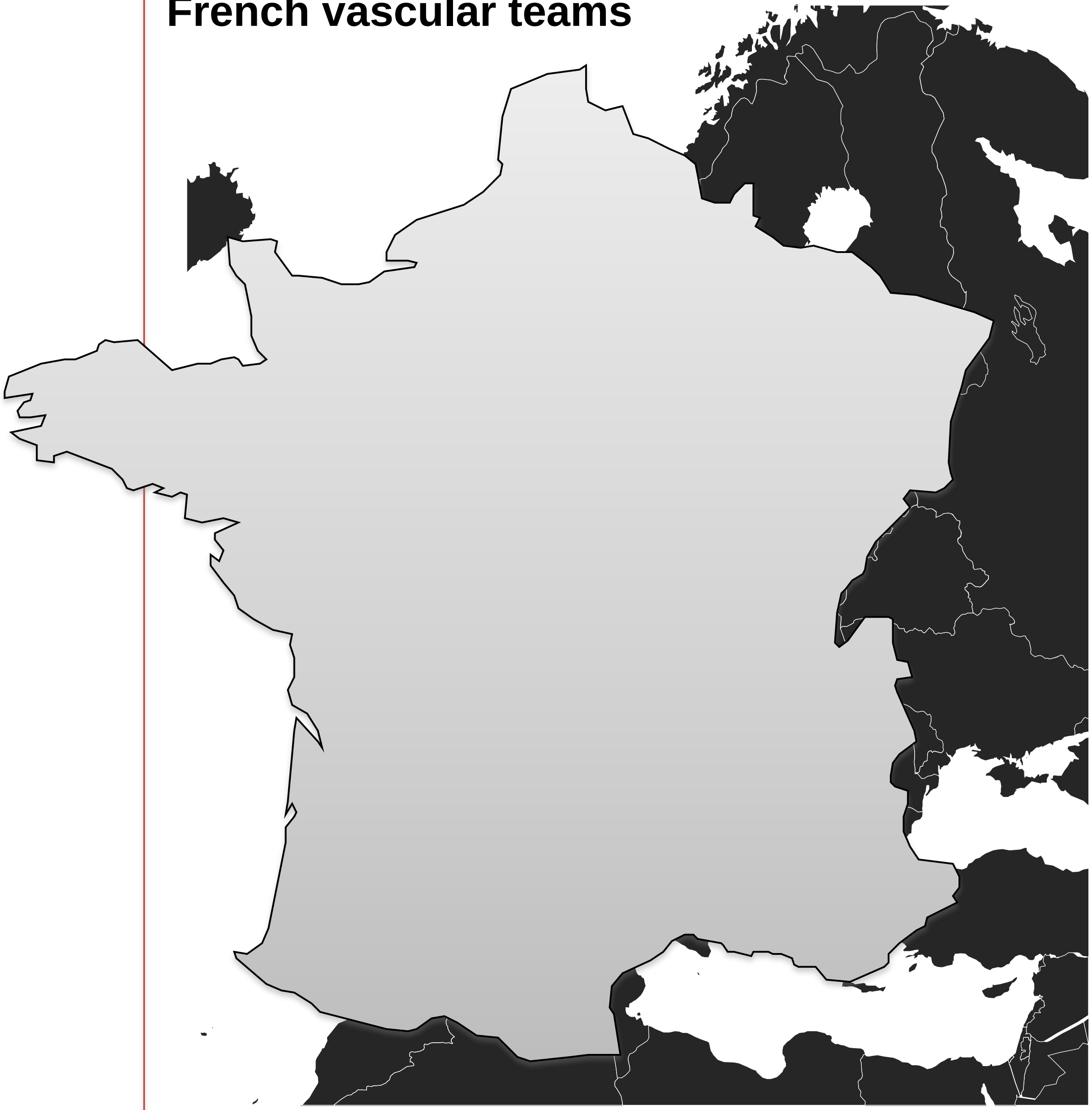
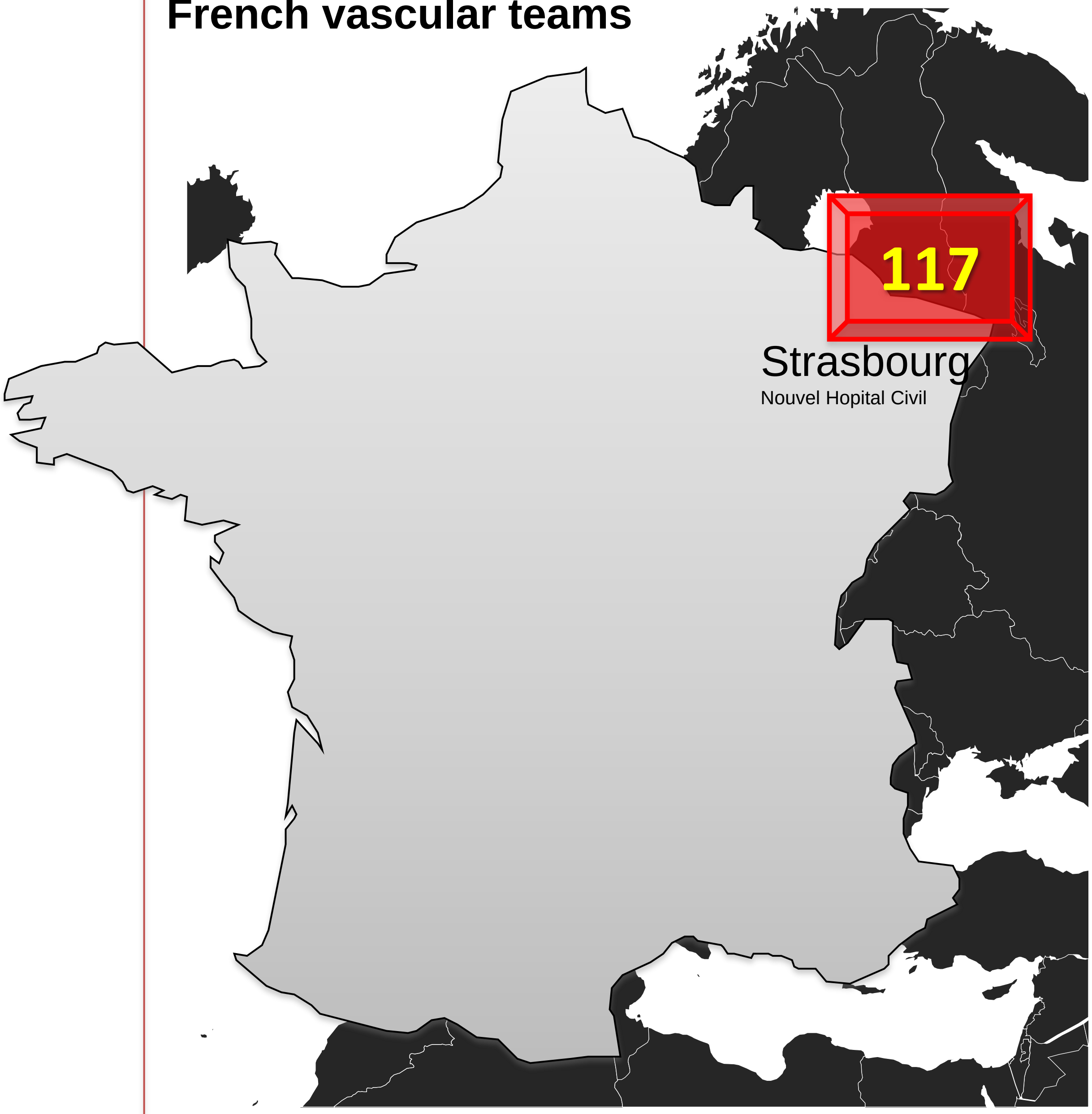
French vascular teams



French vascular teams



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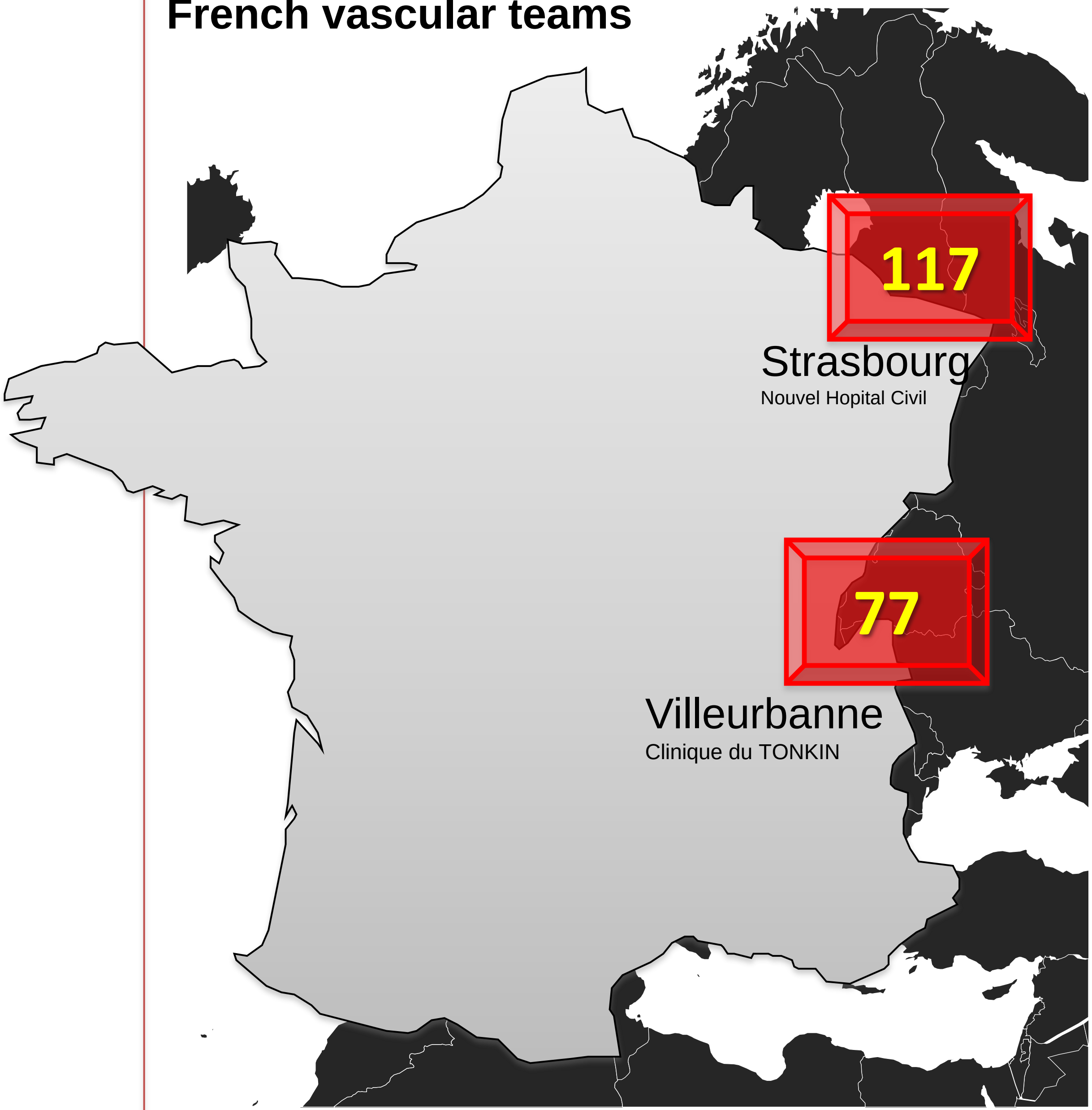

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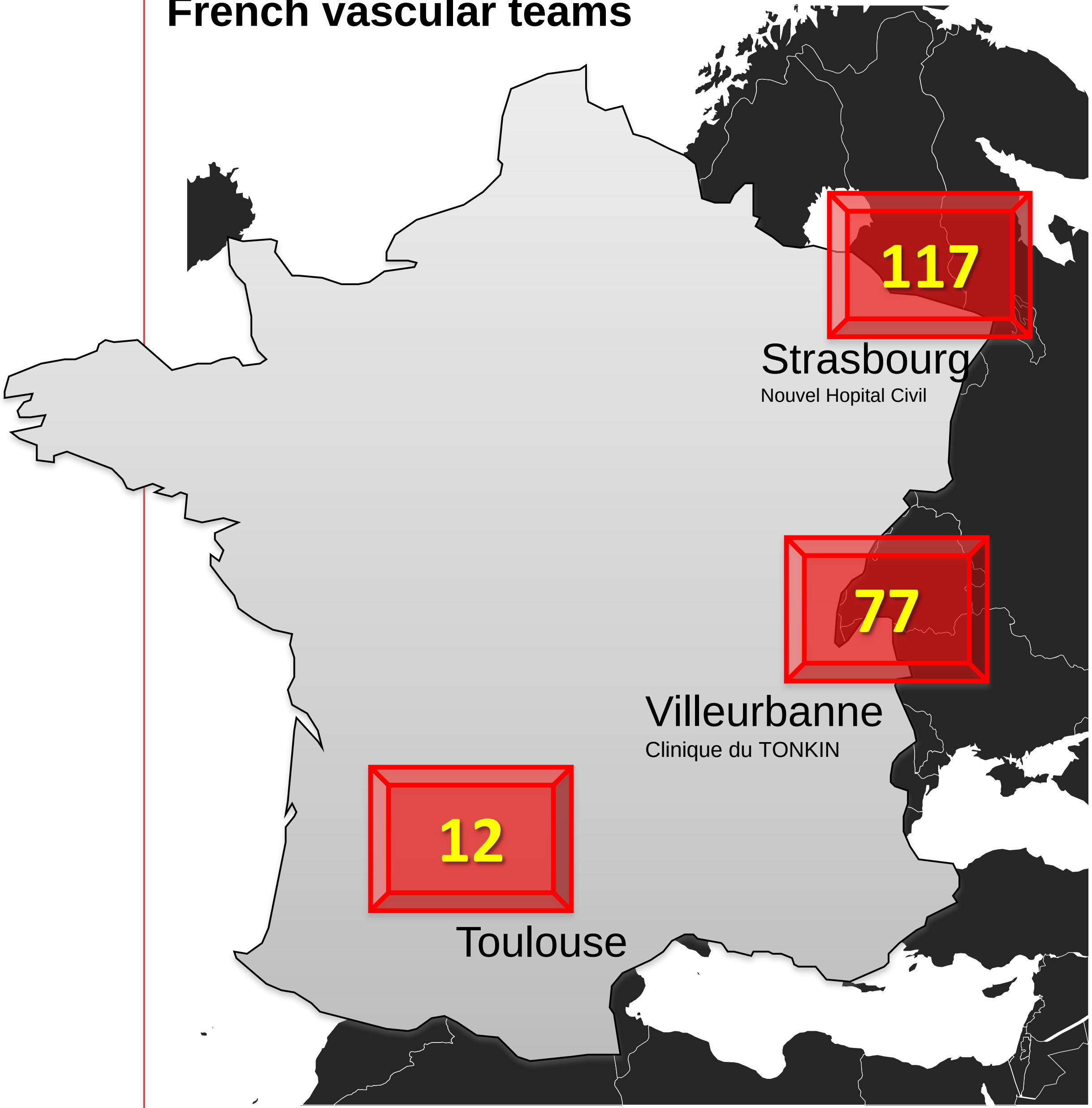

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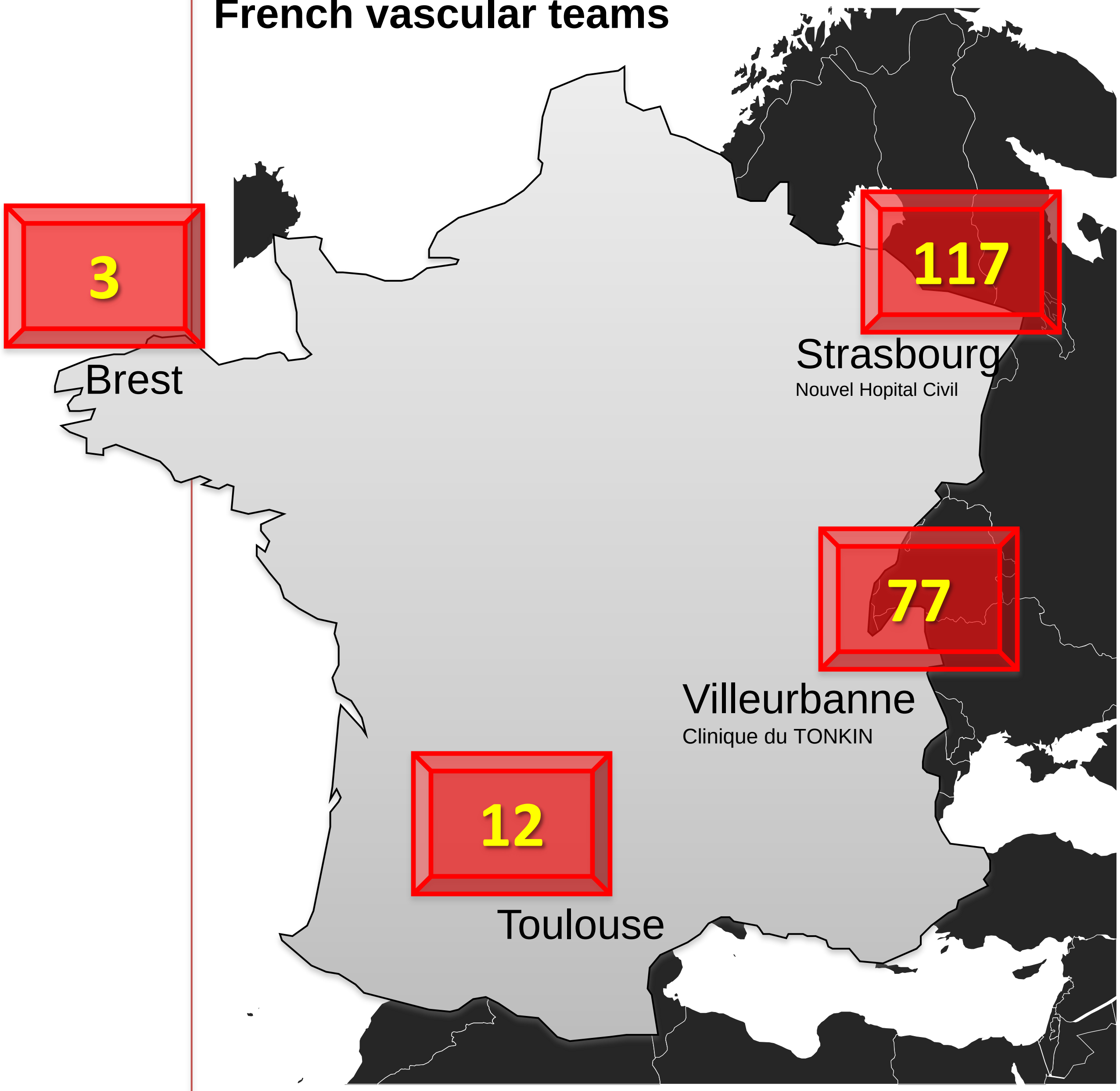

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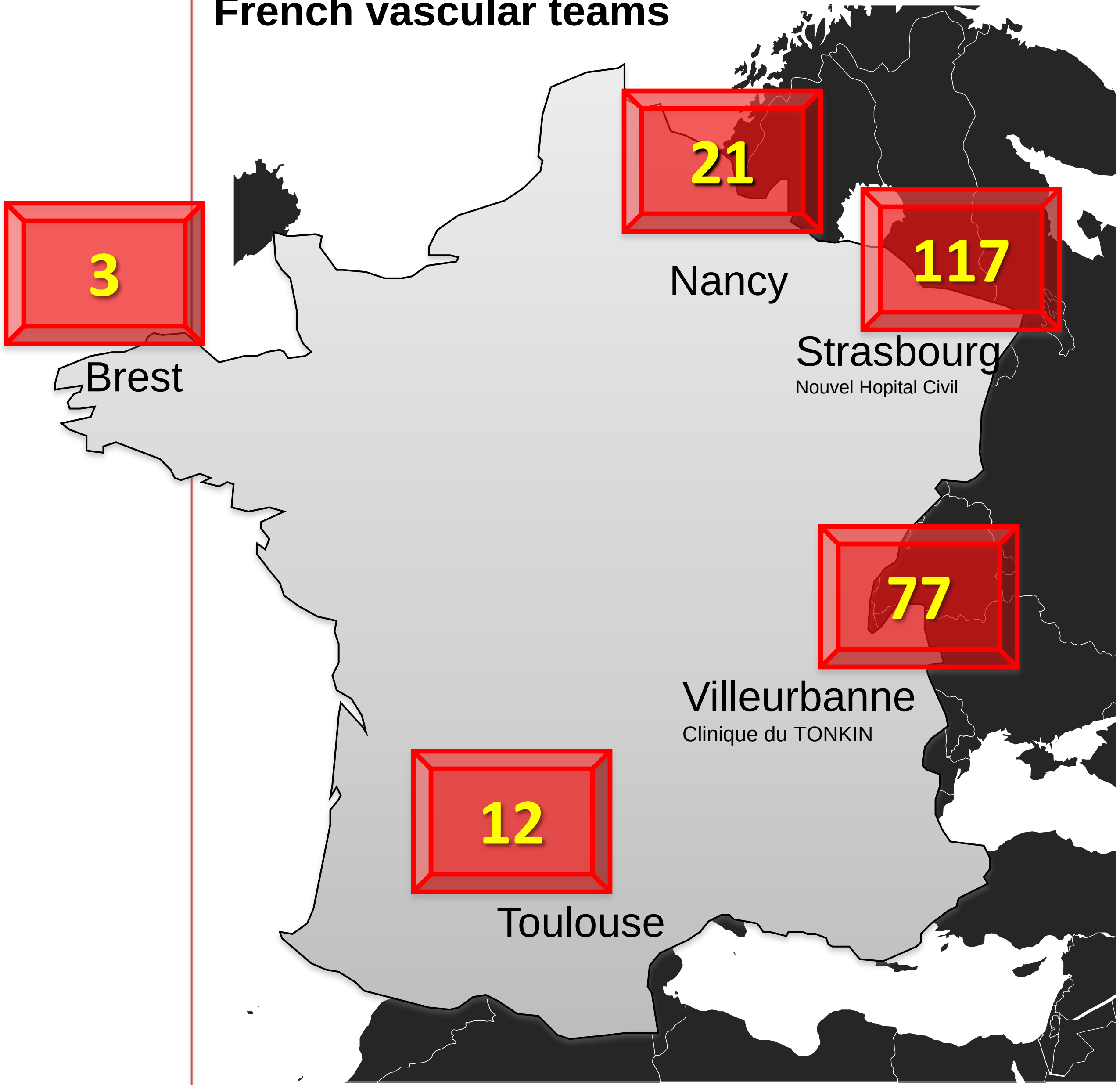

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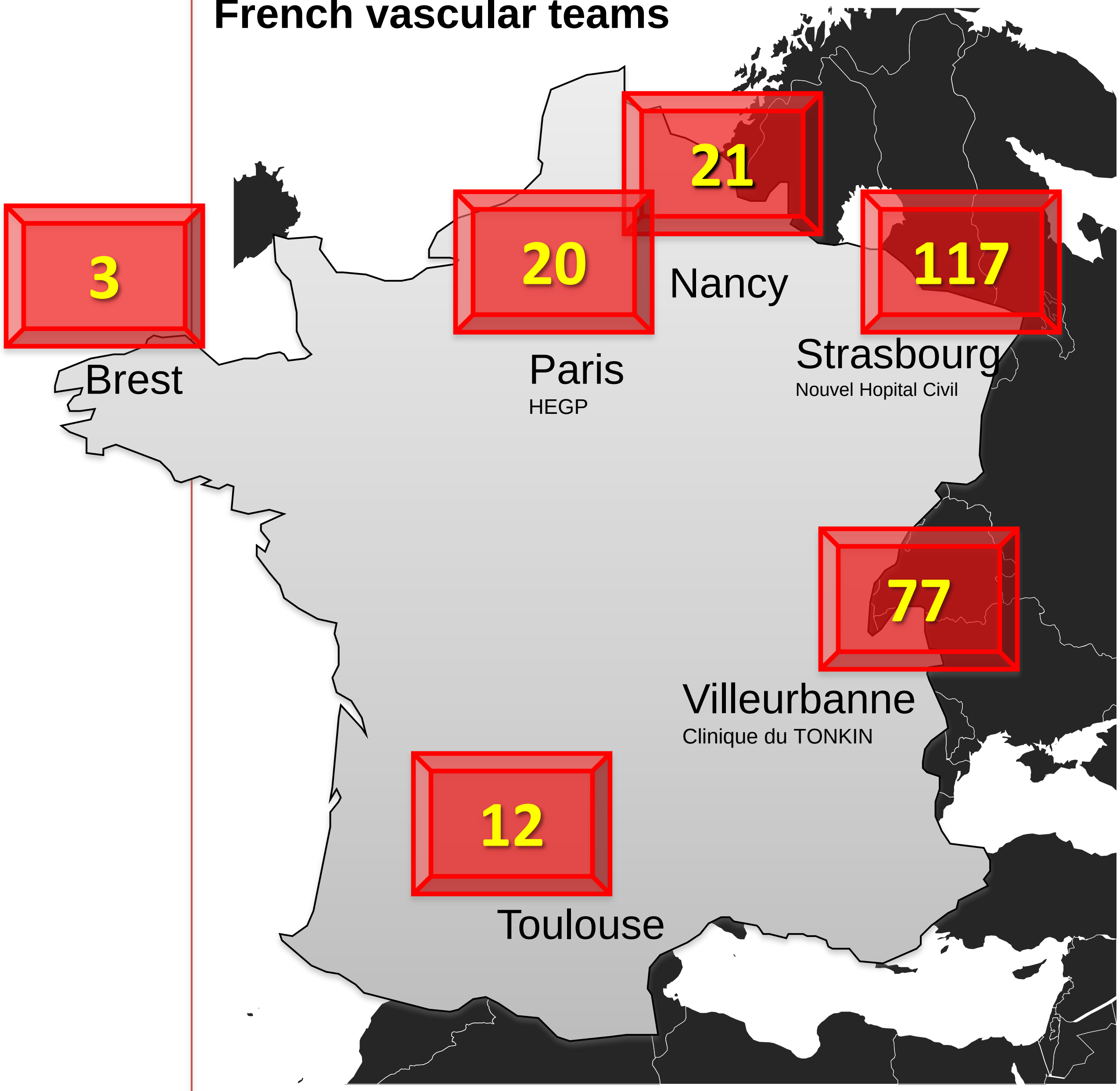


USE OF ROBOT TO PERFORM AORTIC SURGERY IN STRASBOURG

Da Vinci robot available since 2006, sharing between surgical teams

Experience in laparoscopic aortic surgery since 2003

Surgical program: feasibility study

AND

- **aortic dissection and exposure**:

trans-retroperitoneal approach, with left retrocolic / retrorenal dissection

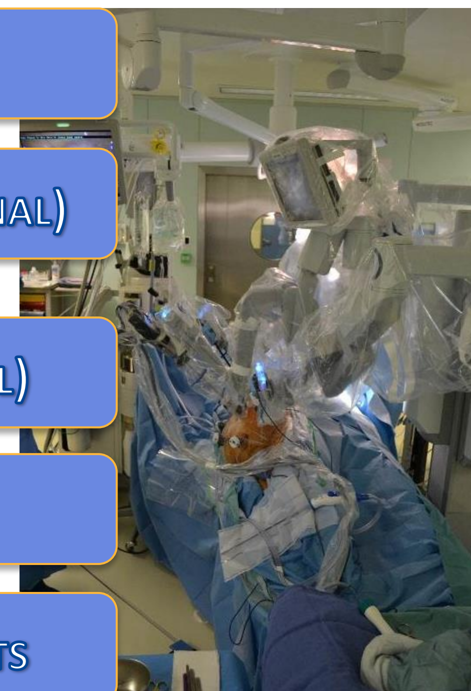
- **aortic anastomosis** for ABF, tube and bifurcated graft for AAA

117 CASES

Occlusive disease

- 5 AORTOFEMORAL
- 81 ABF (15 SUPRA RENAL)

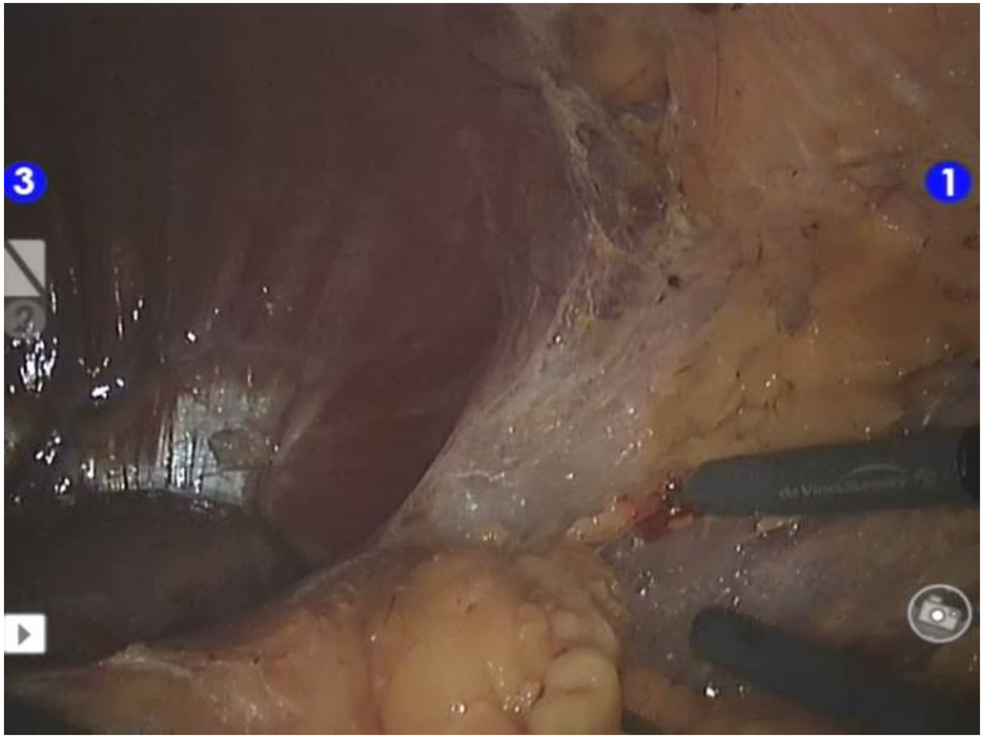
- 8 ABF (1 SUPRA RENAL)
- 14 TUBE GRAFTS
- 9 AORTOBIILIAC GRAFTS



Surgical approach

Trans and retroperitoneal

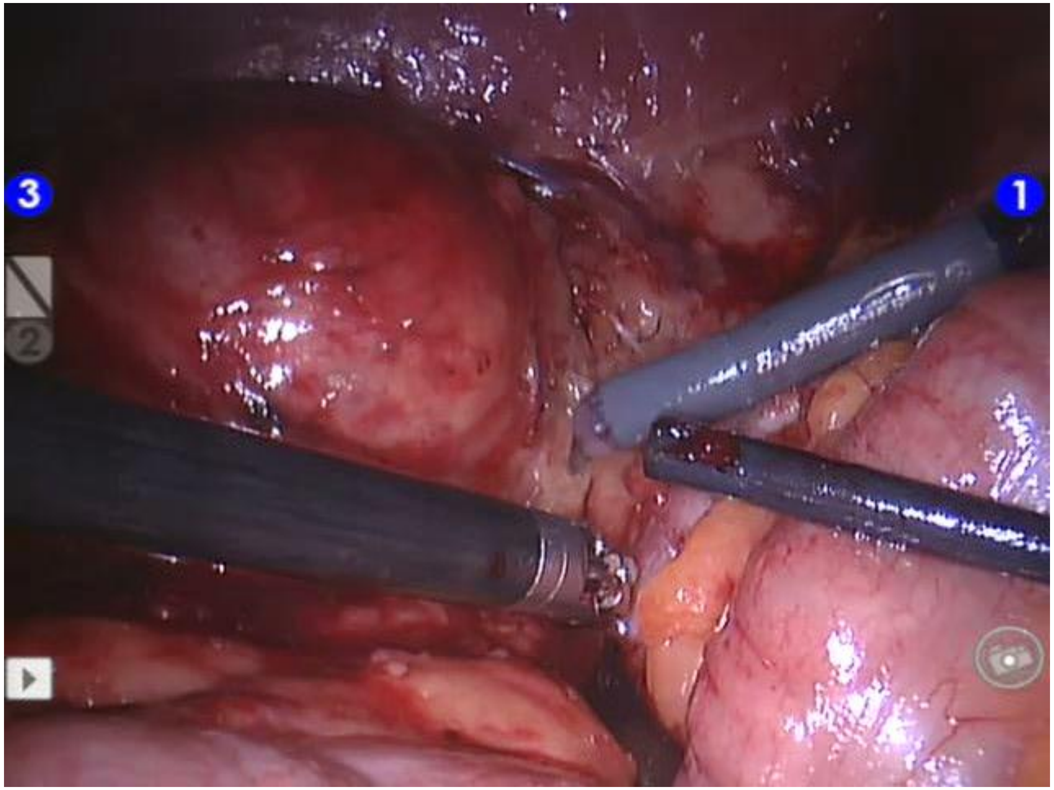
Left retrokidney (90%) or left retrocolic



ABF: 46 ± 21 MIN (15-105)

AAA: 35 ± 18 MIN (15-79)

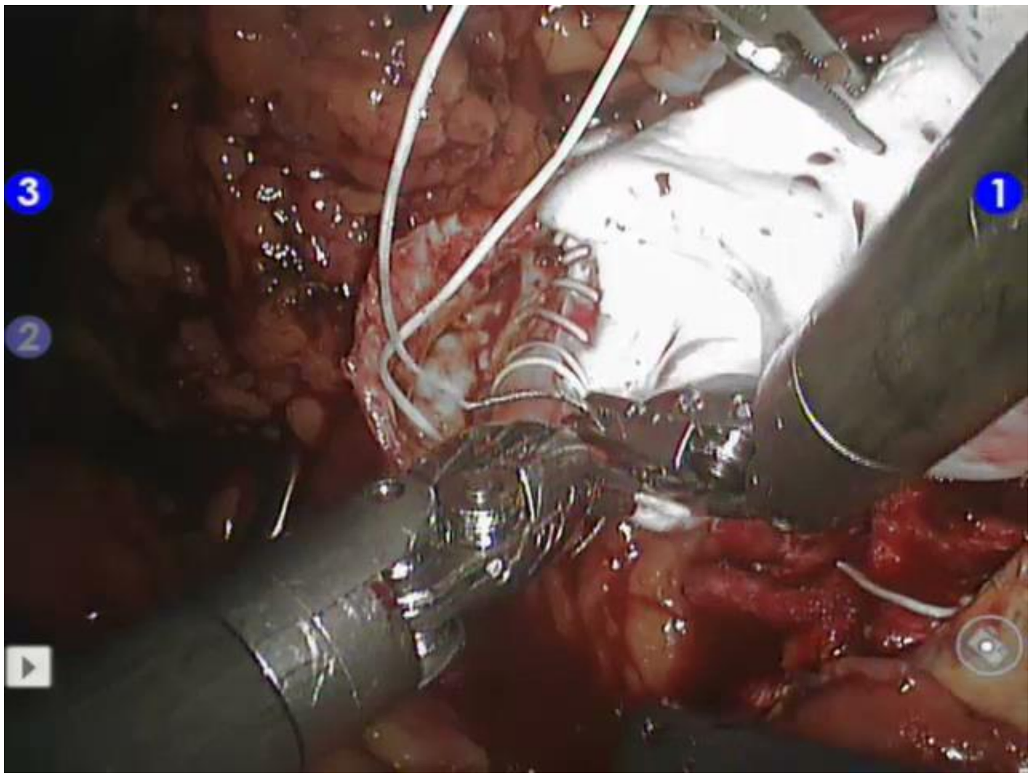
Control of the aorta



ABF: 48 ± 24 MIN (15-152)

AAA: 56 ± 14 MIN (28-77)

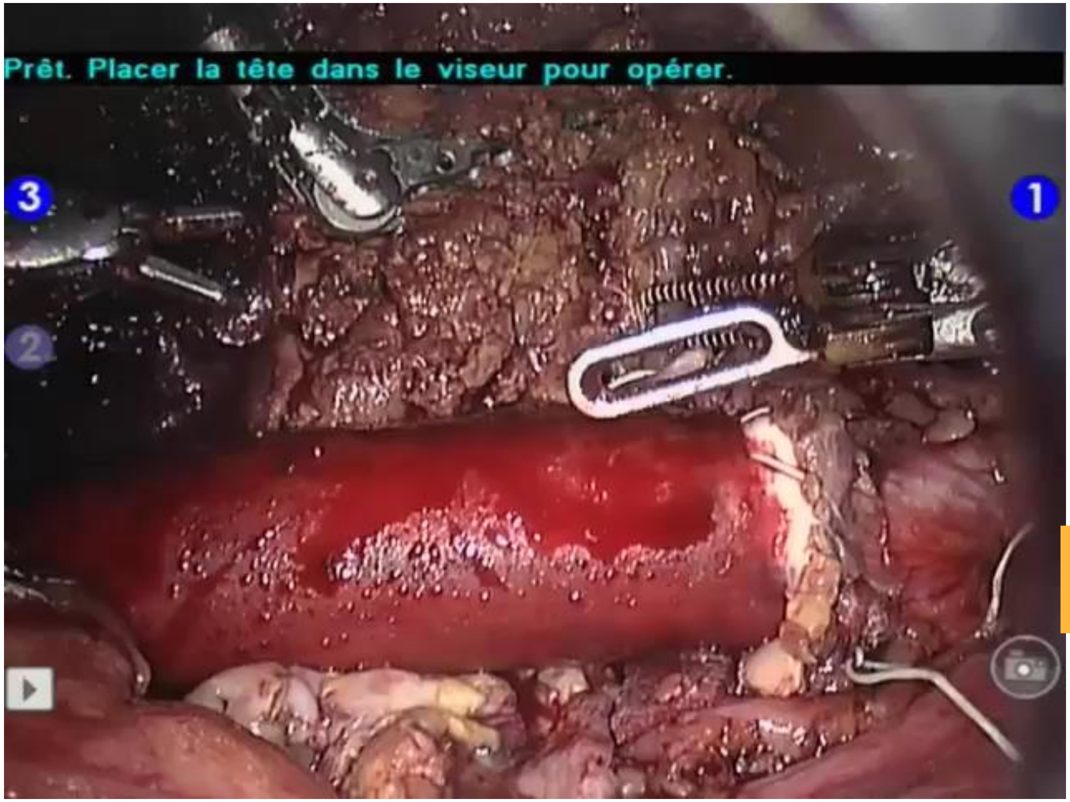
Proximal aortic anastomosis



ABF: 41 ± 10 MIN (24-70)

AAA: 31 ± 7 MIN (22-50)

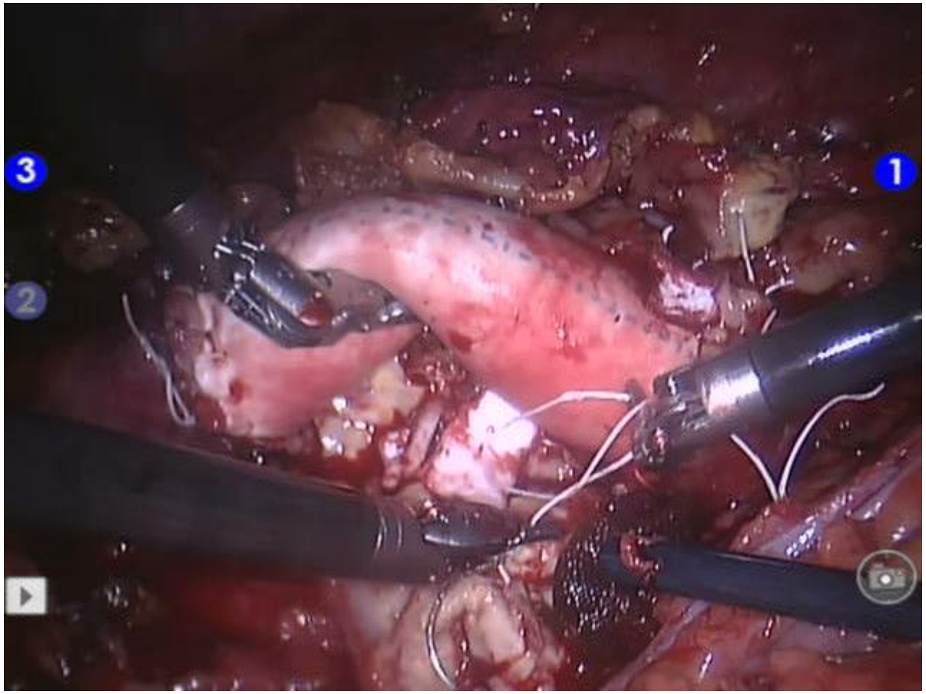
CLAMPING TIME



ABF: 98 ± 29 MIN (34-163)

AAA: 121 ± 29 MIN (66-189)

Total operative time



ABF: 6H31 ± 65 MIN (239-540MIN)

AAA: 5H46 ± 56 MIN (269-450MIN)

Conversion rate in 2012/13: **11**%

Early morbidity

CAS	Type OP	year	type
3	ABF	2006	lung abscess
10	ABF	2007	lymphocel of groin
17	ABF	2008	deep vein thrombosis
21	ABF	2009	pulmonary infection
29	ABF +AAA	2009	Infection of groin
31	ABF	2009	acute renal insuficiency
32	ABF	2009	acute ischemia of the leg
46	ABF	2011	postop D1 acute coronary disease
54	ABF	2012	ischemic colitis
64	ABF	2012	infection of groin
74	AAA	2012	urinoma
87	AAA	2013	acute cholecystitis
101	ABF	2014	acute ischemia of the leg
107	AAA	2014	ischemic colitis

Early morbidity

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31	ABF	2009	[illegible]
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64	ABF	2012	infection of groin
74	AAA	2012	urinoma
87	AAA	2013	acute cholecystitis
101	ABF	2014	acute ischemia of the leg
107	AAA	2014	ischemic colitis

MORBIDITY 30 DAYS = 12,4%

MORTALITY

CAS	Type OP	Year op	Year of death	cause
2	ABF	2006	2007	cardiac
6	ABF	2007	2008	suicide
11	ABF	2007	2009	cardiac
15	ABF	2008	2010	subite death
23	ABF	2009	2010	cardiac
24	ABF	2009	2011	lung cancer
29	ABF + AAA	2009	2010	infectious disease
32	ABF	2009	2011	stroke
34	ABF + AAA	2010	2011	Respiratory failure
108	ABF + AAA	2014	2014	fatal hemorrage

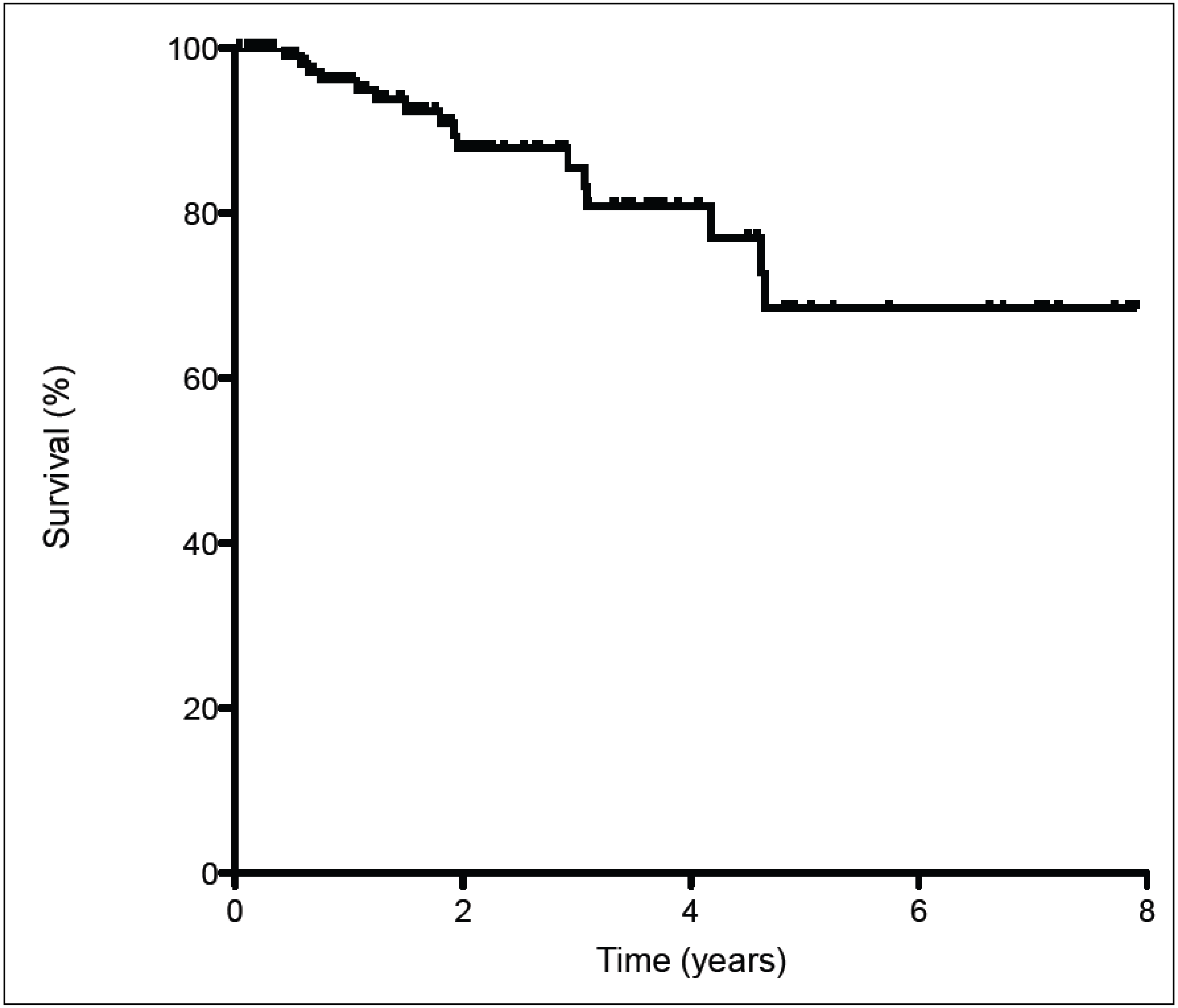
MORTALITY

CAS	Type OP	Year op	Year of death	cause
2	ABF	2006	2007	cardiac
6	ABF	2007	2008	[illegible]
11	ABF	2007	[illegible]	[illegible]
15	ABF	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	cardiac
24	[illegible]	[illegible]	2011	lung cancer
29	[illegible]	2009	2010	infectious disease
32	ABF	2009	2011	stroke
34	ABF + AAA	2010	2011	fespiratory failure
108	ABF + AAA	2014	2014	fatal hemorrage

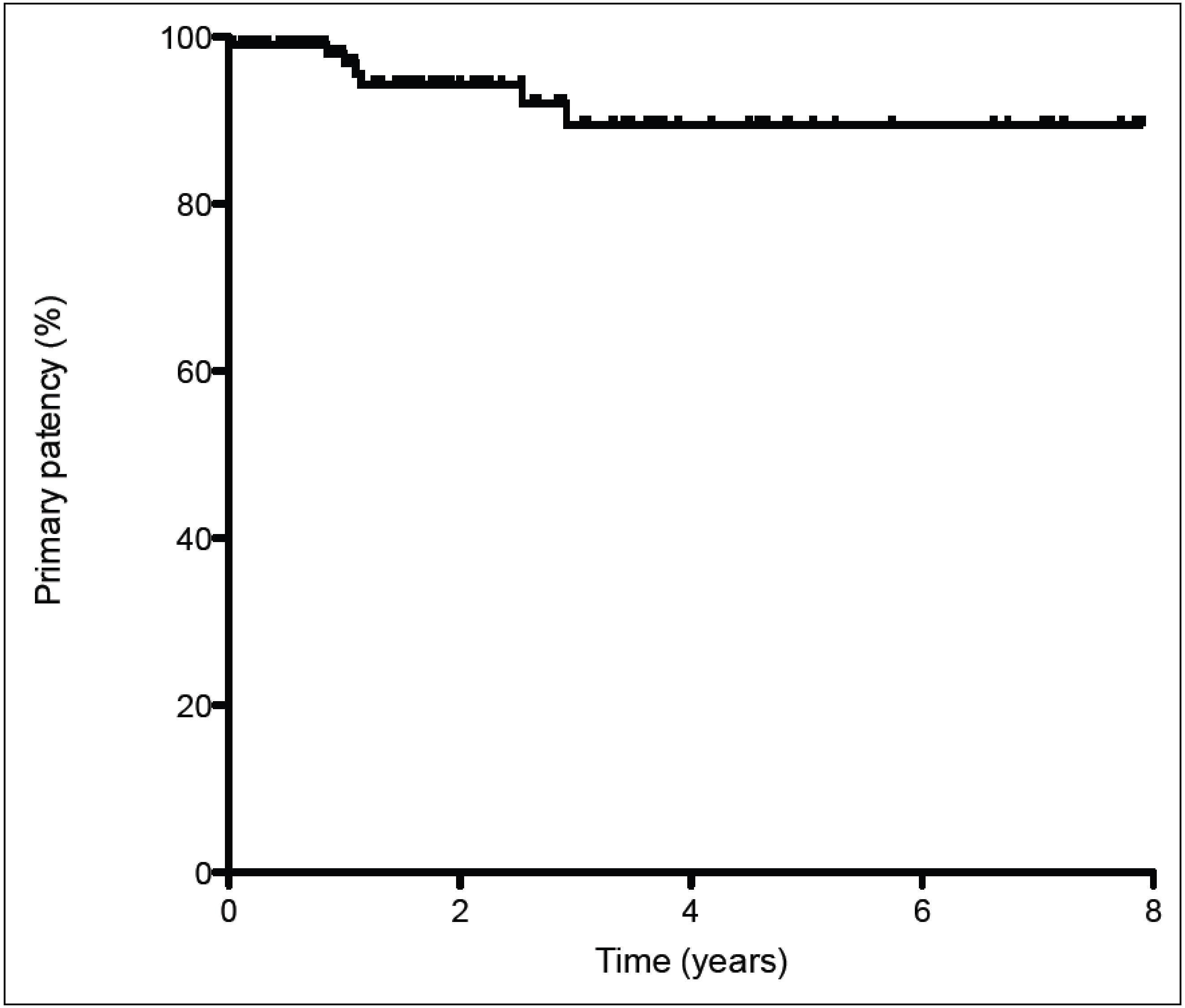
POSTOPERATIVE MORTALITY (DAY 30) = 0,86% (1/117)

GLOBAL MORTALITY RATE = 8,8% (2006-2014)

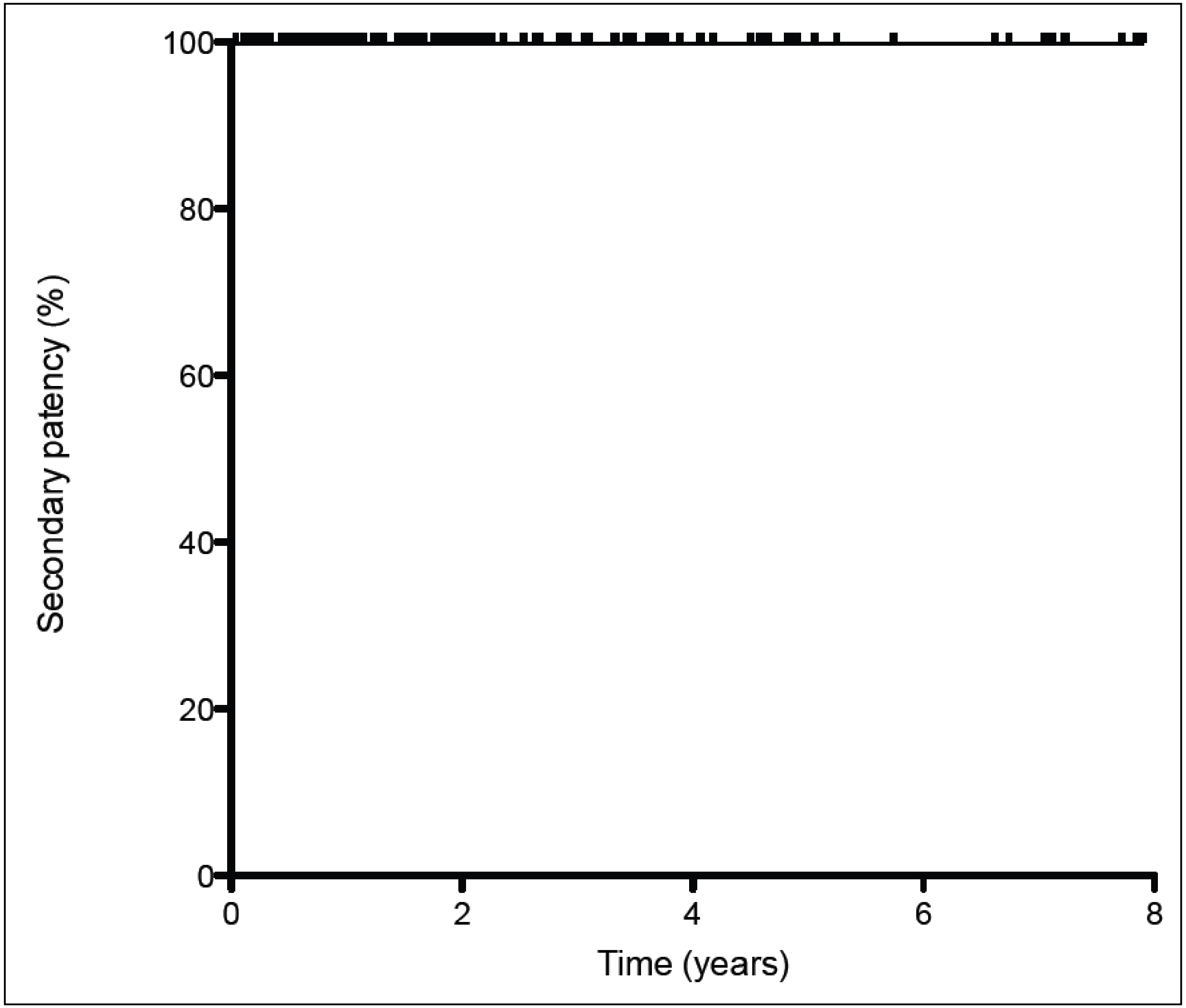
POSTOPERATIVE OUTCOMES



POSTOPERATIVE OUTCOMES



POSTOPERATIVE OUTCOMES



Benefits of using robot?

For our patient:

postoperative recovery,
painless, improvement QOL…

For the vascular surgeon:

achieve surgical procedure which was complex to do with laparoscopic technique

Benefits of using robot?

For our patient:

postoperative recovery,
painless, improvement QOL…

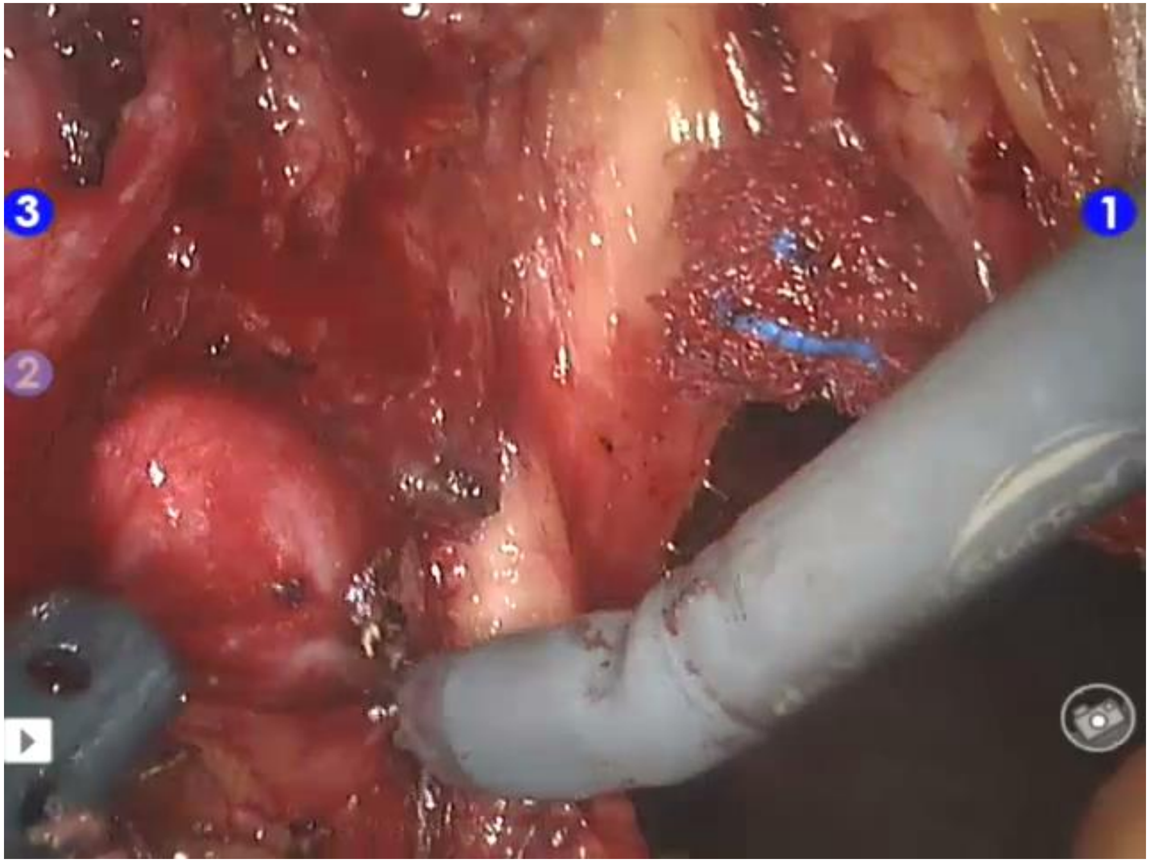
For the vascular surgeon:

achieve surgical procedure which was complex to do with laparoscopic technique

COMPLEX TECHNICAL SEQUENCES

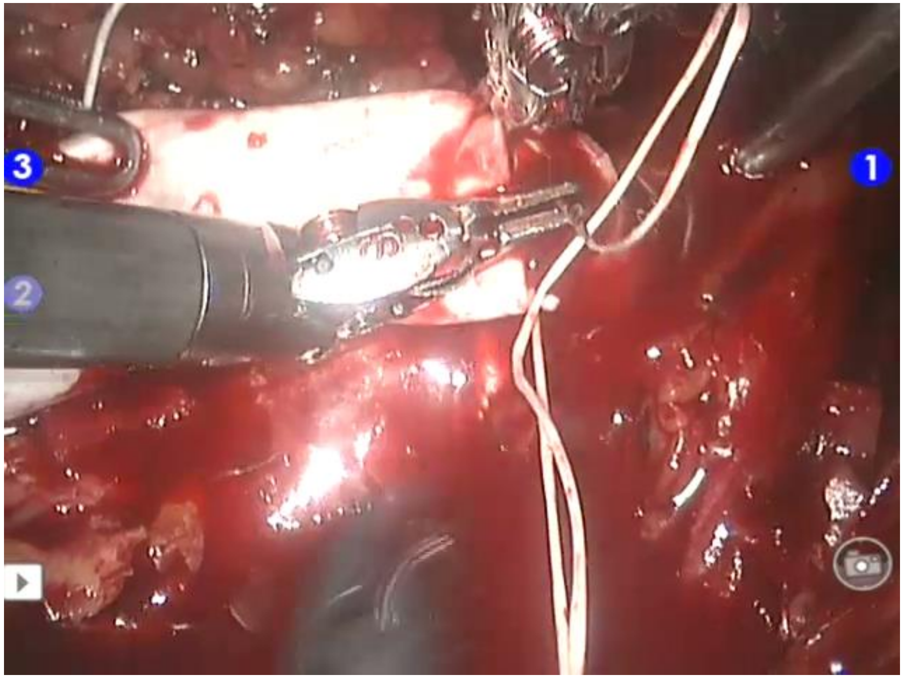
AAA: right common iliac control

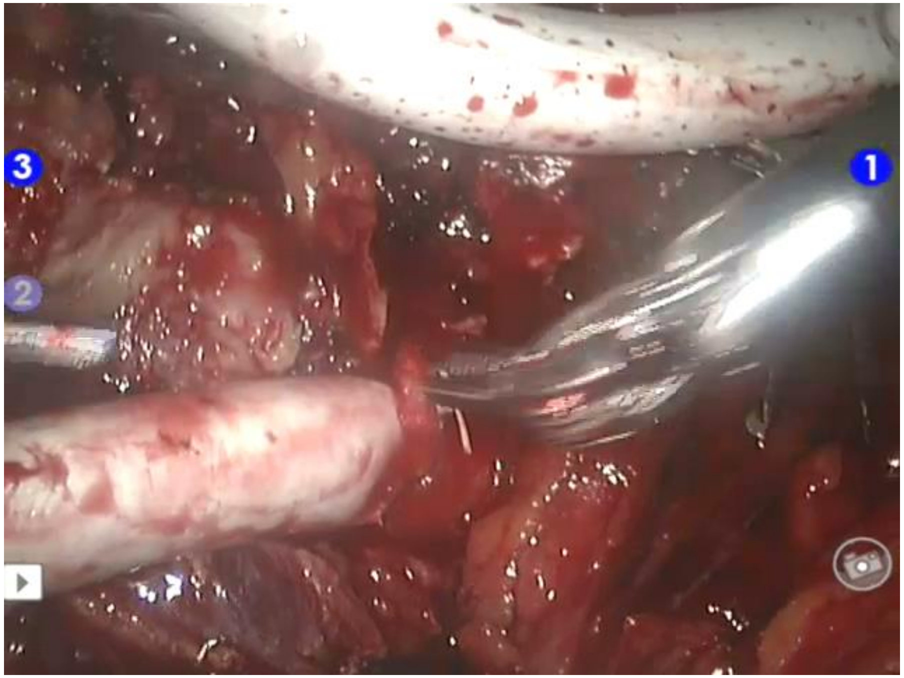
To be able to reach the target safely



COMPLEX TECHNICAL SEQUENCES

AAA: right common iliac anastomosis





Comparison learning curve laparoscopy / robot

10 anastomoses / surgeon (resident without any experience in laparoscopy and robotic)

Laparoscopy Group A

Prostheses: tube 18 mm
CV 3 GoreTex

Robot Group B

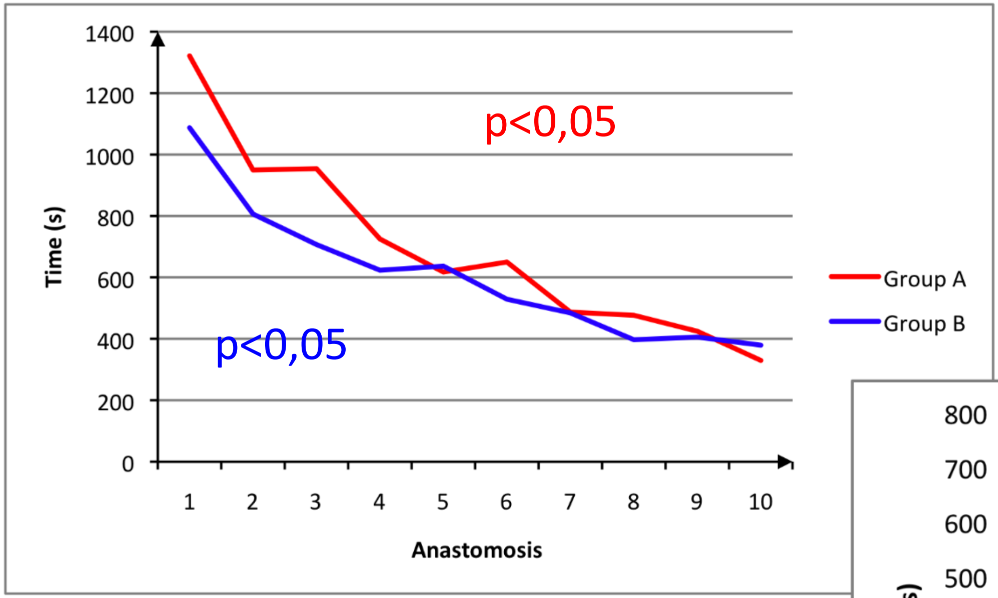
Prostheses: tube 18mm
CV 3 GoreTex

QUANTITATIVE DATA:
Time realization (posterior wall, anterior wall, knot, total)

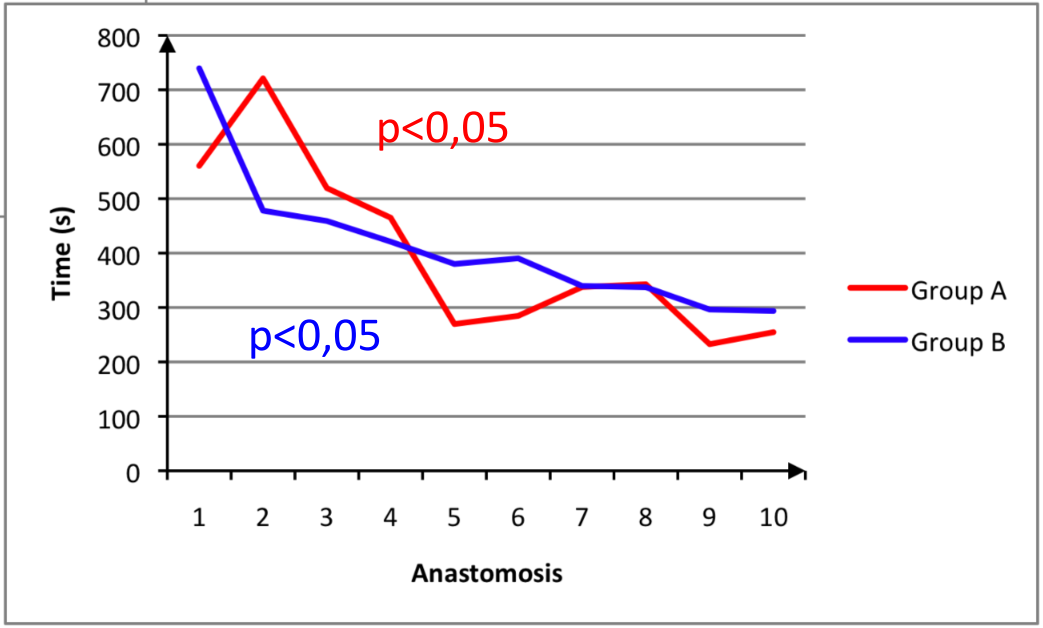
QUALITATIVE DATAS :
Number of points distant of less than 4 mm/Total number of points (ratio of sealing)

Comparison learning curve laparoscopy / robot

Posterior wall

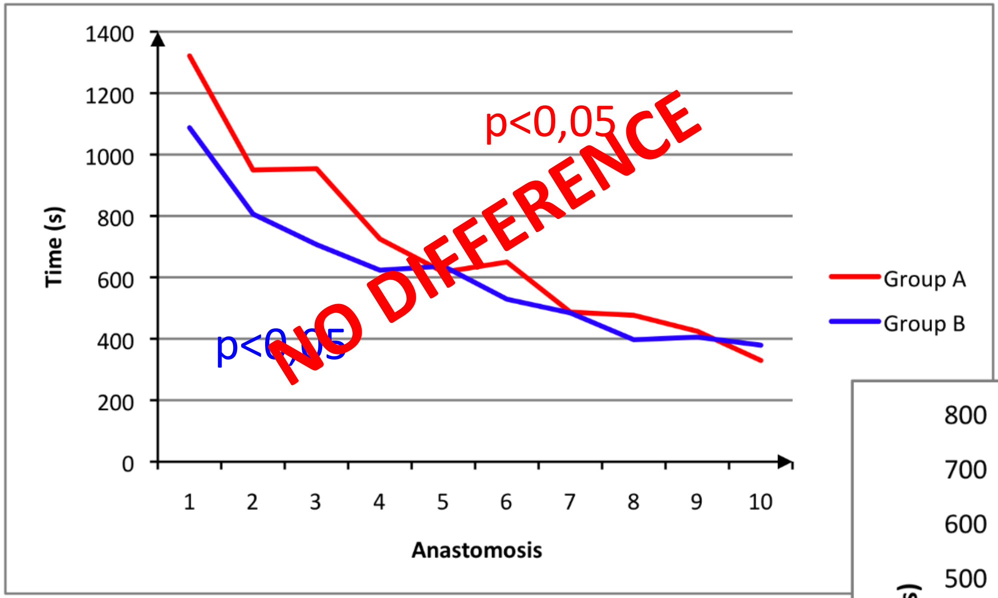


Anterior wall

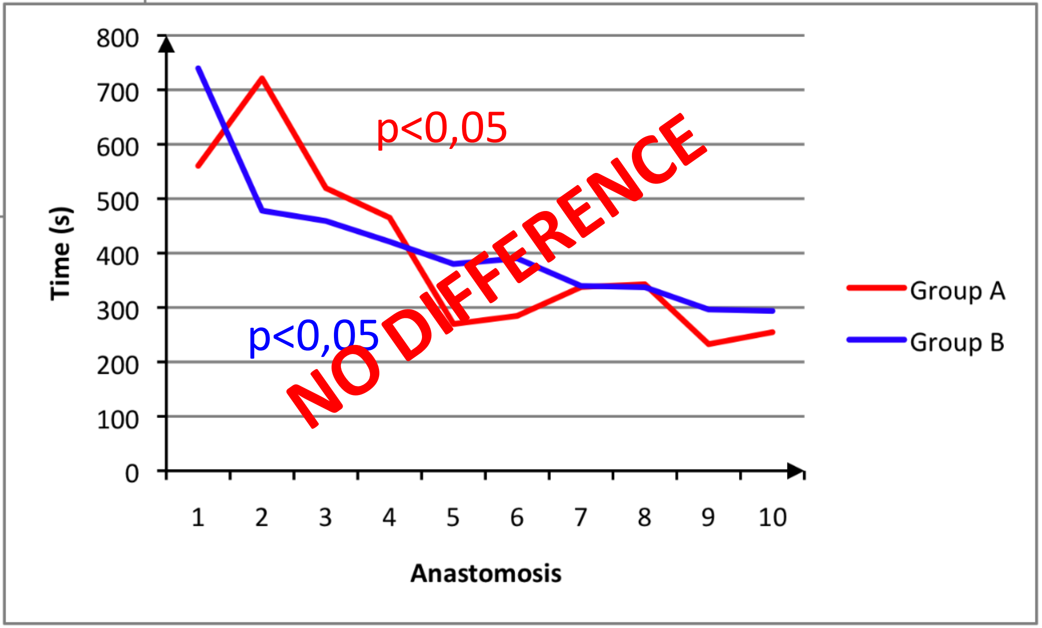


Comparison learning curve laparoscopy / robot

Posterior wall

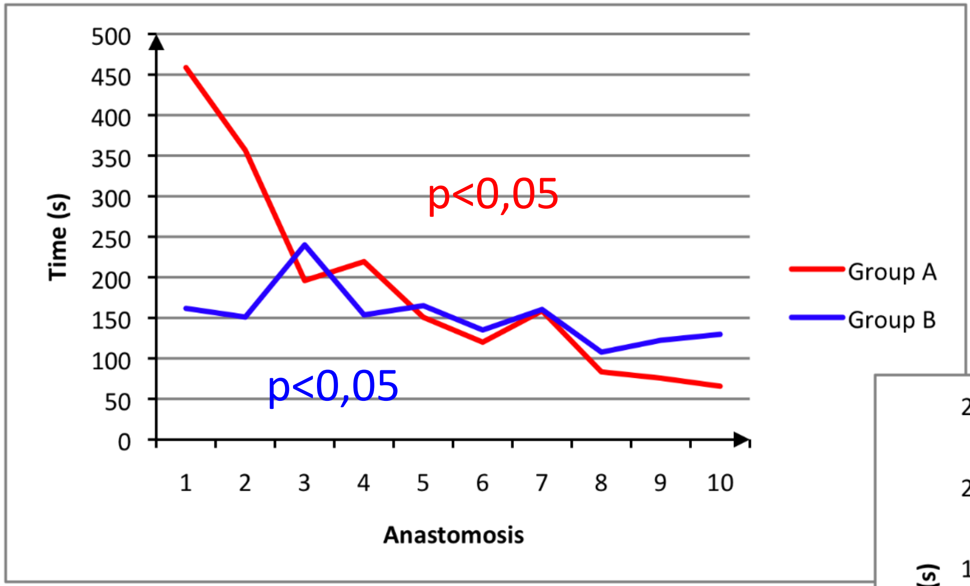


Anterior wall

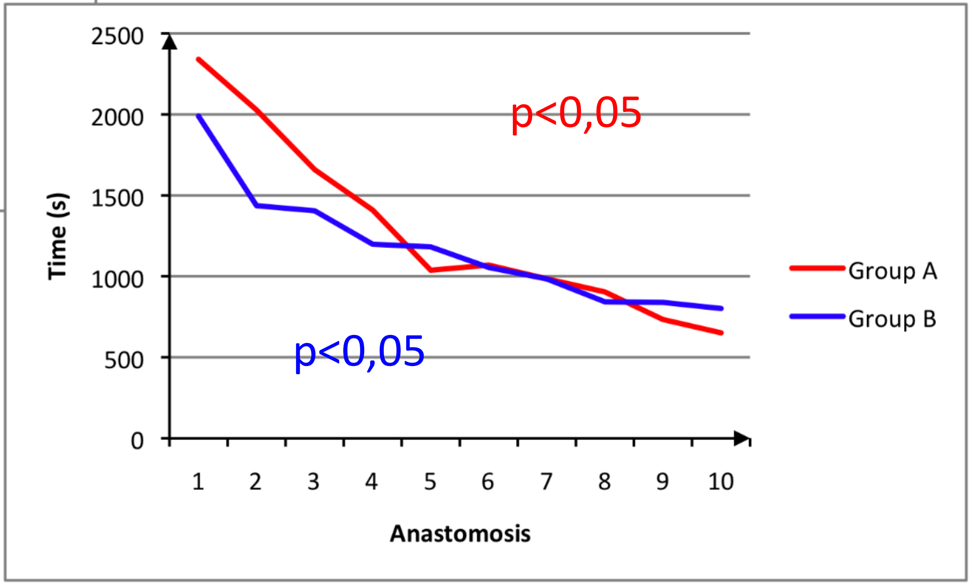


Comparison learning curve laparoscopy / robot

Knot

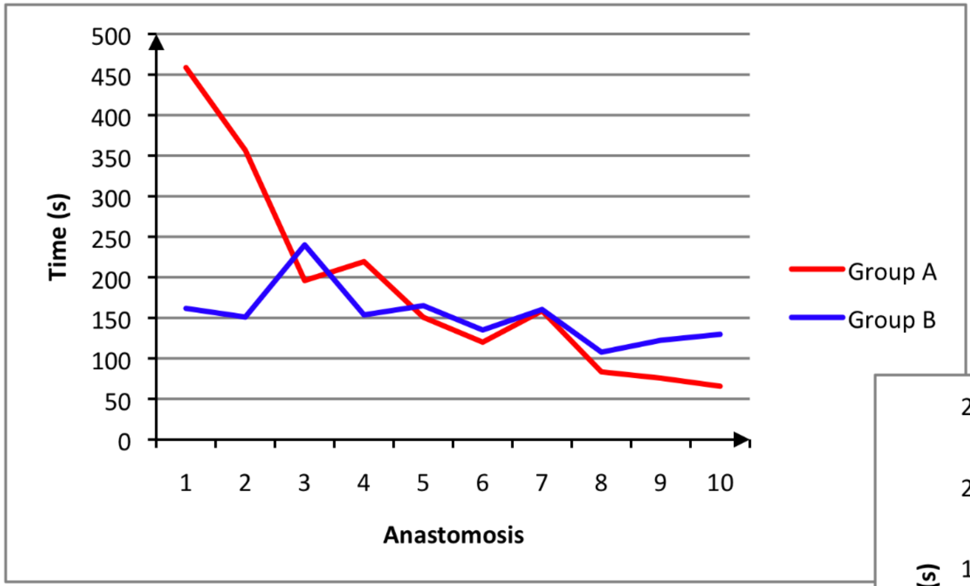


Total Time



Comparison learning curve laparoscopy / robot

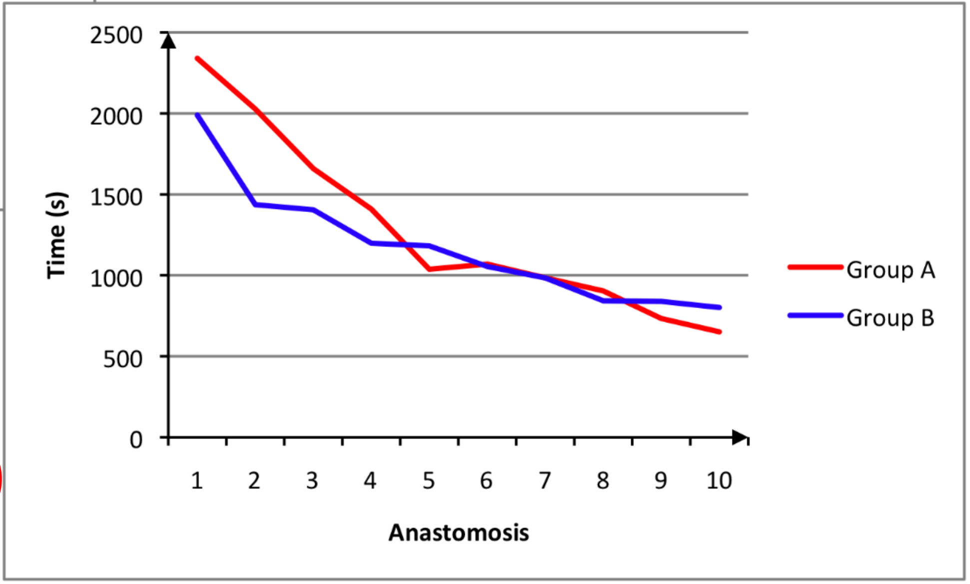
Knot



1st : B>A

10th : A>B

Total Time



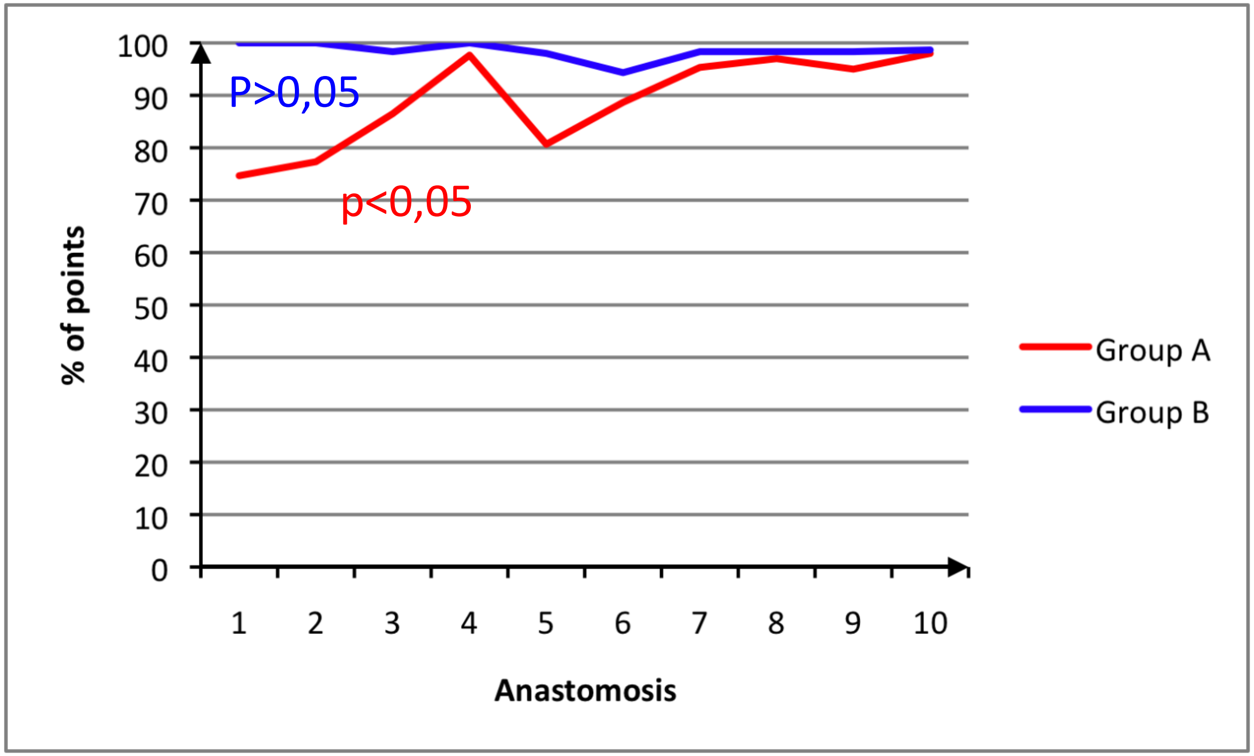
INTEREST OF THE ROBOT

FIRST ANASTOMOSIS (P <0.05)

COMPARISON LEARNING CURVE LAPAROSCOPY / ROBOT

RATIO OF SEALING

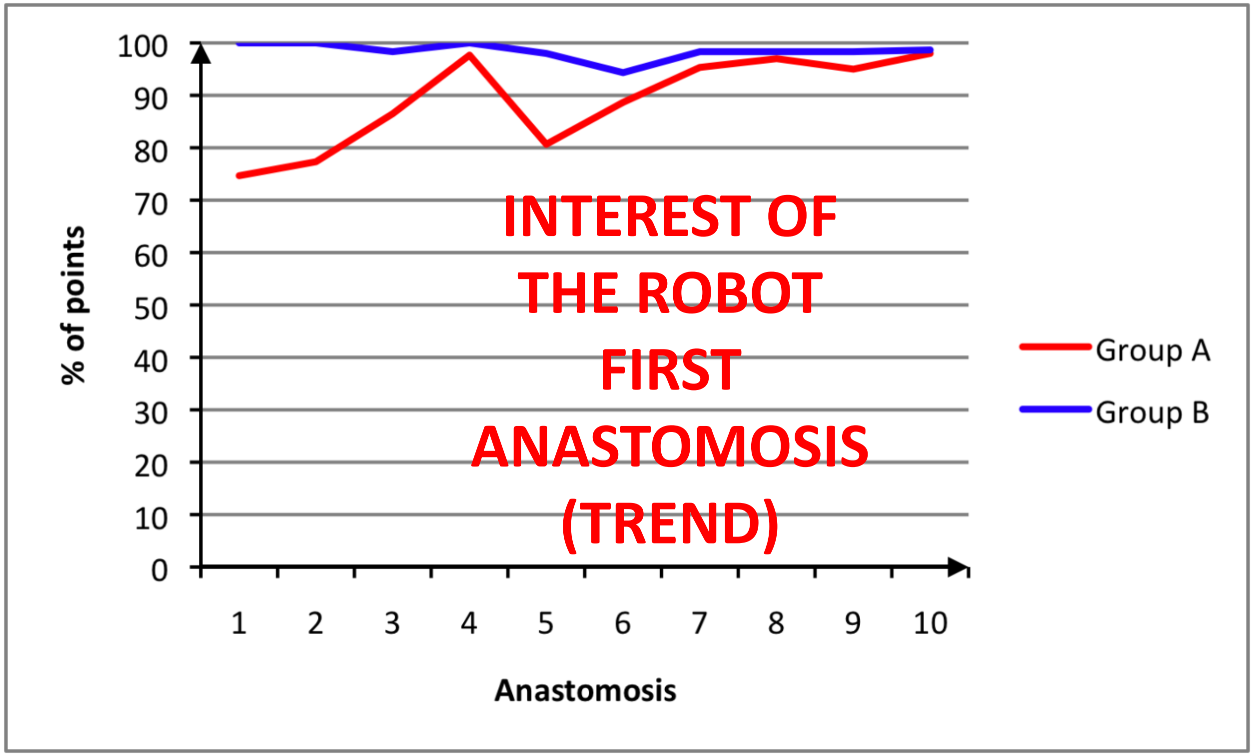
Number of points distant of less than 4 mm/Total number of points



Comparison learning curve laparoscopy / robot

RATIO OF SEALING

Number of points distant of less than 4 mm/Total number of points



Cost?

Université de Strasbourg

2012

Faculté des Sciences Pharmaceutiques et Biologiques

MEMOIRE DE DIPLOME D'ETUDES SPECIALISEES DE PHARMACIE HOSPITALIERE ET DES COLLECTIVITES

Présenté et soutenu publiquement

Le 20 juin 2012

Par

Catherine PERLA

Tenant lieu de

MEMOIRE DE DIPLOME D'ETAT DE DOCTEUR EN PHARMACIE

ETUDE MEDICO-ECONOMIQUE DE LA CHIRURGIE AORTIQUE MINI-INVASIVE LAPAROSCOPIQUE ET ROBOTIQUE : COMPARAISON AVEC LA CHIRURGIE CONVENTIONNELLE

MEMBRES DU JURY

Président : Pr Geneviève Ubeaud Sequier

Directeurs de thèse : Dr Sandra Wisniewski, Dr Fabien Thaveau

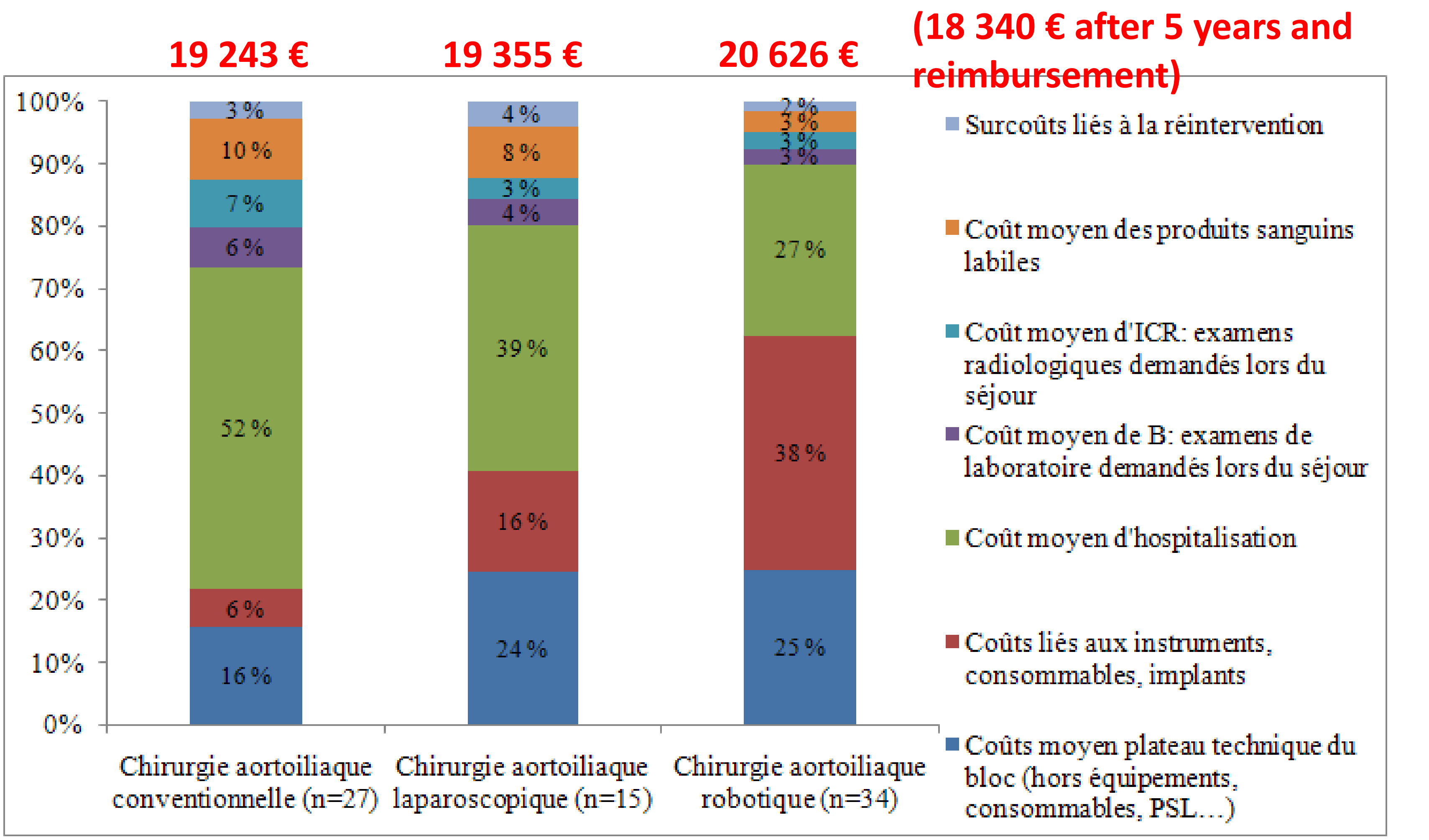
Juges : Dr Bertrand Decaudin

Dr Dominique Levêque

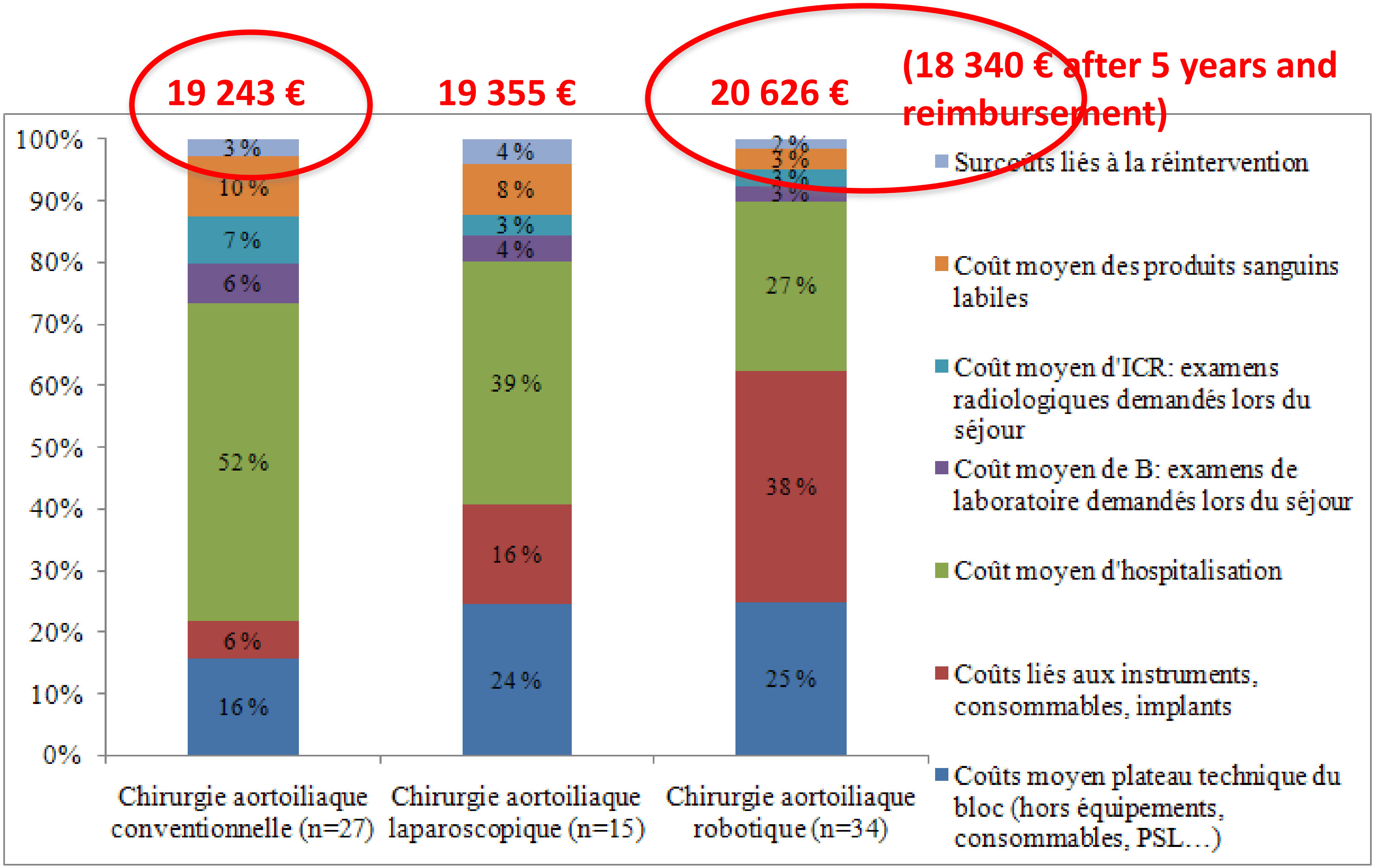
Dr Bruno Michel

Approuvé par le Président de l'Université de Strasbourg en date du

TOTAL COST / PATIENT



TOTAL COST / PATIENT



Take home message

- Is the robotic aortic surgery feasible?

Take home message

- Is the robotic aortic surgery feasible? **YES**

Take home message

- Is the robotic aortic surgery feasible? **YES**

- Routinely with a short learning curve?

Take home message

- Is the robotic aortic surgery feasible? **YES**
- Routinely with a short learning curve? **YES**

Take home message

- Is the robotic aortic surgery feasible? **YES**

- Routinely with a short learning curve? **YES**

- Is this technique in competition with endovascular surgery?

Take home message

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Take home message

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- Routinely with a short learning curve? **YES**

- Is this technique in competition with endovascular surgery? **NO, complementary techniques**

-Is it more expensive?

Take home message

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Take home message

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-Is there a gain for the patient?

TAKE HOME MESSAGE

- Is the robotic aortic surgery feasible? **YES**
- Routinely with a short learning curve? **YES**
- Is this technique in competition with endovascular surgery? **NO, complementary techniques**
-Is it more expensive? **NO, after reimbursement**
-Is there a gain for the patient? **YES**

Robotic aortic surgery could be a part of our surgical future

Eur J Vasc Endovasc Surg (2008) 36, 401

ELSEVIER

Is Robotic Surge
Procedures? Re

P. Štádler*, L. Dvořáč

Department of Vascular Surgery, N

Submitted 12 April 2008; accepted
Available online 21 August 2008

KEYWORDS
da Vinci System;
Robot-assisted aortoiliac reconstruction;
Arterial occlusive disease;
Common iliac artery aneurysm

Introduction

Major developments in laparoscop
have had a delayed impact on vasc

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doi:10.1016/j.ejvs.2008.06.028

Eur J Vasc Endovasc Surg (2008) 36, 405—406

ELSEVIER

INVITED COMMENTARY

"Is Robotic Surgery Right for Vascular Procedures? Report of 100 Aortoiliac Cases" by Petr Štádler, et al.

W. Wisselink*

Department of Vascular Surgery, VU University Medical Center, De Boelelaan 1117, PO Box 7057, 1007 MB Amsterdam, The Netherlands

The authors are to be commended with their meticulous description of the largest series in the world of patients treated with robot assisted laparoscopic aortoiliac reconstruction.

Laparoscopic aortic surgery, in spite of the devotion of many pioneers,[1,2] has never really become mainstream simply because it 's *too difficult*. Sewing the aortic anastomosis laparoscopically is very much like playing a guitar behind once back or riding a bike with reversed steering: very much possible, *with sufficient practice*, but hardly optimal.

The first use of the operative robot in aortic surgery has been described in 2002.[3] In spite of clear, intuitive advantages whereby the robotic technology has eliminated many of the classic laparoscopic obstacles such as unnatural eye-hand coordination, unnatural working-axis, 2-dimensional vision, limited degrees of freedom and the 'fulcrum effect', to date, not many vascular surgeons have been convinced. Mere availability of robotic systems does not seem to be the issue: pushed by "evidence backed" advantages in other fields, such as urology and gynaecology, many modern hospitals have adopted robotic systems the world over.

As I have witnessed in Prague, Dr. Štádler and colleagues have built a strong aortic robotic program based on individual skill and excellent team work. Certainly the latter is an absolute and unconditional requirement for an efficient and safe robotic aortic program. The modified transperitoneal approach for aortic exposure as described in this article, with only minor changes in patient position during the operation and lack of mobilization of the descending colon, is unique and a valuable addition. The nearly supine position of the patient allows for the robotic system to be placed on the right side of the patient, thereby optimizing camera and instrument angles. Also, interference with the shoulder and head of the patient seems to be diminished in comparison with techniques described earlier.[3] Although mean total operating time has been diminished further by these elegant additions, the reported maximum of around 6 hours may still turn out to be prohibitive in *certain* patients (and we don't always know who they are).

It is remarkable that the authors have been able to accumulate such a large number of patients in such a short time. Besides a good reputation and a large catchment area (virtually all of Czechia), certainly a confounding factor in their success has been the relative underexposure of endovascular techniques within their institution. A good number of patients described in this article would have preferably undergone percutaneous endovascular treatment in other hospitals, including ours. Maybe this constitutes a possible point of criticism towards the authors: I believe, as full-time vascular surgeons, we should not restrict ourselves to just one technique, but treat vascular disease in each individual patient with the procedure of choice: either best non-operatively, endovascular, laparoscopic or open.

Undoubtedly, however, it takes skilled, focused, devoted and maybe therefore somewhat monomaniac pioneers like Dr. Štádler and colleagues to truly bring us forward in our perpetual quest: to treat vascular patients in

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Thank you