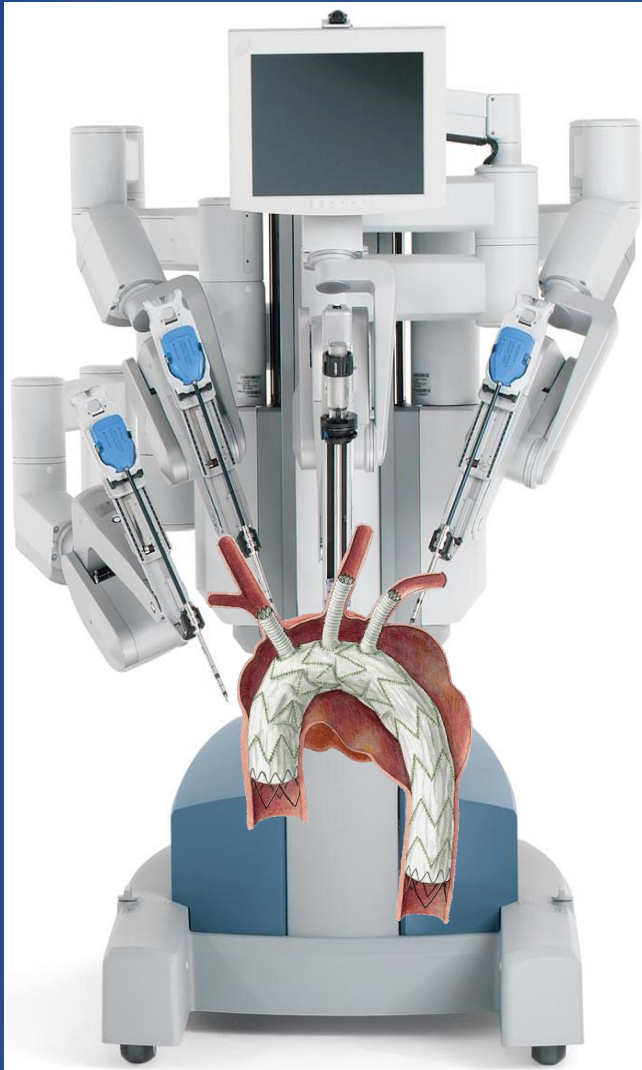




Articulated Robots for Aortic Disease

A Failed Experiment

Willem Wisselink MD FACS
VU University Medical Center
Amsterdam



Disclosure

Speaker name:

Willem Wisselink

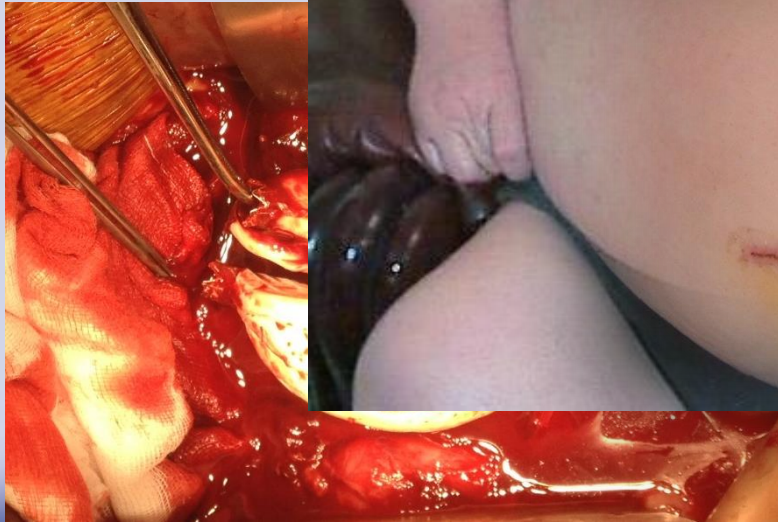
I have the following potential conflicts of interest to report:

- Consulting Medtronic, Inc.
- Intellectual property, Cook, Inc.

Definition Robot Webster's

- A **robot** is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program

WHY Laparoscopic aortic surgery?



Ann Vasc Surg 2013

Results of laparoscopic surgery for abdominal aortic aneurysms in patients with standard surgical risk and anatomic criteria compatible with EVAR.

Javerliat I, Capdevila C, Beauchet A, Di Centa, Goeau de Brissonniere O, Coggia M

- 99 eligible for EVAR
- Operative time: 210 (180-520) minutes = 3-8 hrs
- Clamping time 81 (35-140) minutes = up to 2 hrs

Ann Vasc Surg 2013

Results of laparoscopic surgery for abdominal aortic aneurysms in patients with standard surgical risk and anatomic criteria compatible with EVAR.

Javerliat I, Capdevila C, Beauchet A, Di Centa, Goeau de Brissonniere O, Coggia M

- 0% mortality
- 3% severe morbidity
- 10% moderate morbidity
- Operative time indicative for complications

Laparoscopic Vascular Surgery: A Systematic Review

D. Nio,^{1*} J. Diks,³ W.A. Bemelman,² W. Wisselink³ and D.A. Legemate²

¹Department of Surgery, Spaarne Hospital, Hoofddorp, The Netherlands, ²Department of Surgery, Academic Medical Center, Amsterdam, The Netherlands, and ³Department of Surgery, Vrije Universiteit Medical Center, Amsterdam, The Netherlands

Eur J Vasc Endovasc Surg 33, 263–271 (2007)

Table 3. Aneurysm repair. Operative data of included studies

	Year	N	Operative time (minutes)	Clamping time (minutes)	Anastomosis time (minutes)	Hospital stay (days)	Mortality x/n	Conversion x/n
<i>Total laparoscopic surgery</i>								
Cau ²²	2006	23(23t)	251+/-57*	101+/-15*		6(4-12) [†]	1/23	7/23
Coggia ²⁶	2005	30(13 t,17 bif)	255(170-410) [†]	80(35-110) [†]		9(5-37) [†]	1/30	1/30
Coggia ²⁹	2004	30(11 t,15 abi, 4 abf)	290(160-420) [†]	78(35-230) [†]		9(8-37) [†]	2/30	2/30
Kolvenbach ²	2004	37(nr)	227+/-34*	81+/-31*	53+/-9.0*	6.3+/-21.1*		6/37
Dion ³²	2004	7(6 abf, 1 t)	299+/-75*	109+/-52*	48+/-23*	6(3-32)*	0/7	1/7
Edoga ³⁷	1998	22(16 abf,4 abi)	391(180-600) [†]	146(6-286) [†]		6(2-25) [†]	2/22	2/22
<i>Robot-assisted laparoscopic surgery</i>								
Kolvenbach ²	2004	10(8 t,2 abi)	243+/-41*	96+/-22*	41+/-4*	7.3+/-2.4*		2/10
<i>Laparoscopic-assisted surgery</i>								
Alimi ¹¹	2003	24(12 t,3 abi, 8 abf,1af)	238(155-360) [†]	76(42-160) [†]		7(3-21) [†]	1/24	4/24
Castronuovo ²¹	2000	60(60 bif)	422(90-690) [†]	112(43-286) [†]		6(1-25) [†]	3/60	3/60
Kline ⁴⁷	1998	20(t)	246+/-55.2*			5.8+/-1.6*	0/20	2/20
<i>Hand-assisted laparoscopic surgery</i>								
Ferrari ⁴⁰	2006	122	257+/-70*	76+/-26*		4.4+/-1.7*	0/122	9/122
Kolvenbach ⁵⁰	2001	29(nr)	181(130-345) [†]	57(44-90) [†]		6(4-21) [†]	1/29	

An overview of laparoscopic techniques in abdominal aortic aneurysm repair

Konstantinos P. Economopoulos, MD,^{a,b,c} Eirini Martinou, MD,^{c,d} Shahrhad Hakimian, BS,^{a,e}
Dimitrios Schizas, MD,^c Sotirios Georgopoulos, MD,^b Christos Tsigris, MD,^b and
Chris N. Bakoyiannis, MD,^b *Boston, Mass; Athens, Greece; and London, United Kingdom*

J. Vasc Surg 2013

- Total Laparoscopic
- Laparoscopy assisted
- Hand assisted laparoscopy
- Retroperitoneal/intraperitoneal
- Retro/ante colic Retro/anterenal
- Robot assisted

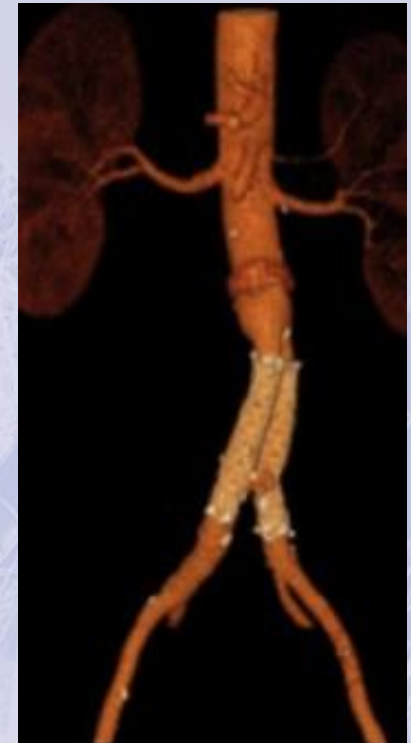
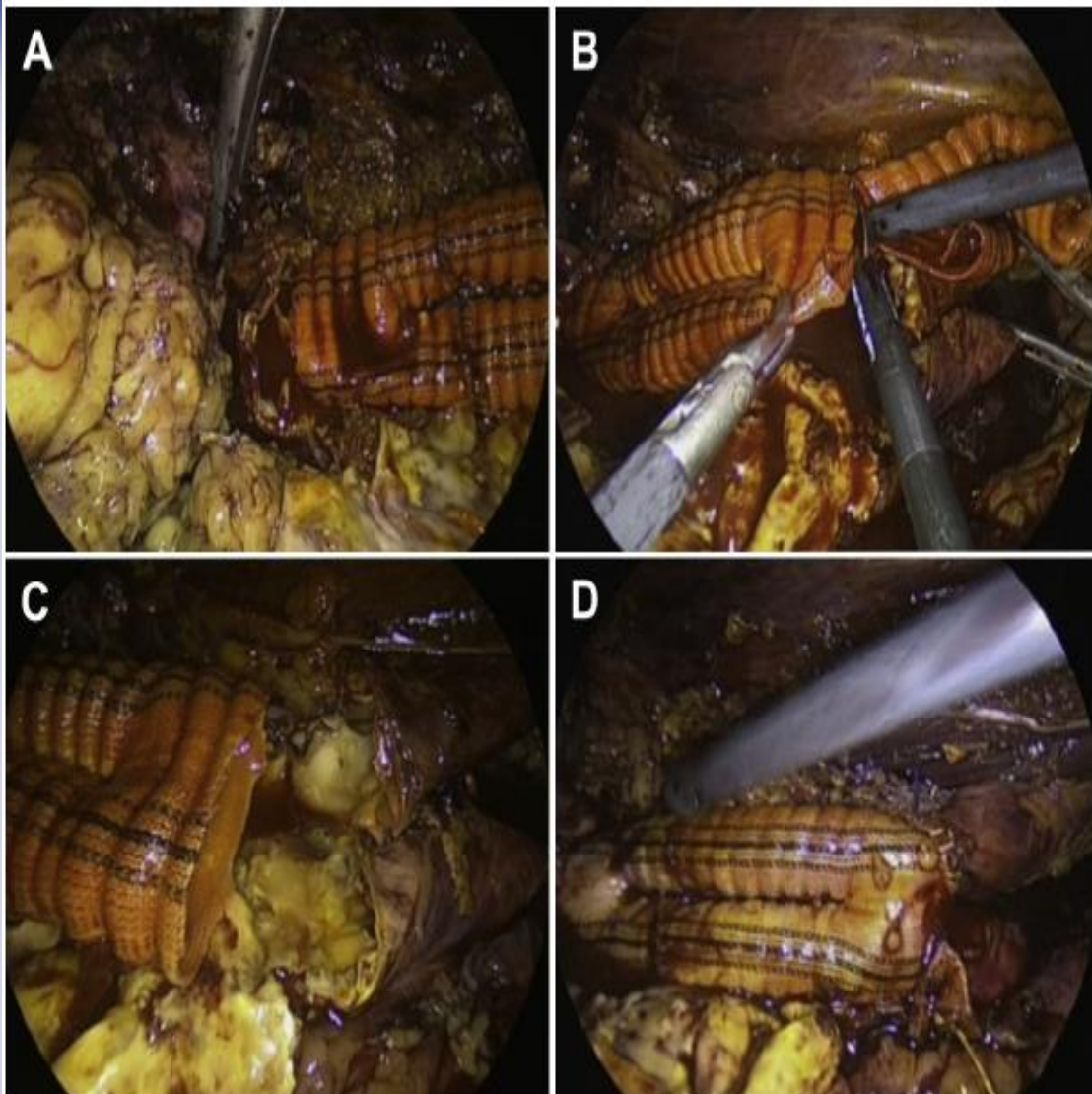
VASCULAR AND ENDOVASCULAR TECHNIQUES

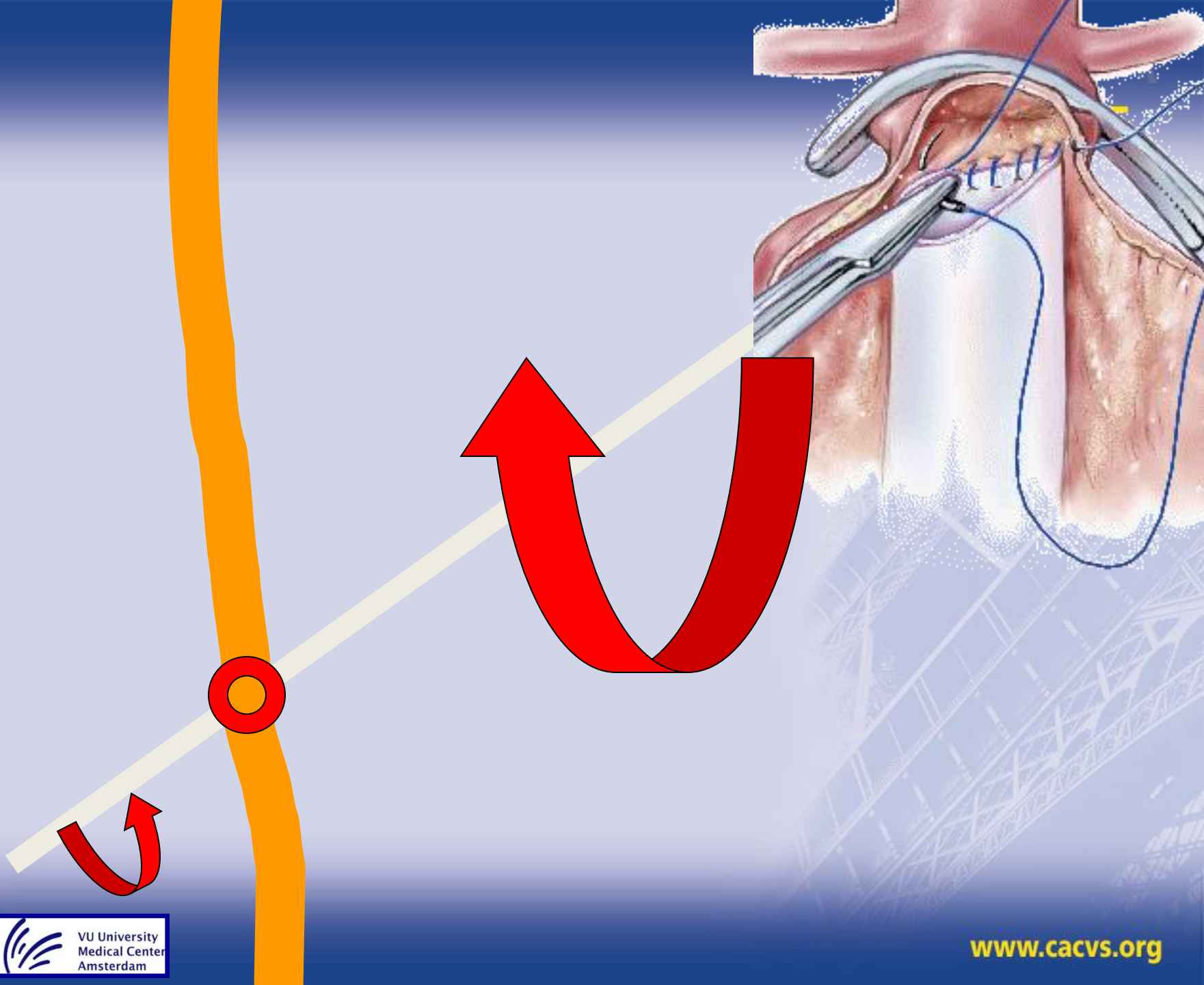
Peter F. Lawrence, MD, Section Editor

Bitubular graft as an adjunct for laparoscopic hybrid repair of an abdominal aortic aneurysm

Raphaël Coscas, MD, Clément Capdevila, MD, Olivier Goeau-Brissonniere, MD, PhD, and Marc Coggia, MD, *Boulogne-Billancourt and Montigny-le-Bretonneux, France*







Practice practice practice





What's the problem with laparoscopic vascular surgery?

What's the problem with laparoscopic vascular surgery?

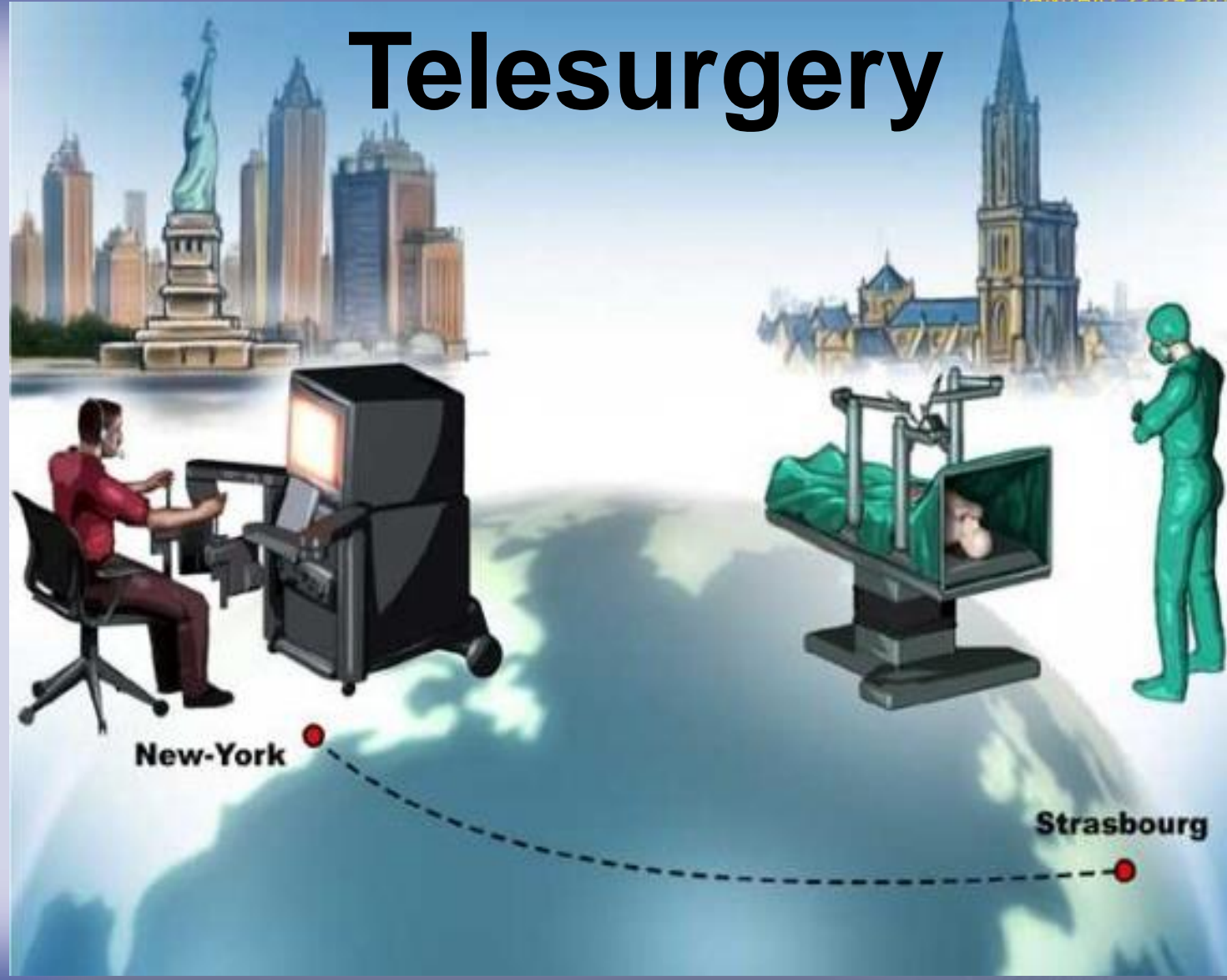
It's just too difficult!



Technology!



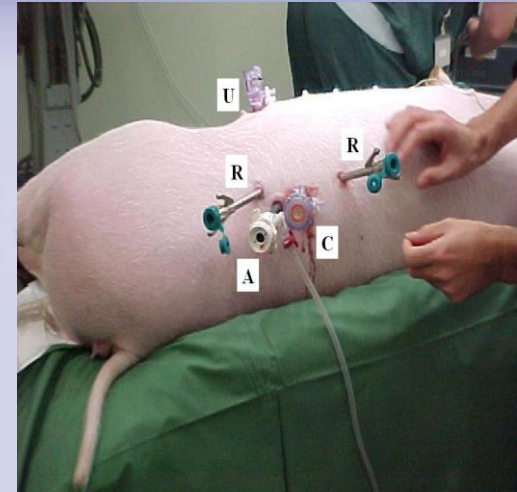
Telesurgery



ROBOT

Experimental study

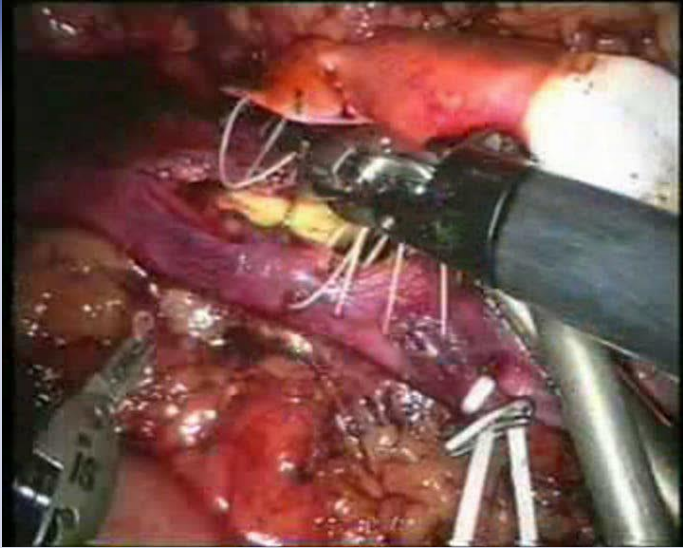
- 20 pigs
- Tubegraft
- Robot vs Conventional Laparoscopy



Robot: Quicker
More accurate
Less blood loss



EJVES, 2001



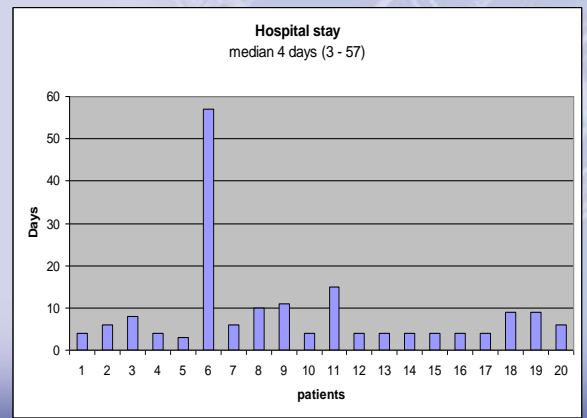
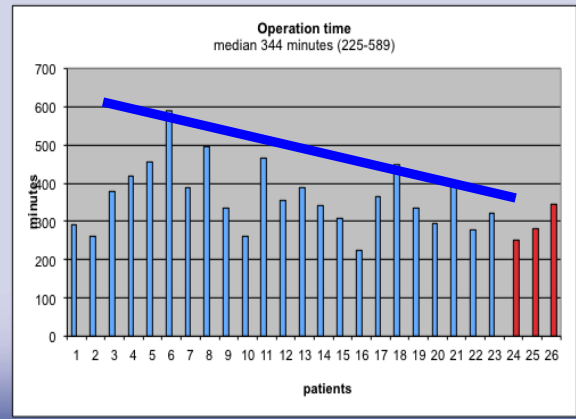
Robot-assisted laparoscopic aortobifemoral bypass for aortoiliac occlusive disease: A report of two cases

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

(J Vasc Surg 2002;36:1079-82.)

31 patients, AIOD

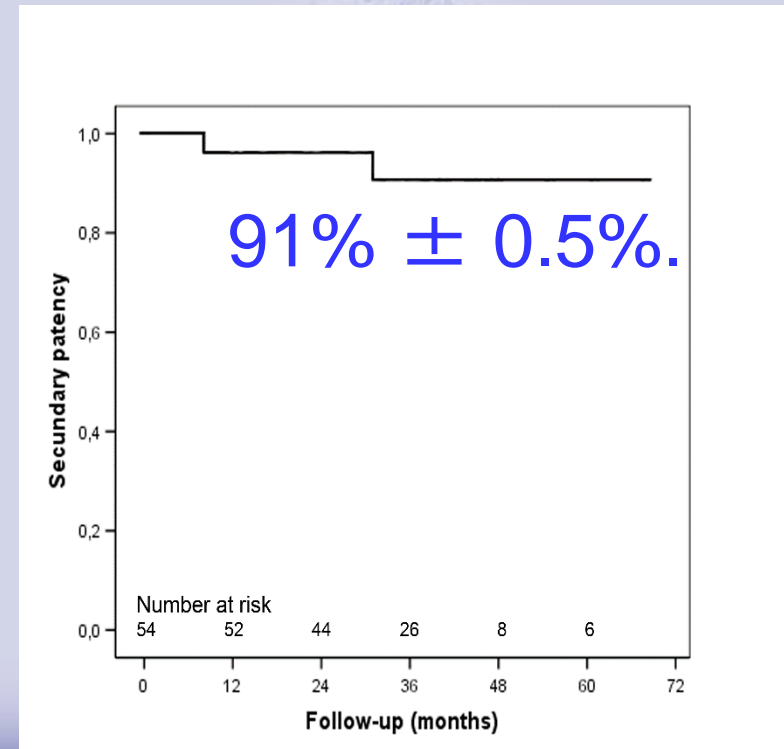
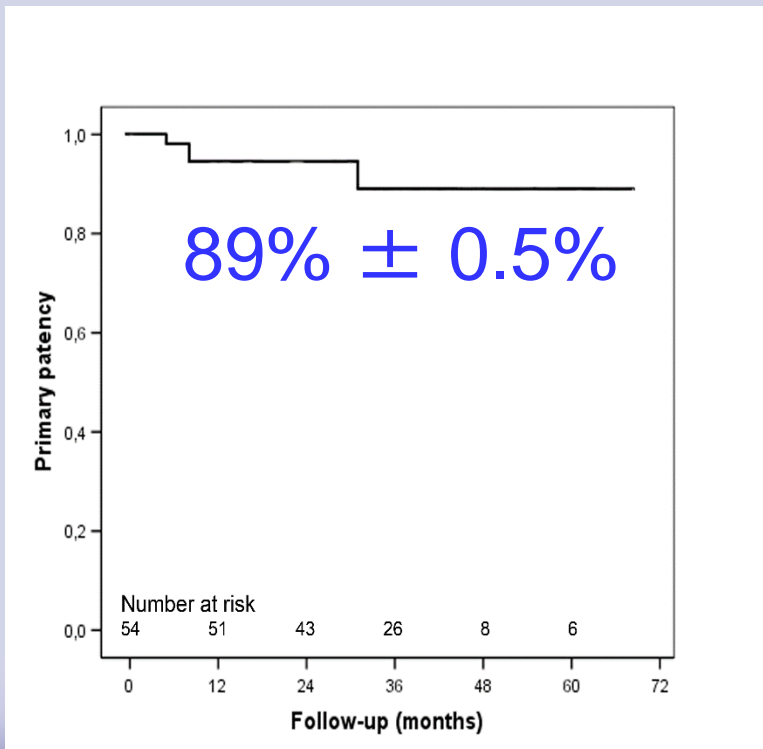
- ABF or
- endarterectomy



Results

- Conversion to minilaparotomy in 3 pts
- Mortality 3%.
- Minor complications 9%.

Medium term Kaplan Meyer Patency at median follow up of 36 months (range 12 to 68)





6 months post op



ELSEVIER



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

P. Štádlér*, 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

- 97.3% technical success
- 2.7% complication rate,
- anastomosis and clamp times 27 and 39 min

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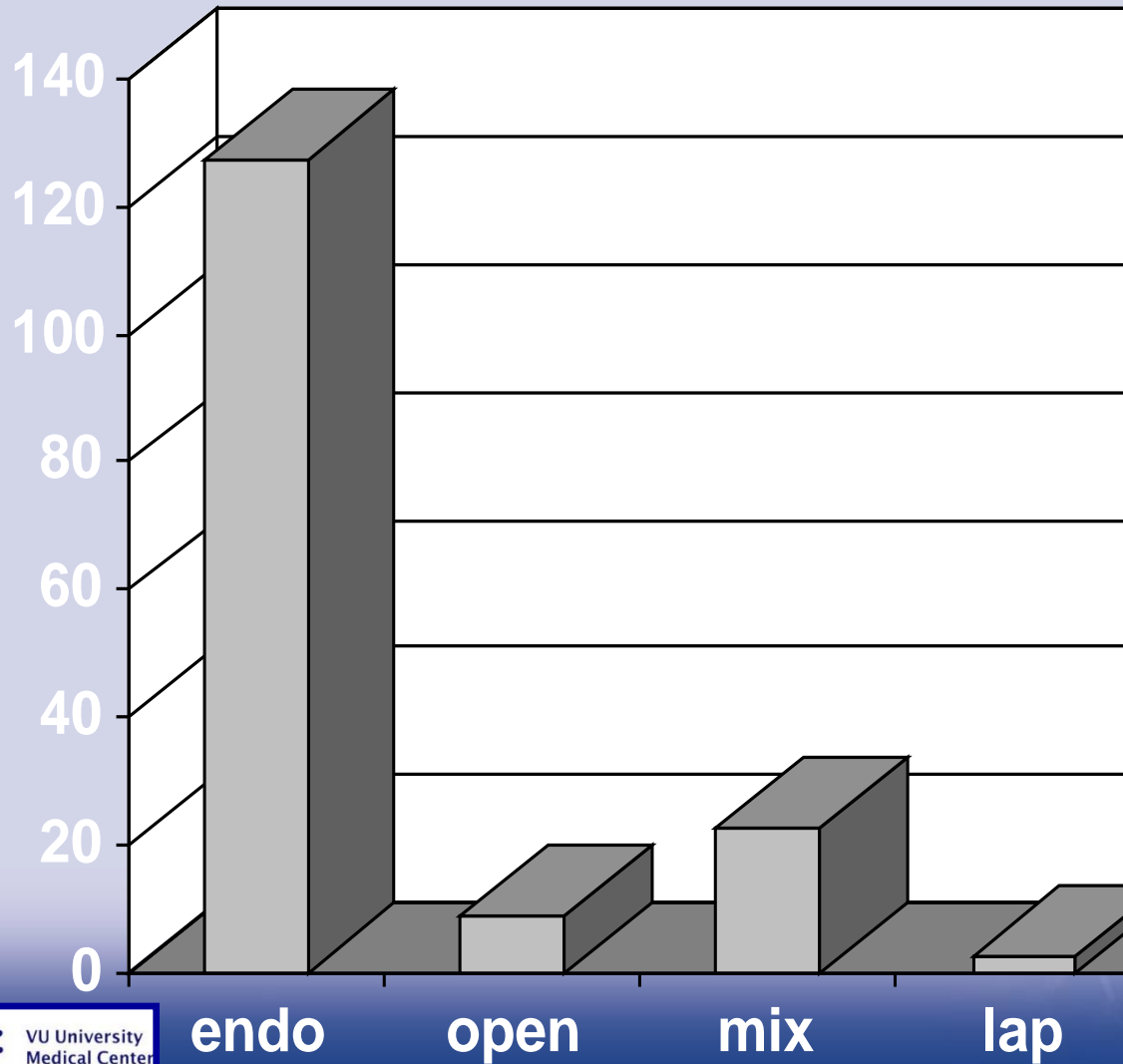
Literature since 2002

Robot assisted aortic surgery:

13 (thirteen!) papers

- Amsterdam (\approx 40 cases)
- Kolvenbach (\approx 40 cases)
- Stádler ($>$ 200 cases)
- Lin

talks on aortic disease VEITH



Amsterdam Robotic Aortic Program

- “competition” of endovascular surgery
- < 5-10 cases per year
- On hold



Draw backs

- Too bulky
- Cumbersome
- Depending on additional personnel
- Expensive!

FEDERAL RESERVE NOTE

UNITED STATES OF AMERICA

NOTE IS LEGAL TENDER
FOR ALL DEBTS, PUBLIC AND PRIVATE

L11180916G

WASHINGTON, D.C.

12

\$ 1,200,000 robot
\$ 150,000 per year



FW H 57

bedo Cabral

SERIES
2003
A

John W Snow

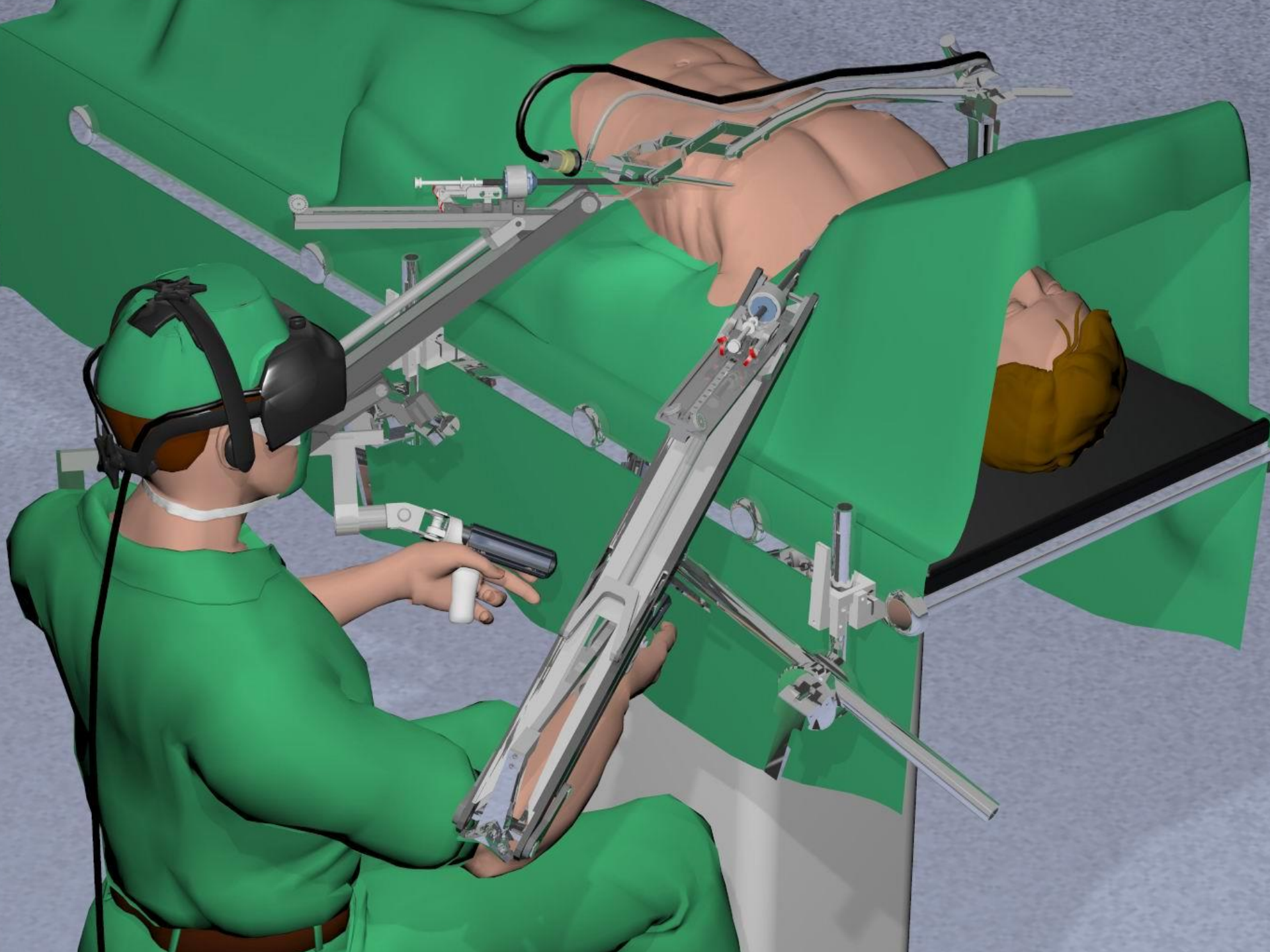
12

United States

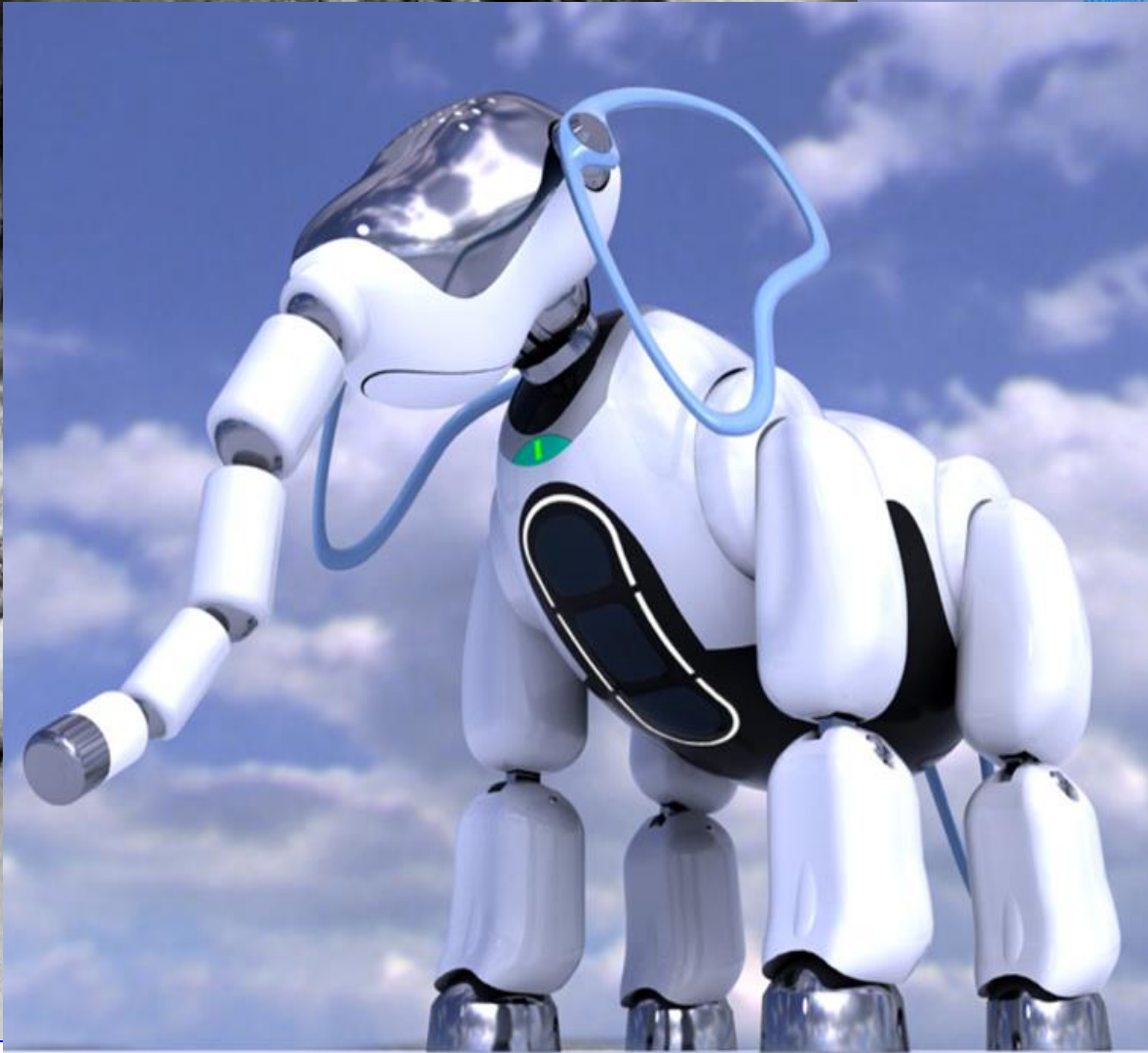
Secretary of the Treasury

WASHINGTON
ONE DOLLAR



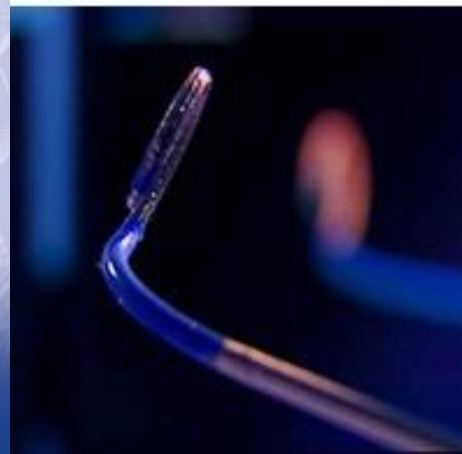


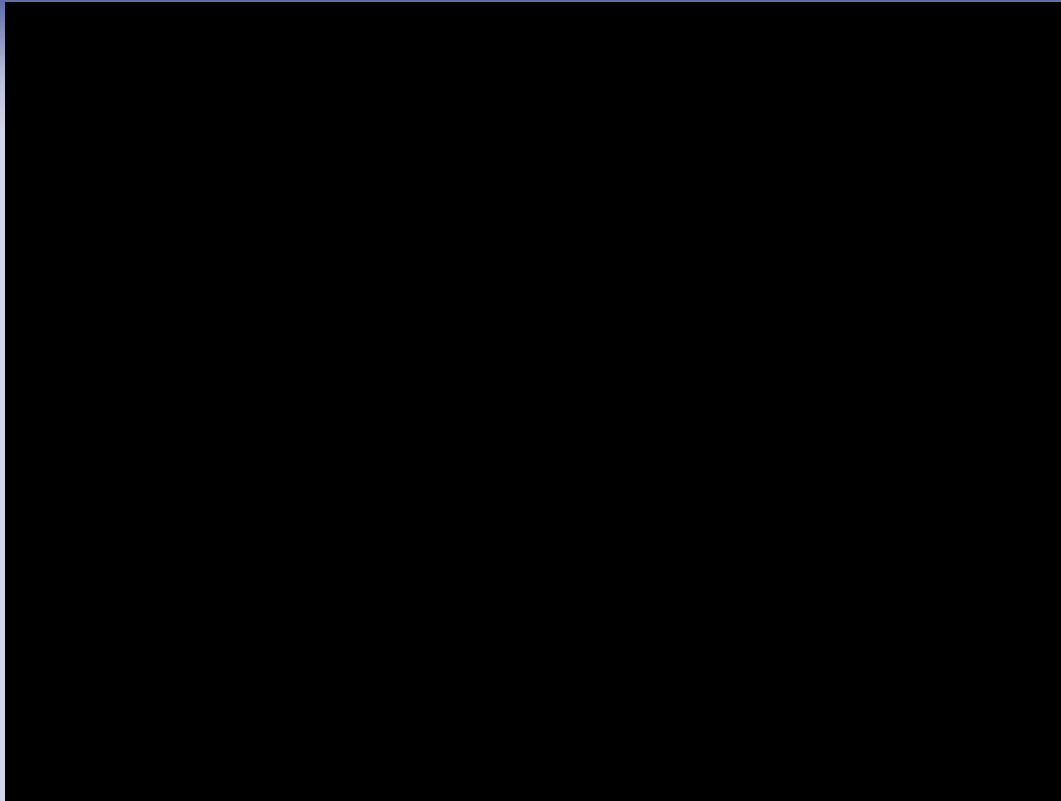
endovascular surgery



Open (laparoscopic) vascular

Hansen Sensei robotic
system





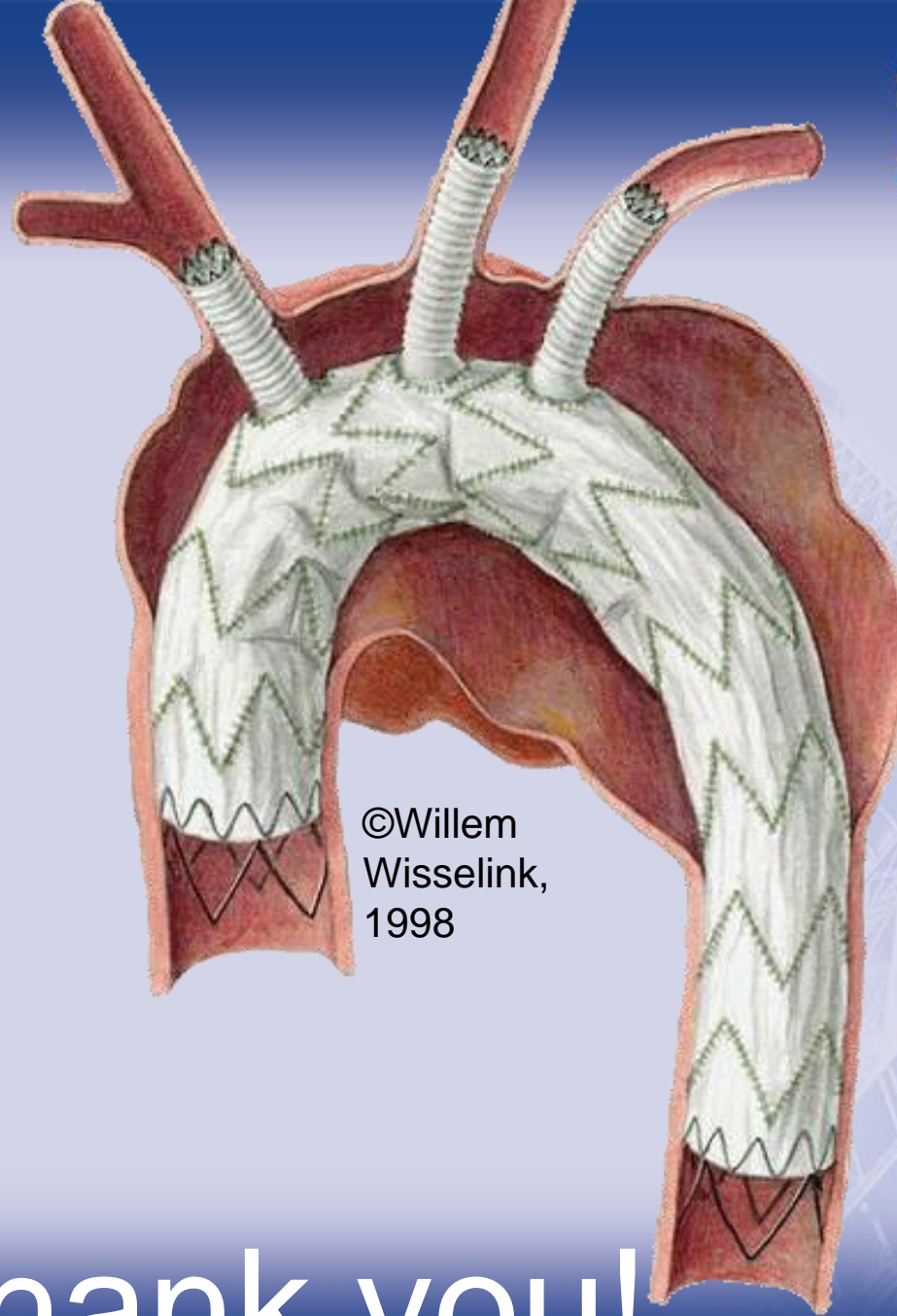
“The robotic system enables precise manipulation, stable positioning, and minimum instrumentation of the aorta and its branches while minimizing radiation exposure”

Cheshire et al

Conclusion

Articulated robots for laparoscopic aortic surgery have not fulfilled the high expectations

- In spite of all efforts, they never became mainstream
- lack of reproducibility and thus proof
- The technology will be completely trampled by the ever and much faster improvement of endovascular surgery



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Wisselink,
1998

Thank you!