Robotic surgery in Gynaecology, a Friend or Foe?!

Dr. Salwan Al-Salihi

Contents:

- Overview and background
- Technical aspects
- Implementation
- Role in Gynaecology and Subspecialty
- Limitations and evidence

Overview and background

- A surgical robot is a computer-controlled device that can be programmed to aid the positioning and manipulation of surgical instruments.
- First developed in the 1980s to address the limitation that conventional laparoscopy has in term of two dimensional exposure and limited articulation of used instruments.
- Advantages of robotic over conventional laparoscopy include three-dimensional imaging, mechanical improvement (eg, instruments with seven degrees of freedom), stabilization of instruments within the surgical field, and improved ergonomics.
- The major advantage to the patient is a potentially shorter hospital stay and more rapid postoperative recovery and return to full function.*

Range of articulation:

History:

- First Robotic surgery in 1985 using The PUMA 560 model. (Brain needle biopsy under CT guidance)
- First Robotic surgery in Urology 1988 using Probot model.
- First Orthopaedic surgery 1992 using Robodoc.
- First Robotic Gynaecology surgery in Human patient was 1998 using Zeus model. (re-anastamosis of Fallopian tubes)
- The AESOP (Automated endoscopic system for optimal positioning) introduced in 1994 for intraabdominal surgery.

History: Thanks to the Armed Forces!!

- First Telepresence technology became commercially available in 2000 *(Da Vinci)*.
- *First developed by The Stanford Research institute, The US Defense Dept, and the National Aeronautics and Space Administration.*
- *The intent was to perform surgery from a remote location to the battlefield.*
- *One of the Obstacles at the time were the telecommunication band width requirement.*

- The Robotic assisted Laparoscopic Surgery (RALS) was then developed by the Intuitive surgical system Inc., CA and was FDA approved in 2001 for Urologic procedures.
- 2002 approved for Thorascopically-assisted Cardiotomy.
- 2004 approved for Coronary revasculaization.
- 2005 approved for Gynaecology surgery based on preliminary reports from Univ of Michigan. (Reynolds et al Am J Surg 2006)

- Further technical development in upgrading the standard 3 arm system to the 4 arm “S” system in 2006.
- There was a high uptake of research in the field since.(2006/3, 2007/14 and 2008/27)
- in 2009 There was 825 units in the US and at least 500 Gynaecology Oncologist have attended at least one robotic training course in the last 3 years.
- In Belgium, population of 10.9 millions there are 13 units only 6 are in use.

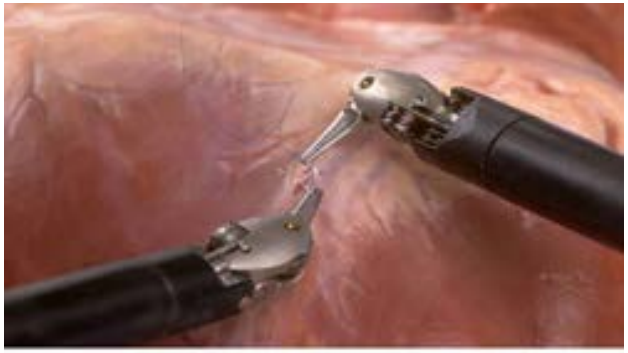
THE DA VINCI® TECHNOLOGY(Intuitive Surgical Systems, Inc. Sunnyvale, CA)

- Three major components:
- 1. The vision system.
- 2. The surgeon console.
- 3. The Robotic Platform.

Da Vinci surgery: Less invasive. More precise. Faster recovery

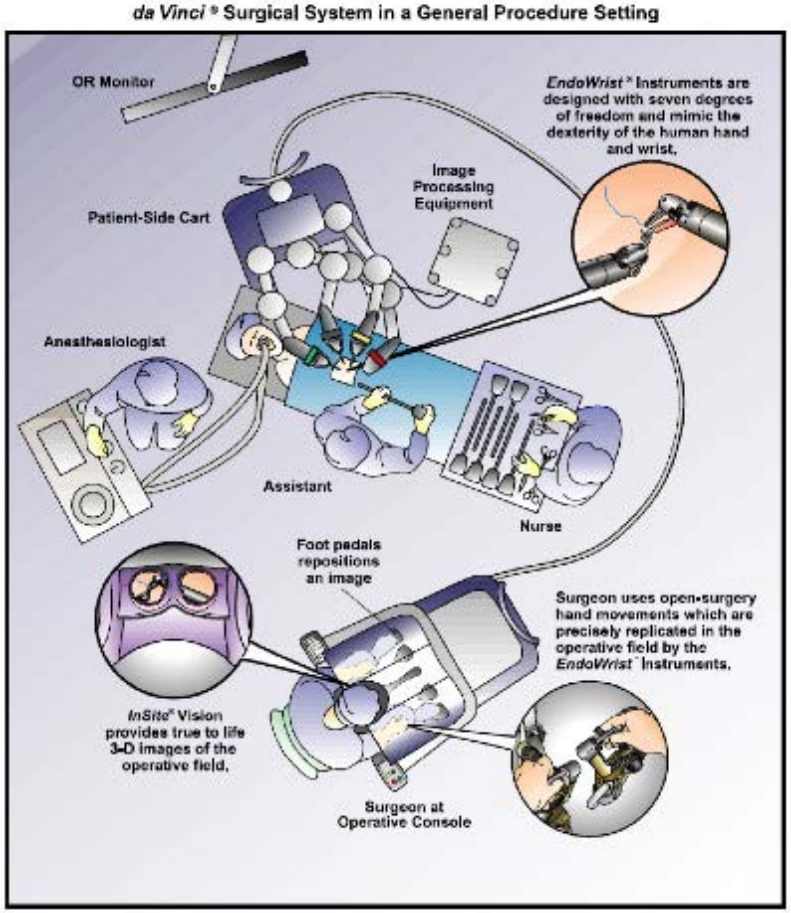
Da Vinci Technology

- Pneumoperitoneum
- “Docking” the Robot
- Cabled “EndoWrist” Tech.



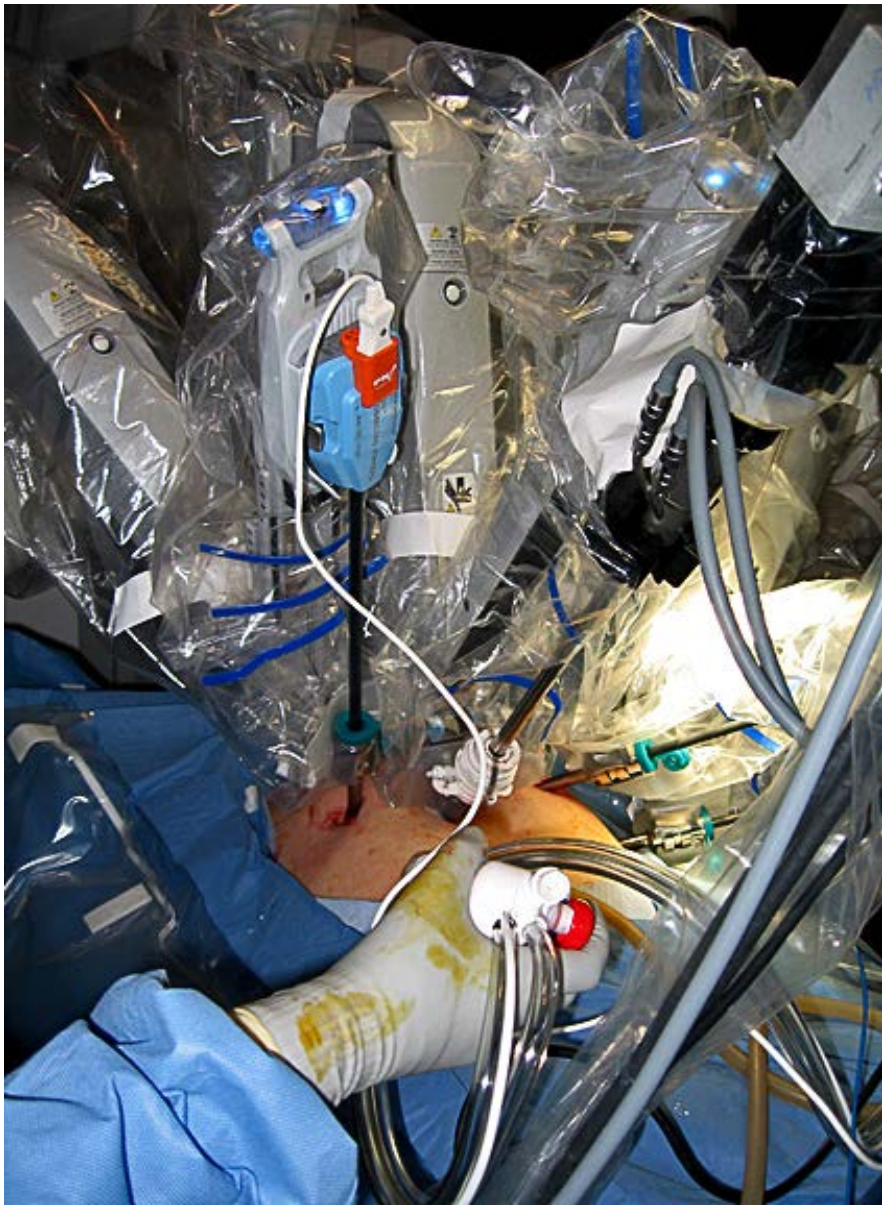
Set up in Theatre:

- Patient's position
- Anasthetics
- IV access
- Conversion to laparotomy (10%)
- Uterine manipulator
- Zero Degree camera or 30 degree



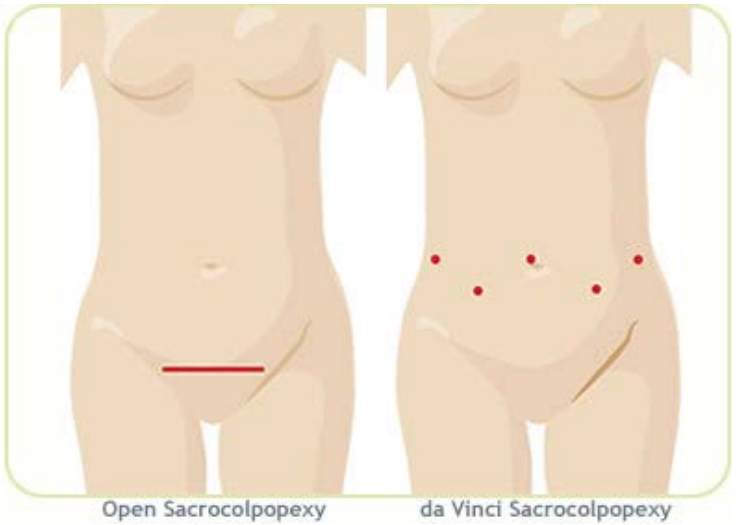
Assistant Role:

- Ports
- Suction
- Handing sutures
- Uterine Manipulation



Advantages of Robotic surgery:

- Visualization (3D Vs 2D)
- Mechanical improvement (7 Vs 4)
- Stabilization (small movements amplified)
- Ergonomics for Operating surgeon.



Limitations of Robotic surgery:

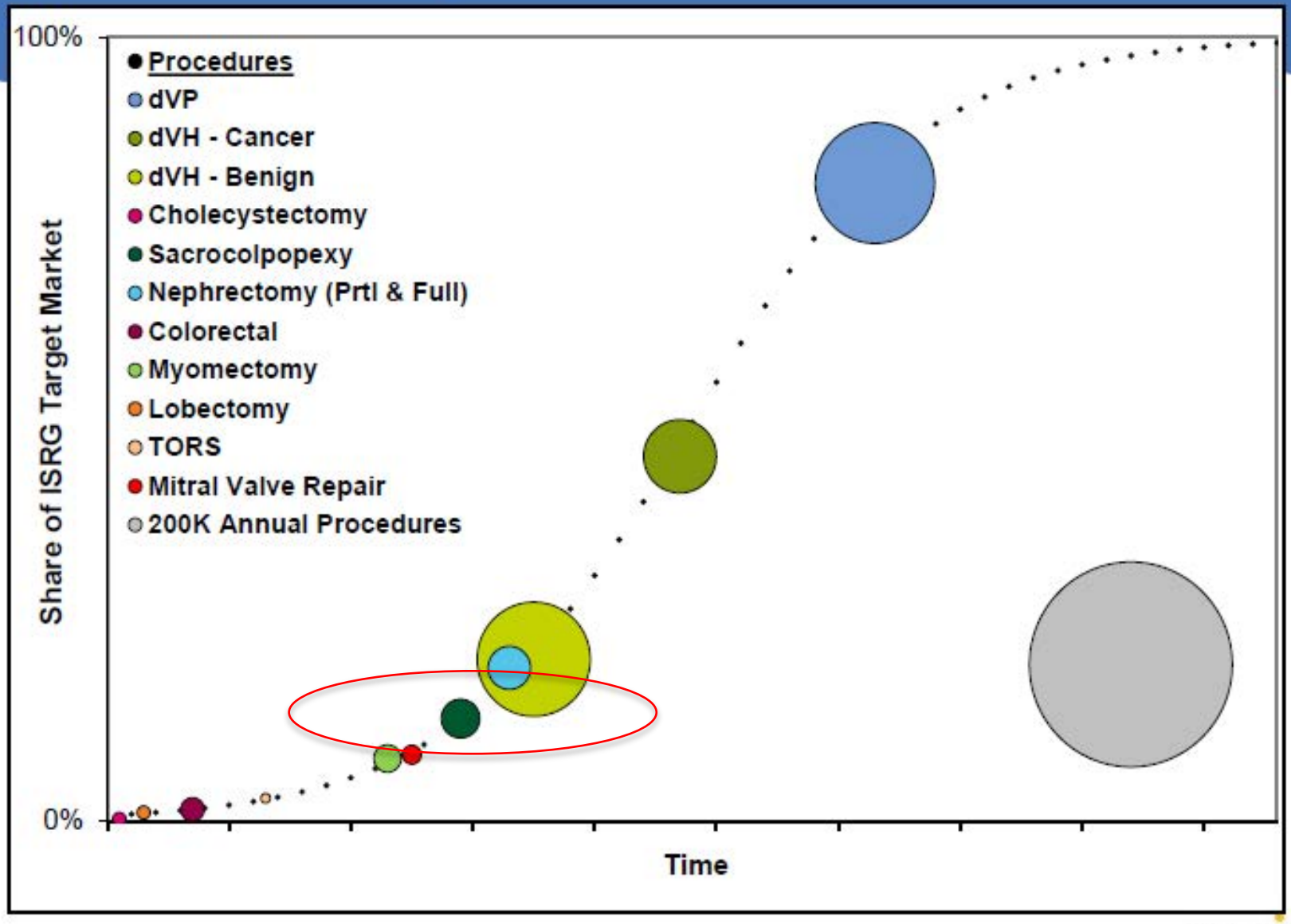
- Additional surgical training
- Increased costs and operating room time
- Bulkiness of the devices
- Instrumentation limitations (eg, lack of a robotic suction and irrigation device, size, cost)
- Lack of haptics (tactile feedback)
- Risk of mechanical failure
- Limited number of energy sources (ie, less than with conventional laparoscopy)
- Not designed for abdominal surgery involving more than one quadrant

In Australia: 8 units

- Epworth Eastern Hospital, Box Hill, Victoria.
- Epworth Medical Centre, Richmond, Victoria.
- Greenslopes Private Hospital, Greenslopes, Qld.
- Royal Adelaide Hospital, Adelaide SA.
- Royal Brisbane and Women's Hospital, Herston, Qld.
- St. John of God Hospital Subiaco, Perth, WA.
- St. Vincent's Private Hospital, Darlinghurst, NSW.

That was in 2010

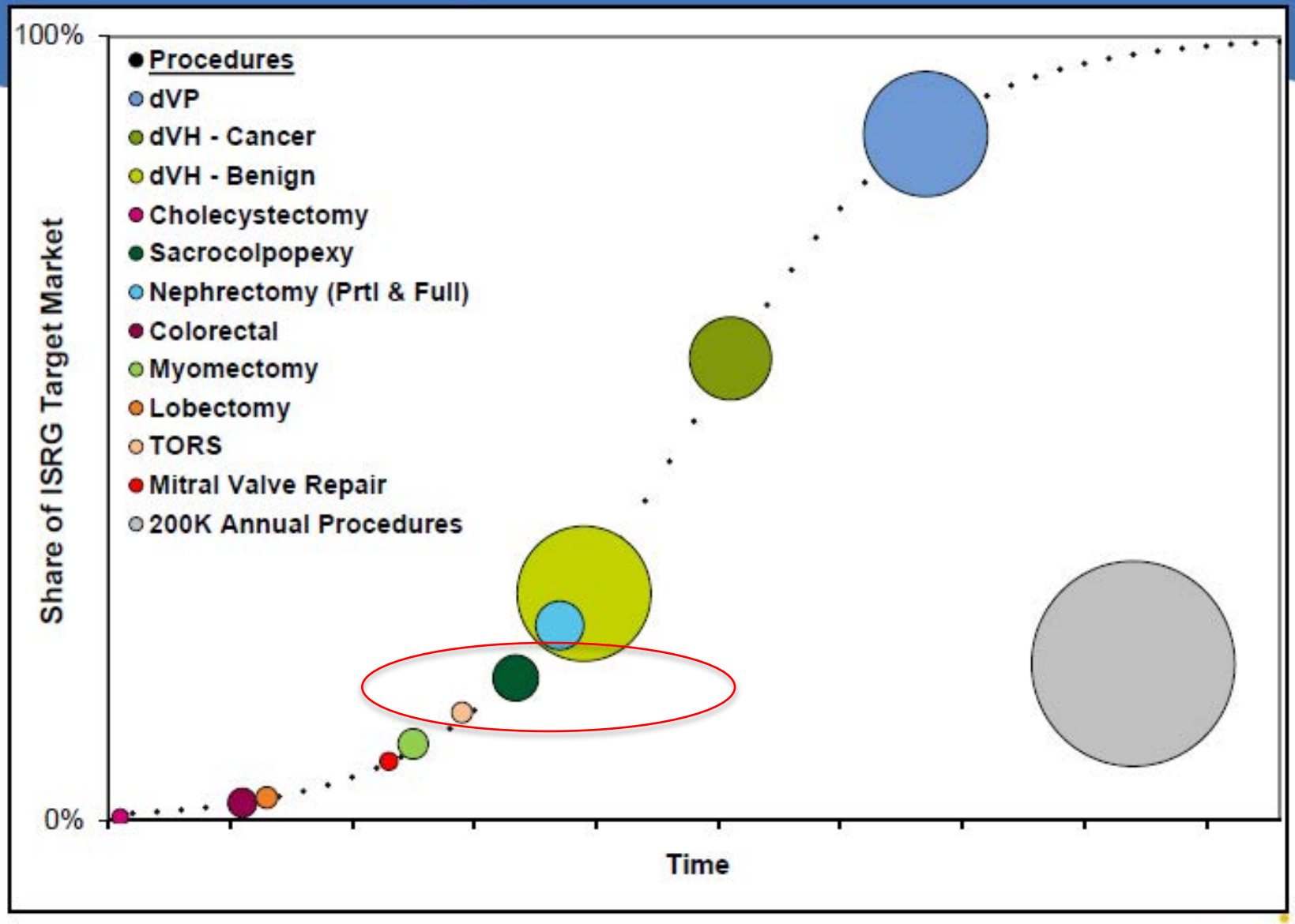
US Procedure Adoption Q1 2010



Conceptual depiction of procedure adoption, scaling is approximate.

INTUITIVE SURGICAL®

US Procedure Adoption Q1 2011



Conceptual depiction of procedure adoption, scaling is approximate.

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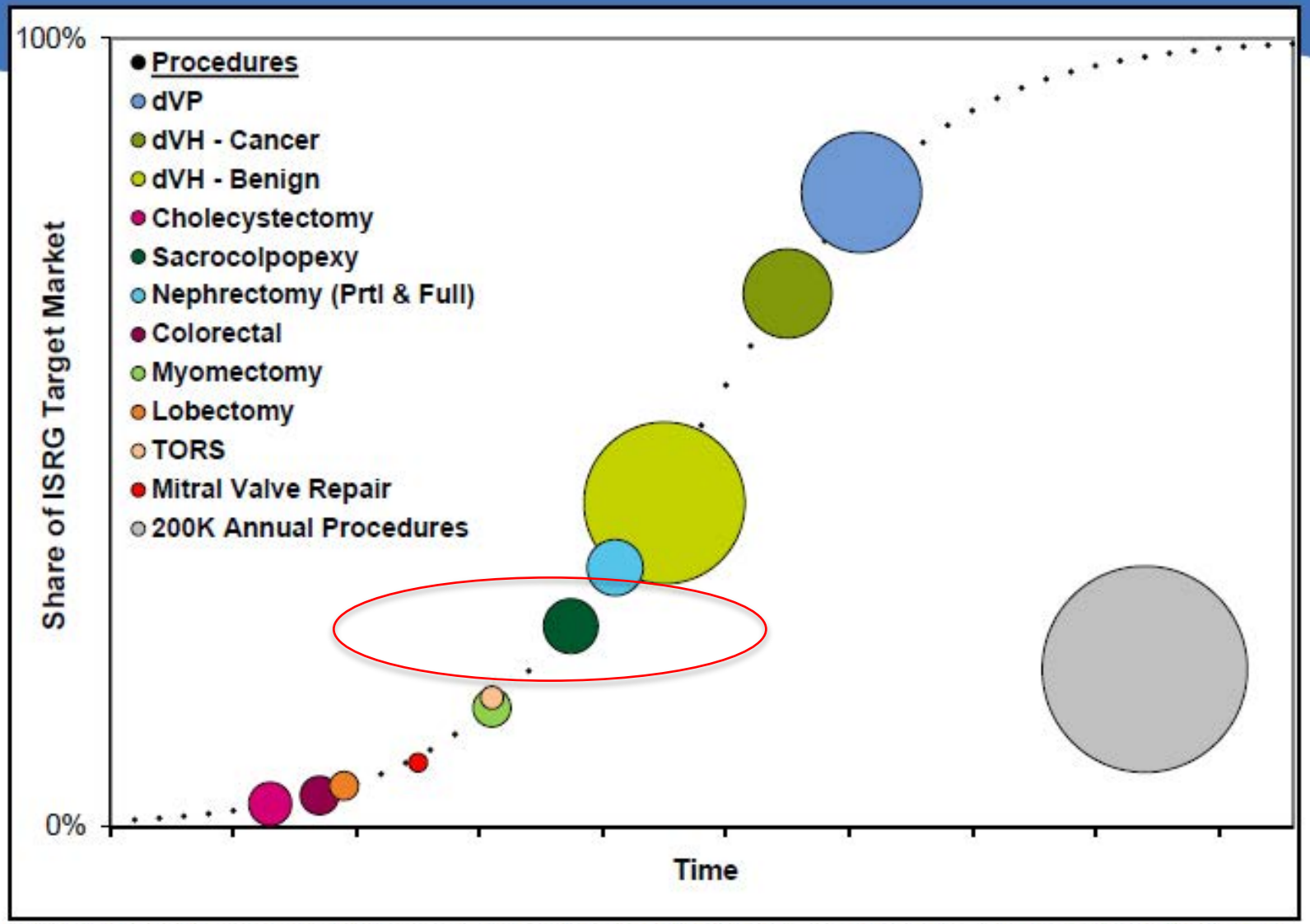
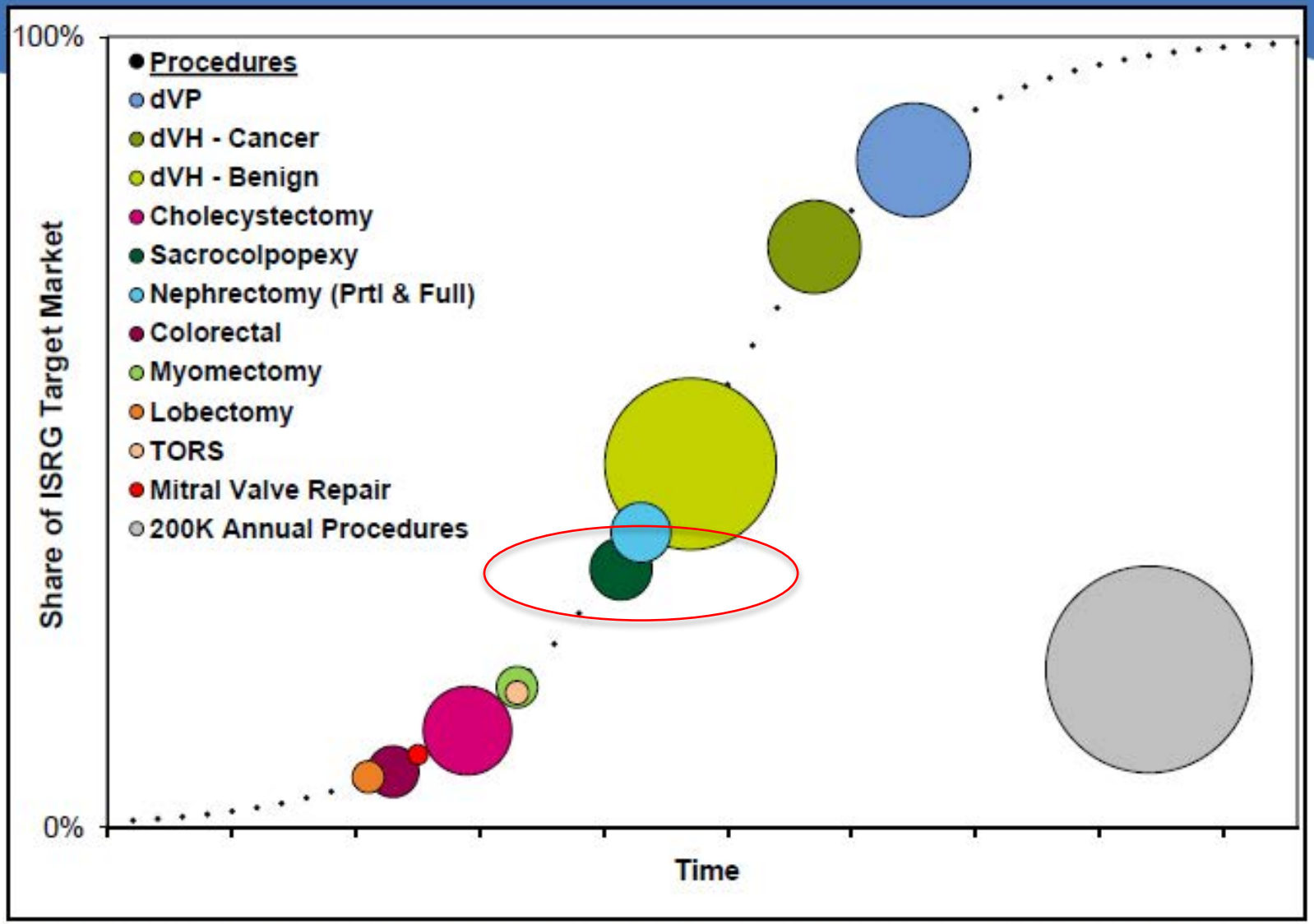
US Procedure Adoption Q1 2012



Conceptual depiction of procedure adoption, scaling is approximate. Q4 2012 US *da Vinci*® Prostatectomy procedures were approximately Full Year 2012 prostatectomy procedures were 15% below 2011. We believe the US prostatectomy decline was driven by a combination of the US Preventive Service Task force recommendation against PSA testing and a change in treatment recommendations for low risk prostate cancer away from definitive treatment. The addressable market is estimated to be 15% lower on the Q112 and Q113 slides

US Procedure Adoption Q1 2013



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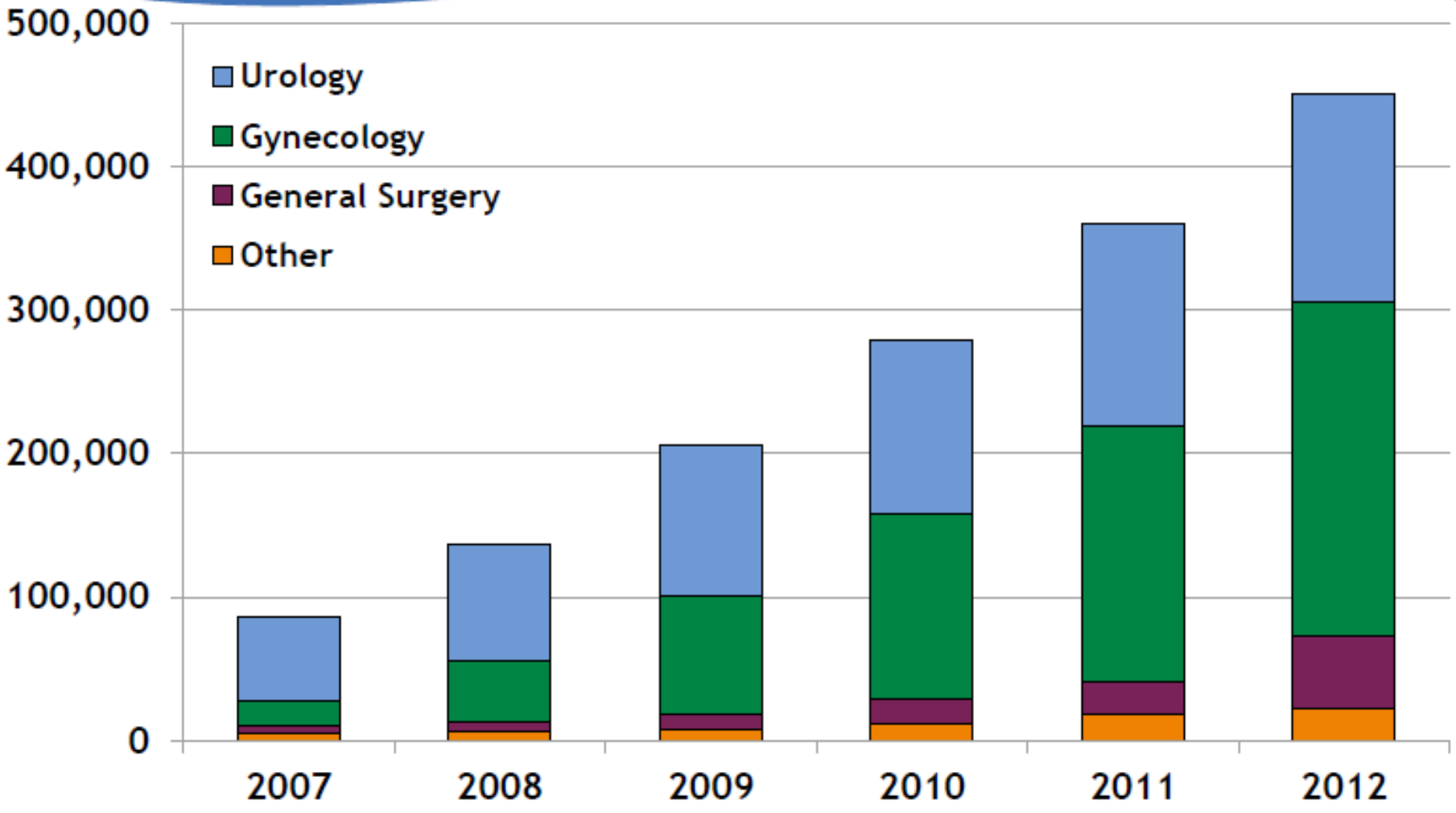
Annual Worldwide Procedures



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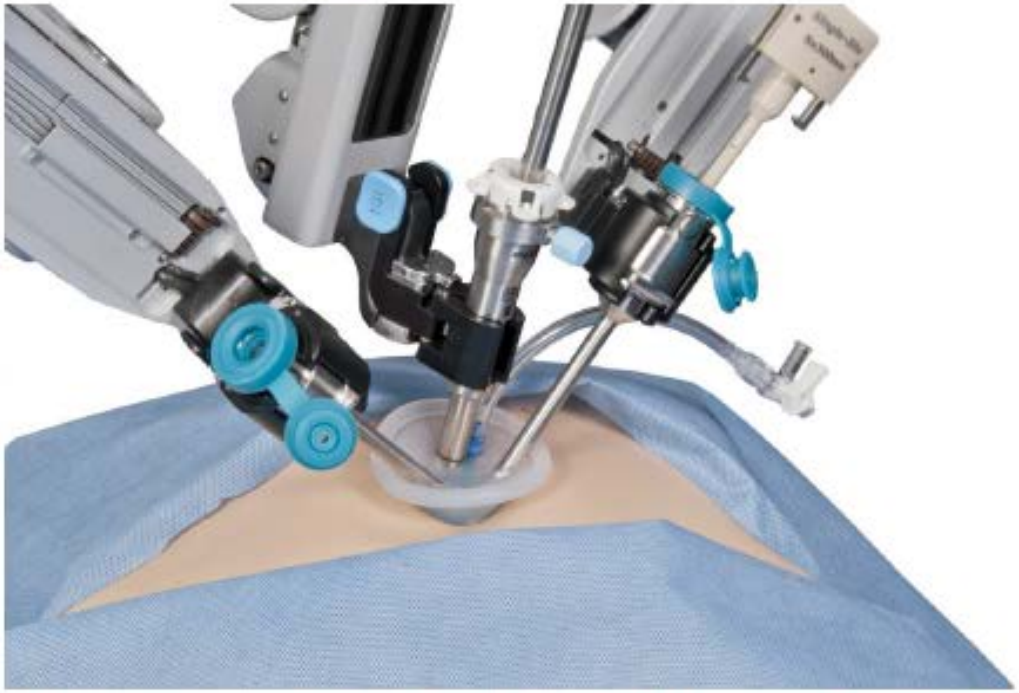
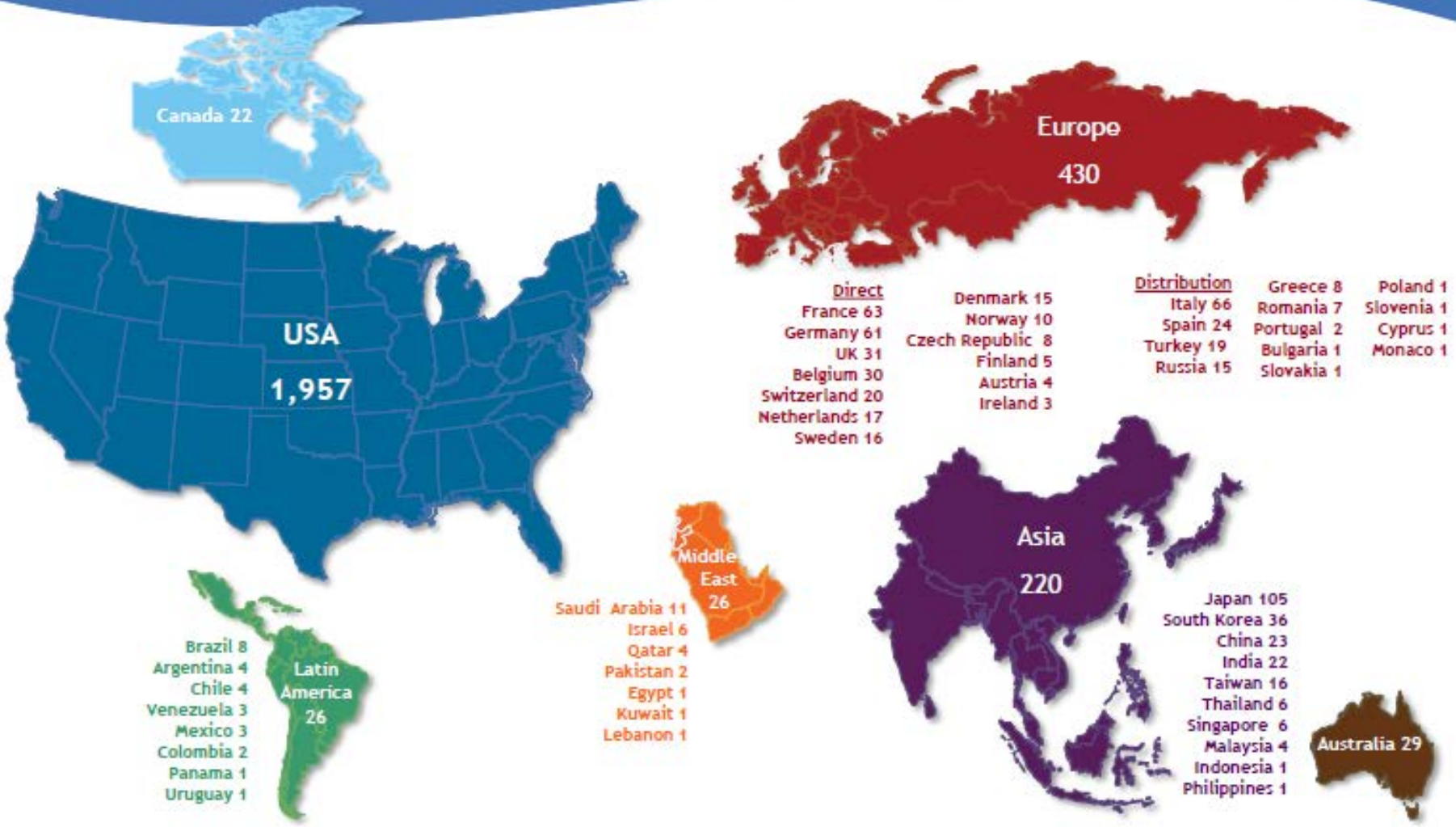
da Vinci® Single-Site



- Robotic Surgery through a single umbilical port
- US FDA Cholecystectomy Clearance Dec 2011
- Benign hysterectomy / Salpingo Oophorectomy 510K Clearance Feb 2013
- 600+ US hospitals have purchased Single-Site products through Q113

INTUITIVE SURGICAL®

Installs by Country and Region



Intuitive sells directly to customers in the US, Korea, and the European countries indicated above. Sales are through distributor partners in all other areas of the world including, Canada, Latin America, the Middle East, Asia and Australia.

INTUITIVE SURGICAL®

Training Facility

da Vinci® Australia and New Zealand Installs 2003 - 2013

da Vinci® Australia and New Zealand Installs 2003 – 2013

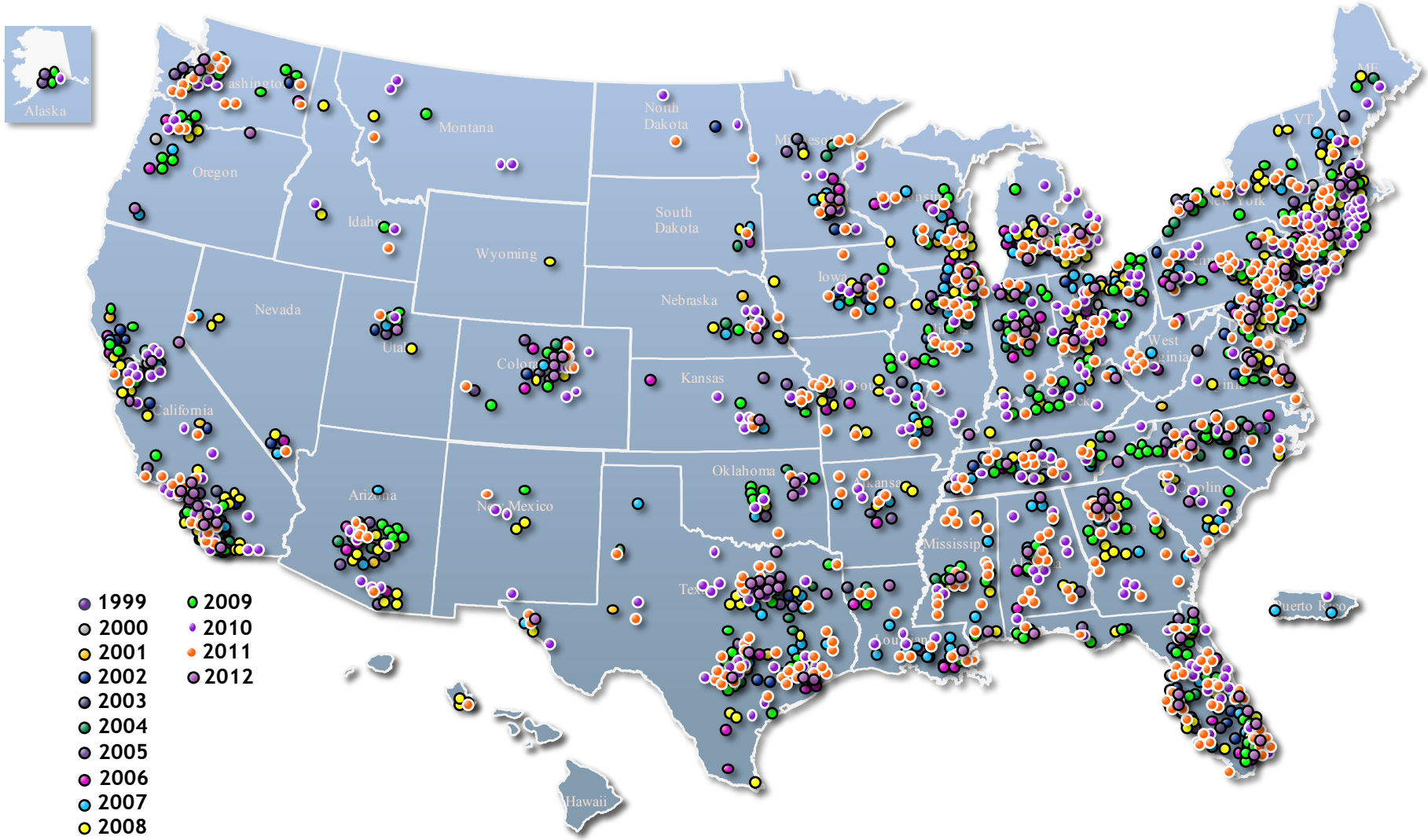
AUSTRALIA

Epworth Freemasons Australia
Epworth Hospital – Melbourne – Victoria
Epworth Eastern Hospital – Box Hill – Victoria
Greenslopes Private Hospital – Brisbane - Queensland
Royal Adelaide Hospital – Adelaide – South Australia
Royal Brisbane Hospital – Brisbane - Queensland
St. John of God Hospital – Subiaco – Western Australia
St. Vincent Hospital – Sydney – New South Wales
Wesley Hospital – Brisbane – Queensland
Peter MacCallum Cancer Centre – Melbourne – Victoria
Cabrini Private Hospital – Melbourne – Victoria
Macquarie Private Hospital Sydney – New South Wales
Strathfield Private Hospital – Sydney – New South Wales
Sydney Adventist Hospital - Sydney – New South Wales
Hurstville Private - Sydney – New South Wales
Westmead Private - Sydney – New South Wales
Nepean Public Hospital - Sydney – New South Wales
Royal Melbourne Hospital – Melbourne – Victoria
John Flynn Hospital – Gold Coast - Queensland

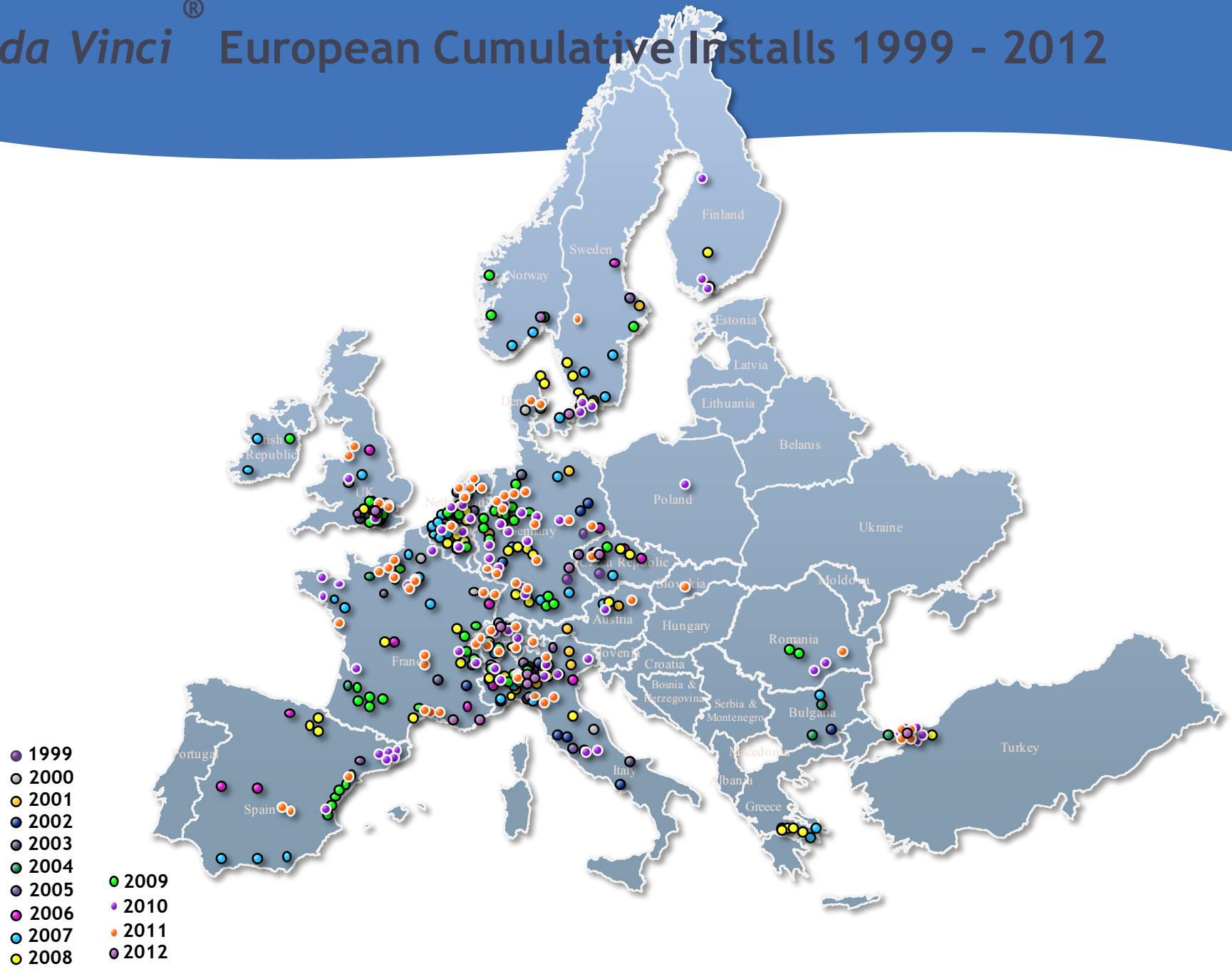
NEW ZEALAND

Grace Hospital – Tauranga
Mercy Ascot Hospital – Auckland
Southern Cross Hospital - Christchurch

da Vinci® U.S. Cumulative Installs - 1999 - 2012



da Vinci® European Cumulative Installs 1999 - 2012



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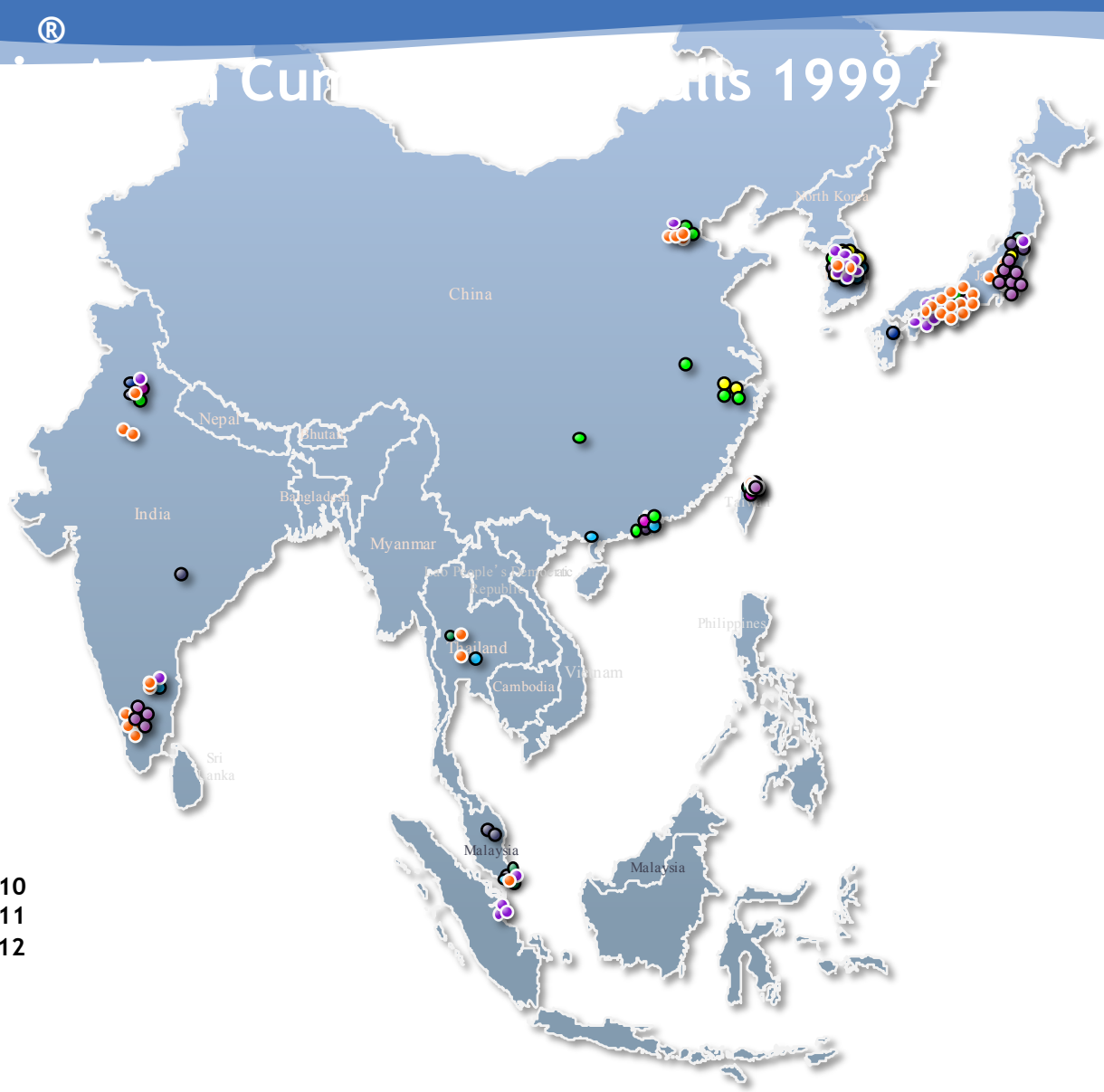
Cum[illegible]nts 1999 -


China
India
Nepal
Bhutan
Bangladesh
Myanmar
Thailand
Cambodia
Malaysia
Malaysia
Philippines
Sri Lanka
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

Reproductive endocrinology and fertility:Tubal reanastamosis

- Two large series comparing Robotic(n=23) to conventional tubal reanastamosis (minilaparotomy)(n=18), showed similar Pregnancy rate, and ectopic pregnancy as well as complications. Robotics though had longer operating time and cost.
- One retrospective case control study comparing Robotic(n=10) versus laparoscopic Tubal reanastamosis (n=15) showed similar pregnancy rate at 12/12 and similar ectopic rate. The robotic procedures though had longer time and more blood loss.

Comparison of Robotic, Laparoscopic, and Abdominal Myomectomy in a Community Hospital

Joseph M. Gobern, MD, C. J. Rosemeyer, DO, James F. Barter, MD, Albert J. Steren, MD. *(JSLS 2013)*

- 308 patients, in- cluding 169 (54.9%) abdominal, 73 (23.7%) laparoscopic, and 66 (21.4%) robotic-assisted laparoscopic myomecto- mies.
- Median oper- ative time for robotic surgery (140 min) was significantly longer (P<.005) compared to laparoscopic (70 min) and abdominal (72 min) myomectomies.
- Postoperative trans- fusion was significantly less frequent in robotic myomectomies compared to laparoscopic and abdominal myomectomies.
- While robotic-assisted laparoscopic myomec- tomies had longer operative times, laparoscopic and robotic- assisted laparoscopic myomectomies demonstrated shorter hospital stays, less blood loss, and fewer transfusions than abdominal myomectomies. Robotic myomectomy offers a minimally invasive alternative for management of symptom- atic myoma in a community hospital setting.

Pelvic Reconstructive surgery:

- Chow et al form Mayo clinic US published in 2004 a case series of 20 RALSCP. They found It is associated with decreased hospital stay, low complication and conversion rates, and high rates of patient satisfaction.
- Visco et al from Duke University in NorthCarolina reported in 2008 a retrospective cohort study of Robotic(n=73) Vs Abdominal (n=105) SCP and found similar short term outcomes with less hospital stay and less complication yet longer operation time with Robotics.

Gyneacology Oncology

- Robotic assistance has been increasingly adopted in gynecologic oncology for radical hysterectomy with improvements in blood loss and recovery time over laparotomy.

Robotic Surgery in Obsterics

- Craparo et al from Penn USA reported in 2007 first Robitically assisted intra-abdominal placement of Cervical cerclage. He concluded that "Da Vinci robot-assisted abdominal cerclage placement is an innovative application of robotic surgery and may alter the standard of care for women who require this surgery".

Conclusion:

- Robotic-assisted laparoscopy for use in gynecologic procedures is currently in the developmental and early adoption phase of the technology life cycle.

- Thus far had its largest impact in gynecologic oncology.

- The use of robotic surgery in Gynaecology is on the rise.
- Links:www.device.com.au<http://www.device.com.au>
- www.intusurg.com<http://www.intusurg.com>
- www.davincisurgery.com<http://www.davincisurgery.com>

Australasian Gynaecological Endoscopy & Surgery
Society Limited

Robotic sacral colpopexy and oopheropexy

Dr. Salwan Al-Salihi, Dr. Marcus Carey
The UroGyanecology Department at
The Royal Women's Hospital, Melbourne, Victoria.

Overview: This video demonstrates robotic surgery to treat vaginal vault prolapse and residual ovary syndrome.

Sacrocolpopexy and oopheropexy is demonstrated involving clinical details:
A 46-year-old para three referred with recurrent prolapse, urinary incontinence, voiding difficulty, obstructive defecation, chronic pelvic pain and dyspareunia. She had undergone a prior vaginal hysterectomy, vaginal repair, and Monarc midurethral tape in 2005. She also undergone laparoscopy. Examination revealed stage three pelvic organ prolapse (Ba +2, C 0, Bp 0, Gh 4, TVL 8). there was right side vault tenderness on bimanual examination. Urodynamic test demonstrated over active bladder and obstructed voiding difficulty.
A vaginal pessary fitted and prescribed Enablex (Darifenacin). This resulted in 50% improvement in her urinary leakage yet persisted pelvic pain. Patient requested surgery. She elected to undergo robotic sacrocolpopexy, management of possible residual ovary syndrome, posterior vaginal wall repair and cystoscopy.
MRI and CT IVP were undertaken prior to surgery and they were normal.

Surgical Details:
Surgery performed on April 2013. A Hasson entry was used. Additional ports placed under direct vision. The Da Vinci Robot was docked (docking time was under 7minuts).
Intraabdominal adhesions were dissected. The right ovary noted to adhere to the vaginal apex. It was dissected from the vaginal vault and repositioned above the pelvic brim.
The bladder and rectum dissected of the vagina. The peritoneum dissected from the sacral promontory to the Cul de sac. Y-sapped ultrapro mesh was sutured to anterior and posterior vaginal walls and apex. The tale of the mesh was sutured to the anterior longitudinal ligament at the sacrum. Using the V-loc suture the peritoneum closed over the mesh. Intercede was positioned over the peritoneal closure.
A distended mega rectum was identified that was considered to be the cause for the patient's defecatory difficulty and a posterior repair was not performed. Cystoscopy was normal. The surgical time was 87 minutes including the docking time.

Outcome:
At surgical review there was excellent vaginal support with no recurrent prolapse. Her pelvic pain had resolved she was referred to a colorectal surgeon for her rectal dilatation. Interestingly her son reported undergoing surgery for rectal prolapse at the age of 18 months.

Discussion: Sacrocolpopexy is considered the gold standard operation for the vault prolapse particularly in younger patients (1). Advances in surgery have seen the sacrocolpopexy procedure progressed from laparotomy to laparoscopy and recently robotic surgery. The main advantage o the robotic surgery includes 3D vision and, when compared to straight stick surgery, superior surgical dexterity (2). However, robotic surgery is more expensive.

References:
1. Surgical treatment of vaginal apex prolapse. Obstet Gynecol. 2013 Feb;121(2 Pt 1):354-74. doi: http://10.1097/AOG.0b013e31827f415c.
2. Update on laparoscopic, robotic, and minimally invasive vaginal surgery for pelvic floor repair. Minerva Ginecol. 2009 Jun;61(3):173-86.