Robotic Surgery in Gynae-Oncology

Welsh Obstetrics & Gynaecology Society

Thomas Ind
St George’s and Marsden Hospitals
Today’s Talk

◆ History Robotic Surgery
◆ Pro’s & Con’s
◆ Role in gynaecology
◆ Our experience
◆ Research data at Royal Marsden & St George’s Hospitals joint cancer centre
◆ Future
DISCLOSURES

◆ Received from Intuitive
  – Training including wet & dry labs
  – Business class travel to USA x 1
  – Three days hotel accommodation in the USA
  – Hospitality
Today’s Talk

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History of robotic surgery

- 1985 – Stereotactic brain surgery
- 1989 – PROBOT used for prostatectomies
- 1992 – ROBODOC for hip replacement
- 1993 – AESOP assistant approved by FDA
- 1996 – ARTREMISS
- 1996 – EndoAssist
- 1998 – Zeus
- 2000 – Da Vinci
  - Da Vinci S
  - Da Vinci Si
Da Vinci SI quad console
Applications

- **Urology**
  - Prostatectomy
  - Cystectomy
  - Pyeloplasty
  - Adrenalectomy
  - Nephrectomy

- **General Surgery**
  - Fundoplasty
  - Cholecystectomy
  - Gastric by-pass
  - Colectomy
  - Thymectomy
  - Parathyroidectomy
Applications

- **Cardiovascular**
  - Mitral valve repair
  - Congenital surgery
  - Aorto-bifemoral bypass

- **Paediatric**
  - Heterogenous applications

- **Orthopaedic**
  - Hip
  - Knee
  - Spine
Applications

- Gynaecology
  - Tubal surgery
  - Myomectomy
  - Hysterectomy
  - Endometriosis
  - Adhesiolysis
  - Ovarian cystectomy
  - Fistula repair
  - Prolapse repairs
  - Lowe et al 2009 – 835 cases

- Gynaecological Oncology
Articles Published

- 1980
- 1990
- 1995
- 1998
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007

0
200
400
600
800
1000
1200
1400
1600
Today’s Talk

- History Robotic Surgery
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- Role in gynae-oncology
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- Future
Robotoic Assisted vs Straight Stick

- No haptic feedback
- Three dimensions
- More degs of freedom
- No Fulcrum effect
- No tremor
- Telesurgery
- Telementoring
- Easier
- Quicker to learn
- ?cost
- ? More breakdown

- Haptic Feedback
- Two dimensions
- Less degs of freedom
- Fulcrum effect
- Max tremor
- No telesurgery
- No telementoring
- Less easy
- Slower to learn
- Less cost
- Less risk of op breakdown
Today’s Talk

- History Robotic Surgery
- Pro’s & Con’s
- **Role in gynae-oncology**
- Our experience
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- Future
Gynaecological Oncology 1

- Reynolds et al 2005
  - 7 staging procedures in ovarian and endometrial cancer.
- Marshal et al 2005
  - 12 hysterectomies of endometrial cancer
- Field et al 2007
  - 20 diverse procedures
Boggess et al 2007

- 43 robotic vs 101 straight stick for endometrial cancer
- 0% conversation ct 3% conversation
- Significantly shorter (163 vs 213 mins)
- Significantly more nodes (30 vs 23)
- Significantly less blood loss (63 vs 142)
- Significantly shorter stay (1 vs 1.2)
Gynaecological Oncology 2b

- Shashoua et al 2009
  - 24 robotic vs 44 straight stick for all indications
  - Significantly longer (142 vs 122 mins)
  - Significantly less narotic usage (1.2 vs 5 units)
  - Significantly shorter stay (1.0 vs 1.4)
Gynaecological Oncology 3

- Seamon et al 2007
  - 70 patients with endometrial cancer
  - TAH BSO PLN PALN
  - Learning curve of 10 cases

- Seamon et al 2009 - 105 cases
  - Improvements compared to laparoscopic especially in obese

- Jung et al 2009 - 109 cases

- Gocen et al 2009 – 25 cases

- Lowe et al 2009 - 405 cases
Gynaecological Oncology 3b


- Retrospective review of 30 laparoscopic, 40 Robotic, 40 open for endometrial cancer

- Robotic hysterectomy provides comparable node retrieval to laparotomy and laparoscopic procedures in the case of the experienced laparoscopic surgeon.

- While robotic hysterectomy takes longer to perform than hysterectomy completed via laparotomy, it is equivalent to laparoscopic hysterectomy and provides the patient with a more expeditious return to normal activity with reduced post-operative morbidity.

- Average cost for hysterectomy and staging was highest for laparotomy, followed by robotic, and least for standard laparoscopy.
Radical Hysterectomy

- Sert el al 2007
  - 15 cases ct straight stick
  - Quicker robotic
  - No difference in LN or parametrial volume

- Magrini at al 2008
  - 27 cases ct straight stick and open
  - Operating times similar to open and shorter than SS
  - Blood loss and stay significantly longer in open arm
Radical hysterectomy

- Sert et al 2007 – 15 cases
- Magrina et al 2008 – 27 cases
- Kowalski et al 2008 – 14 cases
- Boggess et al 2007 – 13 cases
- Lowe et al 2009 – 42 cases
- Persson et al 2009 – 80 cases
- Maggioni et al 2009 – 40 cases
- Others I could find – 22 cases
- Total – 253 cases
- Unpublished many 100s
Radical hysterectomy

♦ Maggioni et al 2009
  – 40 robotic ct 40 abdominal
    • Longer operative time (199 vs 272 minutes)
    • Less blood loss (78 vs 222 ml)
    • More LNs (11.7 vs 6.9)
    • Shorter stay (3.7 vs 5 days)
Radical hysterectomy

- Estape et al 2008
- 32 robotic ct 14 abdominal ct 17 laparoscopic
  - Less complications
  - More LNs
  - Shorter stay
Radical trachelectomy

- Chaung et al 2008 – 1 case
- Persson et al 2009 – 2 cases
- Burnett et al 2009 – 6 cases
- Royal Marsden Hospital
Today’s Talk

- History Robotic Surgery
- Pro’s & Con’s
- Role in gynae-oncology
- **Our experience**
- Research data at Royal Marsden & St George’s Hospitals joint cancer centre
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Our UK Experience

October 2006 – Robot at London Clinic
December 2006 – Robot at Royal Marsden
September 2008 – Robot at St George’s
Our UK Experience

October 2006 – Robot at London Clinic
December 2006 – Robot at Royal Marsden
September 2008 – Robot at St George’s
Our UK Experience

- Jan to June 2007 – Regular practice on robot at Marsden
- July 2007 – Training at Beth Israel (Newark)
Our UK Experience

Grateful thanks to Michael Pitter
Our UK Experience

November 2007
Grateful thanks to Chris Ogden (urologist & Preceptor)
Our UK Experience

December 2007
Grateful thanks to Jan Persson (Preceptor)
Our UK Experience
Our UK Experience

- Changing goals
- Politicians
- Ethics
  - New instrument for an old procedure or New operation.
- Equipment licensing committee
- Clinical Governance Executive
- Medical Director
- Preceptor Approval
- Registration with the GMC for preceptor
- Medical appointments committee for preceptor
- Certification
- Business cases
- Funding
- NIHCE
The Marsden Fire

• Largest fire in London since second world war
• Robot saved by Chris Ogden
• ITU evacuated
• All theatres out of action for 6 months
• Now limited theatre activity
• Expected date of return is end of 2010 (new build)
Our UK experience

♦ More now
Today’s Talk

- History Robotic Surgery
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- Our experience
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- Future
UK efforts (Ind et al)

- Concentrate on basic science
  - Analyse motion
  - Compare ease of surgery in an open setting
  - Analyse the learning curve
Surgical Laboratory
Motion Analysis Transducer
Surgical Laboratory
Ambidexterity

Ambidexterity (duration of each movement)

Robotic  Open  Straight  Stick
Time

- Robotic
- Laparoscopic
- Open

Time (secs)
Number of Movements

![Graph showing the number of movements for robotic, laparoscopic, and open procedures.]
Duration of each movement

- Robotic
- Laparoscopic
- Open

Duration of Movements ( secs )

0.8
0.7
0.6
0.5
0.4
Robotic surgery

- No difference in ambidexterity
- Less hand movements than Straight Stick but more than open
- Longer to perform the task than open but no different to straight stick
- Longer duration on each movement
Robotic versus straight stick

- Less movements
- More purposeful movements
Knot tying

Marielle Nobbenhuis

Jan Haider
Surgical Trainees

♦ Knot strengths

• Duration of exercise
• Secure or insecure knots on tensiometer
• Tensile strength of knots on tensiometer
• Tightness around jig
Time to tie knot

- Robotic
- Laparoscopic
- Open
Tensiometer
Tensiometer
Strength of knot

- Robotic
- Laparoscopic
- Open

Knot Strength (Newtons)
Proportion of secure knots

- Robotic: 68%
- Laparoscopic: 58%
- Open: 50%
Knot tightness

Knot Tightness (Dia. – mm)

25  26  27  28  29  30

Robotic  Laparoscopic  Open
Learning Curve
Surgical Trainees

♦ Learning curves
  – Cutting Circles
    • Breeches in circle
    • Duration of exercise
    • Instrument changes

Tina Rashid

Malli Kini
Circle Cutting
Duration of exercise

- ■ = Laparoscopic
- ▲ = Robotic
Number of Breeches

Number of Mistakes

Subjects

- □ = Laparoscopic
- ▲ = Robotic
Instrument Changes

Number of Changes

Subjects

■ = Laparoscopic
△ = Robotic

Royal Marsden Hospital
St George’s Hospital
Duration of exercise

![Graph showing duration of exercise vs. attempts. The graph compares straight stick laparoscopic and robotically assisted laparoscopic methods. The straight stick method shows a decrease in time to complete the task with each attempt, while the robotically assisted method shows a more erratic pattern with less consistent decrease.]
Duration of exercise

Kruskall-Wallis significant for Robotic arm
(T = 27.2, df = 9, P = 0.0013)

Kruskall-Wallis not significant for straight sticks
Number of breaches

![Graph showing median number of mistakes by attempt number for Robotic Assisted and Straight Stick Laparoscopic procedures.](image)
Number of breaches

Kruskall-Wallis significant for Robotic arm
\(T = 17.45, \text{df} = 9, P < 0.0417\)

Kruskall-Wallis not significant for straight sticks
Number of instrument changes

![Graph showing the number of instrument changes with attempts.]

- **Robotically Assisted Laparoscopic**
- **Straight Stick Laparoscopic**

**Legend:**
- ▲ --- Robotically Assisted Laparoscopic
- ■ --- Straight Stick Laparoscopic
Number of instrument changes

Kruskall-Wallis significant for Robotic arm
\( T = 23.4, \text{ df} = 9, P = 0.0053 \)

Kruskall-Wallis not significant for straight sticks
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Progression in laparoscopic Sx

♦ Urologists
 – Cystoscopy
 – Prostatectomy
Progression in laparoscopic Sx

- Gynaecology
  - Diagnostic
  - Steri
  - Cystectomy
  - Hysterectomy
  - Radical Hyst
Summary 1

- Robotic assisted laparoscopic surgery is fraught with politics and intrigue in the UK
- My team is pursuing the basic sciences.
Summary 2

- Laparoscopic surgery assisted by robotics;
  - Is easier than straight stick
  - Has a shorter learning curve compared to straight stick
  - Is the future of laparoscopic surgery
1000 guineas – Newmarket 2010

- Pollenator
- Trained by Richard Hannon
- Richard Hughes - Jockey

My foot
TIP of the day

- 1840: Bangor-on-Dee. Novices Hcap Chase
- Chicago Alley
  - Trainer AW Carroll
  - Jockey Lee Edwards
- Tissue odds 85/40. No less than 7/4
Laparoscopic surgery

Easy cases
- SILS

Current day laparoscopic procedures
- TRAD
  - Stuck in the Muds
  - Some hysterectomies
  - Difficult ‘easy’ cases
  - Easy ‘complex’ cases
  - Diagnostic

Complex cases
- ROBOT
  - e.g.
  - Radical Hysterectomy
  - Endo Cancer Hyst
  - Myomectomy
  - Some urogynae cases
  - Difficult Endo

- Salpingo-Oo
- Ovarian Cystectomy
- LAVH
- Easy Endometriosis
- Adhesions

- Some hysterectomies
- Difficult ‘easy’ cases
- Easy ‘complex’ cases
- Diagnostic
Laparoscopic surgery

- Complex cases (ROBOT)
- Easy cases (SILS)
- Stuck in the Muds
- Some hysterectomies
- Difficult 'easy' cases
- Easy 'complex' cases
- Diagnostic procedures
  - e.g. Radical Hysterectomy
  - Endo Cancer
  - Hyst
  - Myomectomy
  - Some urogynae cases
  - Difficult Endo
  - Salpingo-
  - Ovarian Cystectomy
  - LAVH
  - Easy Endometriosis
  - Adhesions
Clinical independence is the last refuge of the clinically incompetent
THE END